Executive Summary

Over the last 50 years, there has been a 400 percent reduction in the length of the average product life cycle which is a result of an accelerated pace of product innovation (Von Braun, 1997 & Cooper, 2003). New product development is a means for a company to gain advantage, secure a position, or win a new customer. The more successful and timely an organization can develop new products, the more likely it is that organization will not only survive but prosper.

As suggested by a review of the literature and studies, there are several factors that significantly affect a product's chances of succeeding or failing. Many of these factors are associated with resources resulting from marketing activities that integrate the user/customer needs into the process. There is a significant amount of research that indicates that conducting early stage marketing activities greatly improves the likelihood of new product success, yet the deficiency of these activities is one of the most commonly stated reasons for product failure by NPD managers. One theory for this lack of thorough execution of NPD marketing research stems from a lack of knowledge about which methods to use to integrate users/customers' needs into the Stage-Gate process (Cooper). This issue may arise from an innovation process manager's lack of experience and knowledge with marketing techniques due to a heavily technical or business oriented background. It may also be due to an over-literal interpretation of the illustration of Stage-Gate.

This thesis is a detailed examination of the common factors of new product failure, the established criteria for new product success, the market research tools available for integrating the user/customer needs into the innovative process, the Stage-Gate process in various iterations, and a definition of user/customer integration. The examination of these topics results in the development of an enhanced innovative process model called the Product Innovation Bloom Model. Inspired by the Stage-Gate process models developed by Cooper, this new model will outline specific market research tools that can be applied and how to execute the stages and gates in a natural flow that will integrate the user/customer through-out the entire innovative process. Thereby, allowing an innovative product idea to 'bloom' into a successful new product.

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Chapter 1: Introduction

1.1 Setting the Stage

Imagine, if you will, the following scenario:

You're resting peacefully when you notice the melodic tune of birds chirping. Slowly your mind shifts just a bit as you begin to wonder if the lovely sound is part of the magnificent dream you're having or if it is something else. Finally, at long last, you determine that you were dreaming, but then why are the birds still chirping? A few more seconds pass before you can clearly begin to determine where the sound is coming from and you open your eyes to realize that it is, in fact, your alarm going off. You selected the wrong alert when setting your alarm the night before. Now you find yourself being roused by chirping birds because you chose the "rainforest" sounds setting on your Sharper Image Soundscapes alarm clock instead of your normal "buzzer" alert. At this moment you notice the time projected on the wall behind the clock and realize you've overslept, yet again, and immediately spring out of bed. Running to your bathroom, you start your shower to let the water heat up before heading to the kitchen to pour yourself a cup of Gevalia coffee that started brewing 30 minutes ago thanks to the automatic timer. Now that the shower is warm and you've taken a few sips of coffee to surge energy to your still half sleeping body and brain, you quickly hop under the powerful stream of water spouting from your Mira rotating shower head.

Stepping out of the shower, now clean, refreshed and fully awake, you reach for your Oral B Electronic Toothbrush. A thorough cleaning also requires that you use your Sensodyne toothpaste as well so you smear a large dab on the head of the brush and go to work. As you head to your closet to select your attire for the day, you glance in the direction of your ProForm Elliptical Trainer and acknowledge that your daily work-out will have to be rescheduled for this evening when you return home from work instead of this morning. Once you select your gray suit and the navy blue shirt you begin to head for the door only to realize you can't remember where you left your keys. Thankfully, all you have to do is use your new Key Ringer and it will direct you to your keys with a loud sound and bright flashing light. You follow the sound until you locate your keys in the refrigerator…of course! As you think to yourself, "Well

this day is off to a lovely start!" you hit the automatic ignition button on your keychain to start your car while you activate the home security alarm and lock the front door to your house.

In the short span of one morning, the average person probably uses a large variety of products before even leaving their home and, for the most part, never even gives a second thought to how those products were created. In just the last 20 years alone, the world has seen innovation reshape societies to the point that we can no longer imagine ourselves without certain products. This increase in innovation has had an enormous effect on how we perceive products as both manufacturers and consumers. Consumers use mobile phones, email, Google, instant messaging and Internet shopping and are grappling with even more technologies for entertainment, such as MP3, DVD and high-definition TV (Smethers, 2007).

Consumers are bombarded with new products at a higher rate of frequency than ever before but there are varying types of new products. There are six categories of new products outlined as follows:
1. New-to-World products – these products herein will be referred to as novel products and are products that are the first of their kind which create an entirely new market.
2. New product lines – products that are not new to the market place but are nonetheless new to a particular firm.
3. Additions to existing product lines – products that are new to the firm but that fit in a previously created product line produced by the firm.
4. Improvements and revisions to existing products – includes products that are essentially replacements of existing products in a firm's product line.
5. Repositioning – new applications for existing products and often involve retargeting old products to new market segments for a different application.
6. Cost reduction – the least new of all product categories is products that are essentially being phased out as firms introduce new products designed to replace this existing product in the line.

Each of these product categories provide consumers with different challenges including learning new technology, maintenance and/or replacement of parts and application consistency.

Product manufacturers have a completely different set of issues to deal with as a result of the increase in innovation. They now face a wide range of issues from globalized competition to decreased product life cycles. See figure 1.1 to the right. Over the last 50 years, there has been a 400 percent reduction in the length of the average product life cycle which is a result of an accelerated pace of product innovation (Von Braun, 1997 & Cooper, 2003). In many consumer-oriented industries, product life cycles have dropped to below one year and continue to shrink (Erhorn & Stark, 1994).

Figure 1.1 Decreasing Product Life Cycle
Source: Cooper (2001)
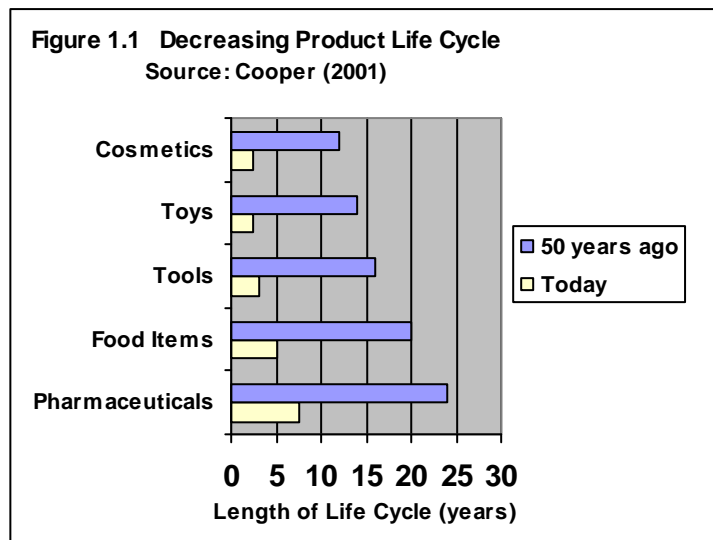
Factors such as the shift in the competitive model to include global competitors and substitutes and the acknowledgement that quality and service are considered "givens" have made time to market a crucial element to product success as well as a company's ability to survive.

An average of 27.5 percent of company sales are direct results of new product launches according to a recent American Productivity and Quality Control benchmarking study (Kahn, 2003). Firms in today's global market must develop new and improved products and services at a lightning fast pace in order to survive and prosper. New product development is a means for a company to gain advantage, secure a position or win a new customer. It is the ultimate weapon in changing the playing field and should be used as such (Annacchino, 2007). Product manufacturers must be constantly looking ahead for the next novel idea even as they are launching the latest and greatest new product. According to Wren, D.A. (1994), Peter Drucker views organizations as being in a constant state of creation, growth, stagnation and decline and it is an organization's ability to innovate that keeps it from failing (Bruchey, 1999). Failure to discover novel new products is what can essentially lead to a company's demise. In fact, forty percent of the major corporations that existed in America in 1975 no longer exist today (Cooper, 2003).

Figure 1.2 Product Life Cycle S-Curve (Source:Smethers, 2007)
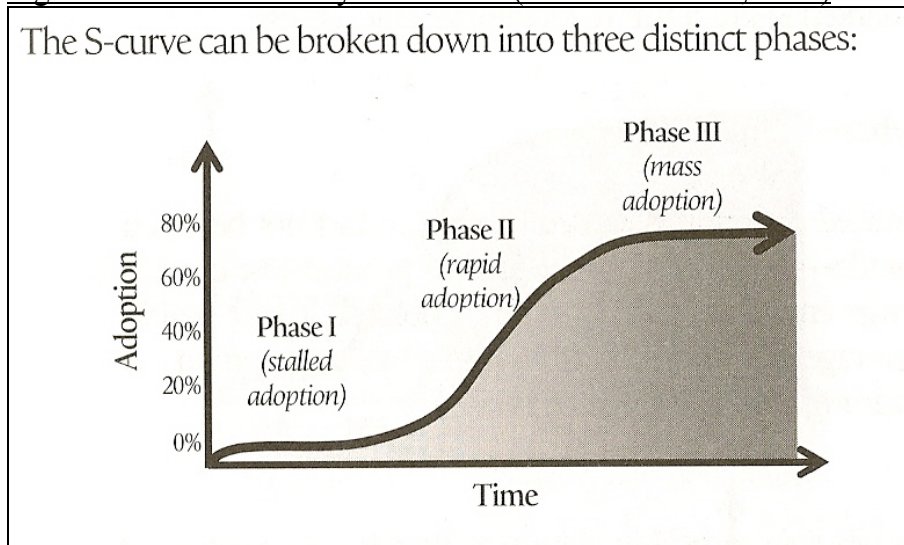
A product's life cycle will be greatly dependent upon the rate of consumer adoption. The Consumer Adoption S-Curve is a commonly used tool for comparing consumer markets and is illustrated in Figure 1.2 above. A typical product life cycle will have three basic phases; Phase One (stalled adoption), Phase Two (rapid adoption) and Phase Three (mass adoption). New products and services begin in Phase One, stalled adoption, and won't progress to Phase Two, rapid adoption, until the product delivers consumer-grade usability (Smethers, 2007). The second phase advances quickly because the barriers to adoptions were removed in Phase One. Phase Three is the goal of all product manufacturers because it is the most profitable of the product life cycle, however, this phase is more difficult as there are usually many products now in the market that can be considered competitors or substitutes. A product will not reach Phase Three until both the product and its key competitive version are consumer grade.

If a company is dependent on new products to prevent failure of that company, as suggested earlier by Bruchey, it is assumed that a business' revenues over time will be reflective of the product life cycles of its products and is illustrated in the figure below. It should be noted that this figure is based on a product's life cycle having an average rate of adoption in contrast to a rapid or slow rate of adoption by consumers.

If the views mentioned earlier by Peter Drucker are accurate, that organizations are in a constant state of creation, growth, stagnation and decline and it is an organization's ability to innovate that keeps it from failing, then an organization's revenues, over time, would look something like Figure 1.3 on the following page if it develops successful new products. This figure illustrates the assumption that an organization which can continually and consistently

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develop successful new products over time can incrementally increase the revenues of the organization and therefore remain in business and prosper.

Figure 1.3 Business Revenues given Successful New Product Development
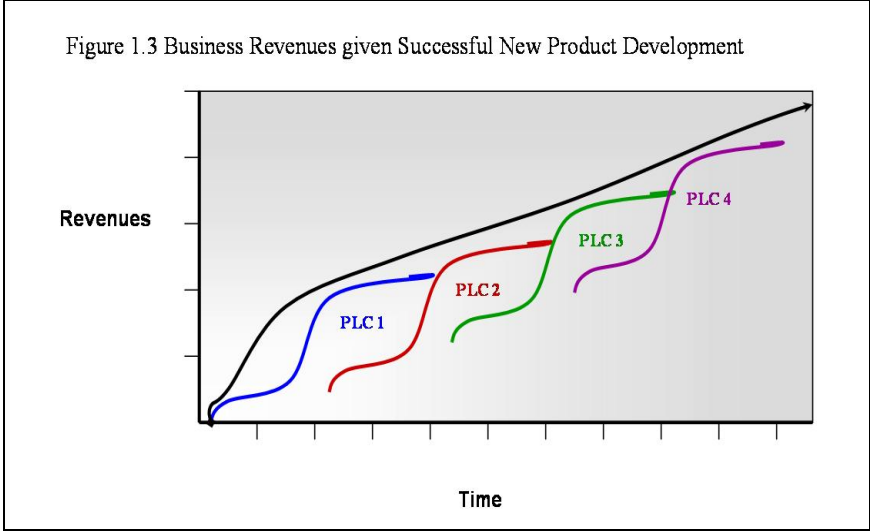
However, if an organization fails to successfully develop innovative, new products, it can be presumed that the organization's revenues will look something more like Figure 1.4 below. This is perhaps the bleakest of all the illustrations because it depicts the increase and sudden decline in revenues when a company develops only one product and fails to develop additional new products. The company might see a brief period of profitability as revenues climb during Phase 2 & 3, Rapid and Mass Adoption. Unfortunately, over time, the product will begin to lose relevance and the company will most likely experience a sudden drop in revenues which would make it impossible to remain in business.

Figure 1.4 Business Revenues given No New Product Development
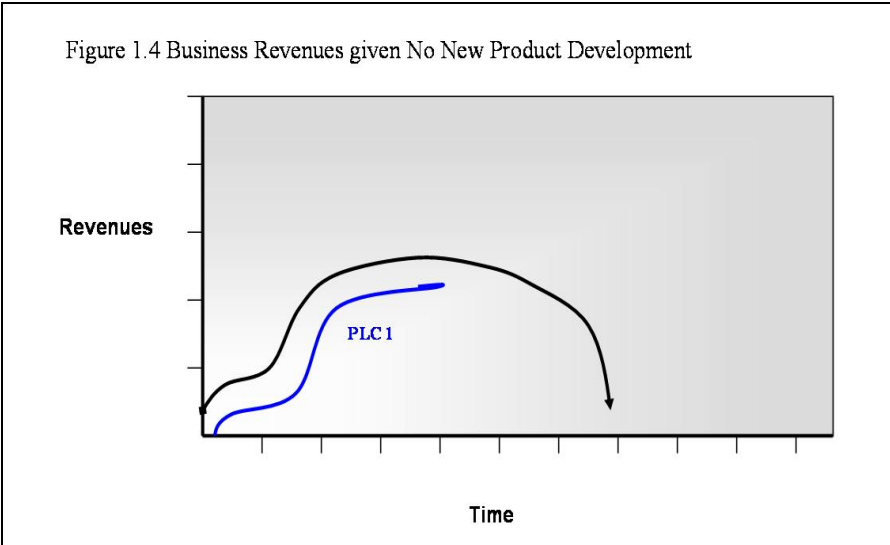
There is a third possibility when examining how new product development affects the revenues of an organization. This instance would be an occasion where an organization develops successful new products but fails to do so in a rapid or timely manner, thus leaving lag time between new product launches and allowing the revenue streams of the organization to stagnate or falter during these periods. This situation is illustrated in the Figure 1.5 below. As illustrated revenues for a company under this circumstance would allow an organization enough revenues to possibly survive but it would most likely never prosper under these conditions.

Figure 1.5 Business Revenues given Slow/Lagging New Product Develop-
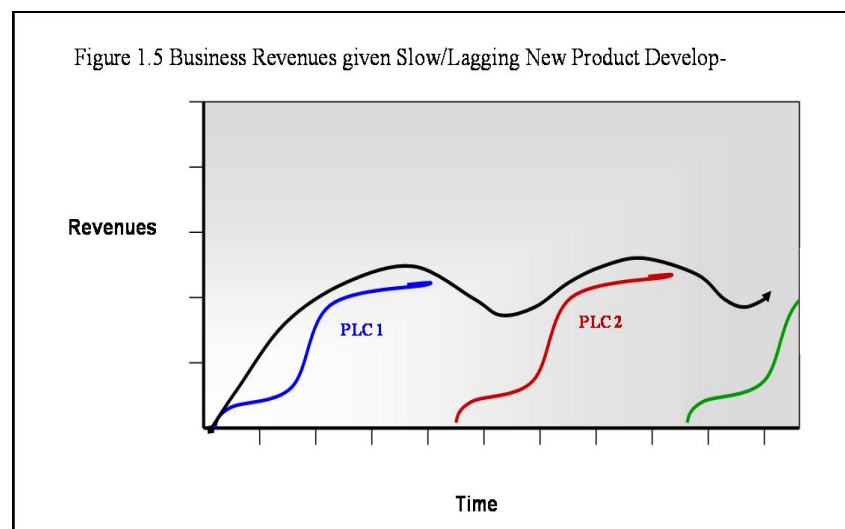
After examining the figures illustrating an organization's revenues in relation to the product life cycle of newly developed products, it is apparent that the more successful and timely an organization can develop new products, the more that organization will not only survive but prosper. New products account for a staggering 33 percent of company sales on average which is one-third of the revenues of corporations being generated by products they did not sell five years ago (Cooper, 2003). This is just the average performance of new products. The top 22 percent of firms - the Best - see results where nearly 50 percent of their sales and profits are derived from new products (Cooper, 2003)!

Much of the literature available regarding new product development seems to agree on the relevance and requirement for a unique, superior product based on the perceptions of users/customers; however, only scarce research has investigated how to best integrate the needs of users into such a development process. Gruner and Homberg (2000) suggest that users can only be integrated in the beginning and finalization of the development process (to be discussed in greater detail in Chapter 4). According to this study, users/customers are incapable of comprehending technical issues and should therefore be excluded from the

development stages. In contract, Cooper (2008) suggests that users should be integrated through-out all phases of the innovative process as illustrated below.

Figure 1.6 The Role of Customers and Users in the Middle Phases of the Innovation Process
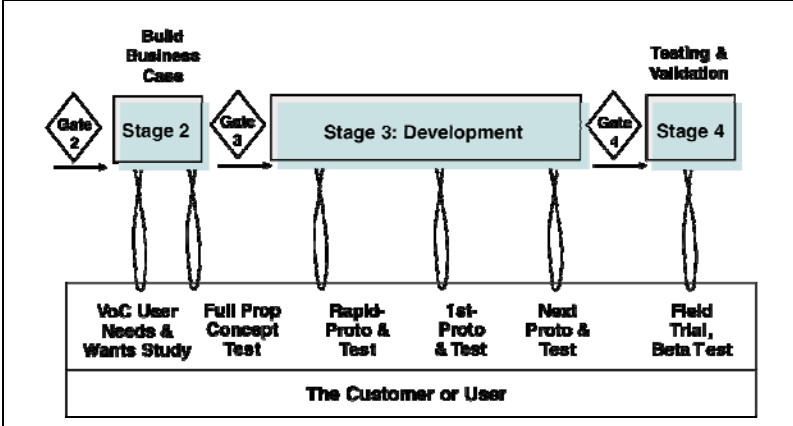
Source: Cooper (2008:225)

A PDMA survey conducted in 2005 also suggests that the best performing companies also use more marketing research tools than the worst performers; however, they fail to elaborate on exactly which user/customer techniques should be integrated into the development process. Other studies and reports have been produced by the APQC (American Productivity & Quality Center) that provide more detail into the inner workings of some sponsor and partner companies during their innovative processes but they again fail to specify in many cases the exact marketing research techniques employed by these companies.

Thus, assuming that the choice of marketing research techniques is strategic, the purpose of this thesis is to analyze which tools are to be used in the designated phases of the product development process as defined by Cooper (2001). Going even further, this thesis will establish an evolution of Cooper's Stage-Gate Process (2001) to incorporate these tools through-out each phase of an innovative process.

1.2 Problem Statement

There has been a lack of specificity in which market research tools and techniques can be used to integrate user/customer needs and requirement into a new product development process in order to increase the likelihood for success. Therefore, this thesis will investigate how best to integrate user/customer market research techniques in a new product development process as defined by Cooper (2001).

In this thesis, I will address how to increase the likelihood of creating successful new products by integrating the user/customer into the innovative process using market research tools and answer the following questions: (1) what are best-practice studies indicating as causes of failure for new products, (2) what are the factors influencing the success of new products, (3) what market research tools are available that might contribute to a new product's success, (4) what information can be attained from employing each of these tools and how can that be applied in an innovative process, (5) what is the Stage-Gate process and how is it applied to new product development, (6) what are the features of this new product development process, (7) how can the user/customer be integrated in this process, and (8) how could this process be modified in the future to better integrate user/customer needs at each stage of the innovative process using the market research tools identified?

1.3 Research Strategy and Methodology

I will substantiate the claim in this problem statement by exploring current new product performers that have been considered successes and failures. This will uncover factors that can be considered indicative of an ongoing deficiency in the understanding or awareness of which market research tools are appropriate for utilization during a new product development process. I will then consider what market research tools are available for user/customer integration, examine the most relevant theories for new product development processes available and conclude with an fully integrated, evolved Stage-Gate process for new product development that will provide specific, substantiated direction for integrating user/customer market research tools. Thus, this will provide the necessary insight for developing a unique, superior product according to users'/customers' perceptions and thereby ensuring the prosperity of the company.

1.4 Delimitations

This thesis will be limited to the development of novel products in the consumer market and will not consider the factors involved in developing products classified as incremental innovation. Nor will this thesis consider product development process variances for the industrial market. This study will not propose to explore any additional theories or models for product development management beyond the various generations of the Stage-Gate.

1.5 Structure of the Thesis

The thesis will be structured in the following chapters in such a manner as to answer the following questions sequentially:

- What do best-practice case studies indicate as factors contributing to product failure and influencing the prospect of new product success?
- What marketing research tools and techniques are available and what information can each provide for new product development processes?
- What is a Stage-Gate process and how does it help managers execute innovative projects?
- How can a Stage-Gate process be modified to integrate users/customers through-out to increase the likelihood that new products will be successful?

Chapter 2: New Product Successes

The purpose of this chapter is to explore available information regarding what factors affect a new product's likelihood for success versus failure. It will be beneficial to establish known conditions that new product managers attribute to the failure of products. It will also be necessary to identify the standard for considering a new product a "success" and overview the factors that have been determined critical to accomplishing this status. By evaluating this information, we will better understand what elements a new product development process must possess in order to be considered successful.

The chapter is structured in the subsequent sections to answer the following questions;

- Why do some new products fail?
- How is new product success measured?
- What factors are critical to influencing the success of new product development?
- Which of these critical success factors can be directly related to marketing research activities?

2.1 Why Products Fail

An estimated 46 percent of resources that firms spend on the conception, development and launch of new products are spent on products that either fail commercially in the marketplace or never make it to market (Cooper, 2003). Most texts and articles focus simply on what makes a product development successful and neglect to consider the opposite in what

conditions contribute to a new product failure. When trying to discover why this failure rate is so high, it is a good idea to analyze past failures in order to look for trends that may be key indicators of poor practices and areas of execution that are lacking.

Figure 2.1 Main Causes of New Product Failure
Source: Cooper (2001)
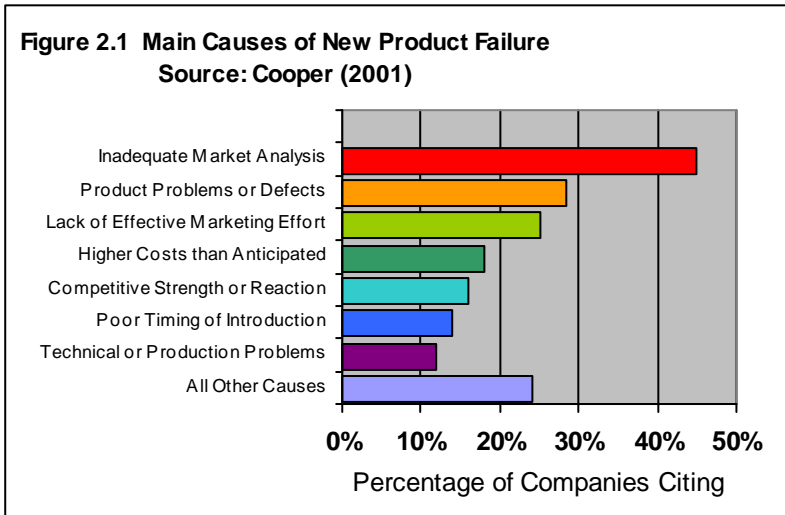
According to a comprehensive analysis conducted by The Conference Board, there are many factors cited that contributed to the products' failures by product development managers when interviewed (Hopkins, 1971). These findings are illustrated in the Figure 2.1 to the left. However, the top four factors that contributed to a products failure mentioned by product development managers remain fairly constant. They are as follows:

1. ***Poor Marketing Research*** - Most often, managers cite insufficient or faulty marketing research as the number one cause of new product failure. It is believed that there is a lack of thoroughness in identifying real consumer needs in the marketplace or recognizing indicators of competition gaining an offensive.

2. ***Technical Problems*** - This is the second most common cause of new product failure which may include problems in design and production that may relate to converting from lab or pilot-plant scale to full-scale production, manufacturing glitches or product quality problems. These problems most commonly stem from a lack of adequate early phase execution (e.g. technical research, design or engineering) or a lack of understanding of the customers' requirements.

3. ***Insufficient Marketing Effort*** - This is representative of a company's assumption that a new product will sell itself and therefore they fail to back up the product's launch with adequate marketing, selling and promotional resources. This may also be representative of the idea that there is a lack of thorough understanding of which marketing tools and techniques to employ at each stage of a process.

4. ***Bad Timing*** - A good number of products fail as a result of moving too slowly through the process and missing the limited window of opportunity in the market,

either because of a shift in customer preference or because a competitor emerges with a new product that seizes the market opportunity.

It is beneficial to note that most of these causes of product failure are preventable, or at the very least identifiable, through effective marketing research conducted early in the process. Building in the Voice of the Customer, seeking customer insights and getting the right market information before Development proceeds are vital requirements (Cooper, 2003). While Cooper illuminates this belief in his recent works, his theory was preceded by nearly 30 years by another expert named C. Merle Crawford. In an article published in the Journal of Marketing back in 1977, Crawford developed 9 hypotheses as to why product failure rates remained high and proposed marketing research as the remedy for many of the causes cited for product failure.

2.2 Measuring New Product Success

The central role of new product development in corporate sustainability and profitability has encouraged a great deal of research on the many factors that drive performance and product innovation success. New products have been determined successful based on their ability to meet project and sales goals, capture market share and satisfy consumers' needs. When examining the numerous studies conducted on successful new products, there is an emerging pattern of factors that make the development of a successful new product more than simply luck. These factors occur at both the project level, such as the way the project is organized and undertaken, and the business-unit level, the specific business practices such as having a new product process, an articulate product innovation strategy, adequate resources and effective cross-functional teams. These factors have become known as the critical success factors for new product development and are discussed below.

2.2.1 Critical Factors for New Product Success

The Product Development and Management Association compared the results of numerous research studies in why new products succeed, why they fail, comparisons of winners and losers and benchmarking studies of best performing businesses to compile a list of critical success factors for new product development processes. The list developed by the Product Development and Management Association (PDMA) is as follows:

➢ Striving for Unique Superior Product

> ➢ Strong Market Orientation that is Market Driven and Customer Focused
> ➢ Predevelopment Work
> ➢ Sharp, Early and Stable Project and Product Definition
> ➢ Planning and Resourcing the Launch
> ➢ Quality Execution of Key Tasks from Idea to Launch
> ➢ Speed (But Not at the Expense of Quality of Execution)
> ➢ Project and Team Organization
> ➢ The Right Environment (A Corporate Climate and Culture that Encourages Innovation)
> ➢ Top Management Support
> ➢ A Product Innovation and Technology Strategy for the Business
> ➢ Leveraging Core Competencies to Foster Synergy and Familiarity
> ➢ Target Attractive Markets
> ➢ Focus and Sharp Project Selection Decisions Regarding Portfolio Management
> ➢ Availability of the Necessary Resources
> ➢ Utilize a Multi-stage, Disciplined New Product Idea-to-Launch Framework

Many scholars, such as Cooper for example, have developed lists of critical success factors much like the one developed by the PDMA. In order to fully understand how these factors can contribute to the success of a new product and how effective marketing research plays such a major role as well, we will briefly discuss each of the critical success factors that can be directly related to the four common reasons cited for product failure; poor marketing, technical problems, insufficient marketing effort and bad timing.

2.2.2 Striving for a Unique, Superior Product

Superior and differentiated products - ones that deliver unique benefits and superior value to the customer - is the number one driver of success and new product profitability (PDMA, 2005). This is a critical success factor because superior products have an exceptional commercial success rate of 98% versus only 18.4% for undifferentiated products (Cooper, 2001). In order for a product to be considered as offering superior and unique advantages, it must meet the following criteria for consumers:

1. offer unique features not available in competitive products
2. meet the customer's needs better than competitive products
3. have higher relative product quality
4. solve a problem the customer has with a competitive product

5. reduce the customer's total costs, high value in use
6. be innovative and the first of its kind on the market.

These six criteria above should invoke key questions to be asked in a new product development process during project screening or production prioritization. By asking these questions and proceeding with only the products that satisfy this outlined checklist of criteria for being a unique, superior product, development teams will greatly improve the odds for success of proposed new products. However, before being able to effectively answer these questions, a significant amount of market research must be conducted.

The important point here is that "superiority" is defined from the customer's standpoint, not in the eyes of the R&D, technical or design departments (Cooper, 2001). As a matter of fact, not only is the definition of "superior" dependent on the customer's standpoint, but "unique" and "benefit" are as well. For instance, a new product development expert cannot accurately say that their new product idea would meet customers' needs better than competitive products unless they first discover what consumers need and require of the product. It would also be impossible for a new product development expert to determine whether their new product has higher relative product quality, can solve any problems customers may have with competitive products, can reduce the customers' total costs or have a high value in use unless they first conduct the necessary market research. Therefore, new product development teams must conduct research to determine customer needs at the outset of the process by; building in the Voice-of-the-Customer (VoC) early in the projects, conducting a competitive product analysis, and building in various test iterations to verify all assumptions about winning product design before entering the development stages.

These six criteria of a unique, superior product can also be viewed as challenges to the product development team to build into the design and functionality of their new product. One example of a unique, superior product would be the Apple iPhone. When it was first launched in 2006, it was the only cellular phone with a touch screen, MP3 capabilities, a camera and the various applications that allowed users to customize their phone's capabilities to fit their lifestyle. Since that time, many companies have produced "me too" products with similar features but these products have not seen nearly as much success as the iPhone and its popularity and profitability continues because none of the "me too" products have been successfully established as unique, superior products.

2.2.3 Strong Market Orientation that is Market Driven and Customer Focused

A thorough understanding of the customers' needs and wants, the competitive situation, and the nature of the market is an essential component of new product success (PDMA, 2005). As mentioned before, a failure to adopt a strong market orientation in product innovation including poor market research, insufficient marketing efforts and bad timing due to market awareness are three of the four main reasons for product failure. The fourth reason documented as a cause of new product failure, technical problems, may be attributed to this factor as well if there is a failure to completely understand users'/customers' needs and requirements that results in a product that is perceived to be technically problematic. A perfect example of this would be in the case of Apple's most recent iPhone having an issue with reception when users/customers hold it a certain way. Had Apple conducted the appropriate market research in the early stages of the product development process, they would have found that this sort of technical problem would not be something that users/customers would accept. Instead, they moved forward with production and launch and felt the backlash from the market when their product was not well received because of this technical problem. Apple's stocks fell slightly in the weeks after complaints began to surface regarding the phone's reception and antennae placement, a time when stocks normally would have been soaring. Apple responded to consumer complaints by saying, "Simply hold the phone a different way." Users/customers needed to be able to hold their phone however they pleased and have it still function as it should. For the price they paid for their new phones, they should have been able to swing upside down from a vine while playing a kazoo and still had perfect reception. Now, Apple is manufacturing special cases for the new iPhone that will allow users to hold the phone as they normally would without experiencing signal interference which increases their per unit cost and cuts into product revenues. Had they discovered this conflict with user/customer needs and requirements early on in the process, they could have avoided this added cost and protected their revenues and reputation.

Not only does a strong customer focus improve success rates and profitability, but it also leads to reduced time-to-market (Cooper, 2001). Allocating the extra time in the early stages of the innovative process to execute a detailed market analysis and conduct high quality market research does not add extra time to the process. In fact, it results in higher success rates,

staying on schedule and better time efficiency. According to one investigation, more than 75% of new product projects omitted detailed market studies.

Perhaps one of the most critical factors that seems to continually trip up firms when developing new products is the importance of marketing research and capturing the voice of the customer (VoC). There are a great many texts and articles that support the idea that sufficient marketing research and a full incorporation of the end users in the innovative process can be most beneficial in developing new products. However, it remains to be one of the less acknowledged steps in the process receiving a far inadequate amount of time and resources. In fact, it would appear that this is one of the first areas where new product development teams attempt to cut corners in order to rush a potential new product to market.

2.2.4 Predevelopment Work

Countless studies reveal that the steps that precede the actual design and development of the product make the difference between winning and losing (PDMA, 2005). This stage of the development project will be one of the most intensive areas utilizing the marketing team members' expertise in conjunction with the technical and financial team members' inputs. A successful firm should spend about twice as much of their resources, such as time and money, on vital up-front activities such as initial screening, preliminary market assessment, preliminary technical assessment, detailed market studies and business and financial analysis before deciding to develop a product. Products that feature a high quality of execution of these front end activities witness a success rate of 75% versus only 31.3% for project where these predevelopment activities are lacking (Cooper, 2001).

As you can see from the figure on the following page, effectively executed marketing activities in the front-end can have a major impact on the success of a new product. This figure illustrates the difference in the quality of execution of early-stage activities between best, average and worst performers in the new product development game (PDMA, 2005).

Figure 2.3 Quality of Execution of Key Early-Stage Activities (Source: Cooper, 2001)

QUALITY OF EXECUTION OF KEY EARLY-STAGE ACTIVITIES

Activity	Best Performers	Average Business	Worst Performers
Business/Financial Analysis	57.10%	26.30%	23.10%
Value-to-the-business Assessment	37.90%	16.50%	4%
Concept Testing	32.10%	27%	15.40%
Market Research Inc. VoC	37.90%	18.30%	7.70%
Prelim. Ops Assessment	29.20%	21.30%	12%
Prelim. Technical Assessment	64.30%	43.70%	23.10%
Prelim. Market Assessment	55.20%	36.30%	34.60%
Initial Idea Screening	53.60%	31.10%	15.40%
Idea Generation	37.90%	19%	11.50%

% of Businesses That Execute Each Activity Well

These activities have also been called the project "homework" and unfortunately small amounts of time and money are usually devoted to these steps. The initial screening, preliminary market assessment and detailed market study are critical areas of the project that require well-developed and executed marketing research. The results of this market research should be utilized at every stage of the new product project. Most frequently, product development managers complain that more "homework" means longer development time when, in fact, experience has shown that it pays for itself in reduced development times. Better project definition, the result of sound "homework", actually speeds up the development process by having well-defined target markets and stable goalposts. Another benefit of having done the "homework" on an innovative project is the ability to anticipate changes in product design earlier in the process and reduce the cost of making these changes later in the development process from a project level stand point. Having the ability to anticipate changes can go beyond just the project level and provide insight into timing issues for new products at the business-unit level. This would prevent firms from proceeding with the development of new products that could become irrelevant before, or soon after, launch due to the introduction of other innovations. One example of this type of situation would be that which portable G.P.S. manufacturers like Garmen® and TomTom® are facing. Now that cellular telephones have G.P.S. capabilities that allow users to get turn-by-turn directions from their

phone, the product life cycle of these portable G.P.S. products has been cut short. Today, companies like TomTom® and Garmen are struggling to find ways for their products to remain relevant for consumers.

2.2.5 Sharp, Early and Stable Project and Product Definition

Establishing sharp, early, stable and fact-based product definitions during the homework phase is a solution to these types of time delays. How well the project and product are defined prior to entering the development stage is a major success factor, having a positive impact on both profitability and reduced time-to-market (PDMA, 2005). By contrast, a failure to define the product and project scope before development begins is a major cause of both new product failure and serious delays in time (Cooper, 2001). The majority of the time that is wasted during the new product development process is a result of unclear or changing definitions of the project and more importantly the product.

A complete and thorough product and project definition should include:
- A definition of the project scope - What are the boundaries of the development endeavor? Is it a single new product, a family of products or a series of releases?
- Specification of the target market - Who exactly is the product aimed at?
- A description of the product concept - What will the product be and do? It is important that this be defined in the language of the customer.
- A description of the benefits to be delivered - What is the value proposition for the customer?
- Delineation of the positioning strategy - How will the product be perceived by potential customers? What is the price point?
- Create a full list of the product features, attributes, performance requirements, and high-level specs.

This is a difficult step at times because the entire project team from each of the functional areas including marketing, R&D, engineering and production must provide input and reach an agreement. If the "homework" has not been conducted properly, then managing to arrive at a sharp definition will be next to impossible. However, with adequate market research and "homework" support, there are several benefits to establishing the project and product definitions early. For starters, by building a definition step into the process, team members are forced to pay more attention to the up-front or predevelopment activities which is crucial for

the success of the project. Also, this definition will serve as a communication tool and guide for the entire team, and the fact that each functional area involved has agreed on this definition means that everyone will have a clear and consistent definition of the product and project. Not only will everyone have the same definition of the product and project, but the definition will also provide them with a comprehensible set of objectives for the development phase of the project and for the development team members.

2.2.6 Planning and Resourcing the Launch

Even if you develop the best product in the world, no one will buy it if they don't know anything about it or where to get it. For this reason, a strong marketing effort, a well-targeted selling approach and effective after selling service are central to the successful launch of the new product (Cooper, 2001). This step is one of the most intensive steps of the new product development process for the marketing team members because it requires a well-developed, fine-tuned marketing plan including appropriate target markets, established marketing objectives, a strong marketing strategy and program. The development of this plan does not start at the launch phase of the process but rather should begin in the early stages of the new product development project. Critical facets of the marketing plan, such as the target market definition, positioning strategy and product design, must already be in place before the product's design and development phase even begins (Cooper, 2001). Other facets, such as pricing strategy and promotional approach will be more tentative and be developed more effectively as the project progresses.

However, every aspect of developing a well-integrated and properly targeted marketing plan is dependent upon the market intelligence that is gathered. Market studies designed to yield information crucial to marketing planning must be built into the new product project (PDMA, 2005). This idea supports the integration of employing the proper marketing research at the predevelopment stages and through-out.

2.2.7 Leveraging Core Competencies

By leveraging current strengths, competencies, resources and capabilities, a company can increase their odds of success in developing new products. However, new product projects that require a company to step outside of their familiar territory often have a lower chance of success. The reason for this impact is because a firm will have strategic advantages in leveraging core competencies such as having existing in-house technology, customers, etc.

will reduce the costs and risks, having considerable "domain knowledge" about the technology or market which to operate and the high likelihood that past experiences will benefit the project.

As alluded to above, there are two types of leverage that are important for firms in new product development; technological leverage and marketing leverage. Technology leverage refers to a firm's ability to expound on in-house development technology, exploit inside engineering skills and make use of existing manufacturing or operations resources and competencies. Marketing leverage is in reference to a firm's fit in terms of customer base, sales force, distribution channels, customer service resources, advertising and promotion and market-intelligence skills, knowledge and resources (Cooper, 2001). In order for a firm to identify areas of marketing leverage, they must have a clear and thorough understanding of their current market position. Firms that have overlooked the preliminary market research and have excluded the VoC will not have the necessary tools for marketing leverage.

2.2.8 Target Attractive Markets

Simply put, products targeted at more attractive markets are more successful. Determining a market's attractiveness is based on two factors; market potential and competitive situation. If a market is large and growing, has a strong customer need for products and the purchase is important for the customer, this would be considered a market with potential. If a market exposed to intense competition, competition on the basis of price, high quality and strong competitive products, or competitors whose sales force, channel system and support service are strongly related would be considered a negative market for entrance or expansion. These two characteristics of a market should be considered as criteria in the selection of new product projects.

2.2.9 Focus and Sharp Project Selection Decisions Regarding Portfolio Management

The project selection process for new product development is a critical element of the portfolio management of a company and thus the company's success. A firm must employ tough go/kill decision points when determining which projects they should proceed with developing. While some of these go/kill decisions will be based on technological and/or financial factors, a great deal of them should be based on factors relating to the market. A new product project that establishes effective marketing go/kill criteria and employs the VoC

through-out the development process will be more likely to create products that will be successful. This focused and sharp process of selecting projects will provide a strong portfolio of products to manage and build upon.

2.3 Marketing as the Key

With virtually all NPD experts recognizing sufficient marketing as critical to the success of new products and acknowledgement by new product development managers of poorly executed or insufficient marketing as a leading cause of new product failure, why is it that this area is still so neglected and poorly executed? Perhaps one of the most persuading reasons would be the non-marketing background of many persons making the key intermediate new product decisions; they have never worked in a situation where an organized research function existed solely as a service to decision makers (Crawford, 1977). In other words, they know that they *should* incorporate marketing information in a new product development process, but they do not know *how* or *when* to execute the proper marketing research tools to assist in establishing criteria for decision making. If new product decision-makers do not possess the ability to use marketing research efficiently, the entire new product development function is unstable; marketing team members will be forced to accept a role for their function considerably less than optimal and then must sell their service against an unfavorable institutionalized misconception. What can be done to allow marketing research to fulfill its proper role in the innovative process and increase the likelihood of new product success? In the following sections we will determine what marketing research tools are available for new product development professionals, examine current innovative processes and develop an evolutionary, multi-stage process for new product development. This will provide NPD decision-makers with a better understanding of marketing research tools that integrate the user/customer in the process and a guide for incorporating these tools in the innovation process will be introduced. Thus, this will allow marketing research to fulfill its proper role in the innovation process and increase the likelihood for success in developing new products.

Chapter 3: Marketing Research Techniques

The purpose of this chapter is to identify the market research tools available for integrating user/customer in the new product development process. I will also investigate the various ways in which these tools are to be utilized and what kind of information or data they can provide for new product experts during the development process.

This chapter is structured in the subsequent sections so as to answer the following questions:

- What is market research and how are the different methods characterized?
- What are the Primary Data Collection Methods?
- What information is attained through each primary data research method and how can this information be used in a new product development process?
- Who are Lead Users and how can their input benefit a new product development process?
- What is a House of Quality Technique and what benefit can be derived from utilizing this research method during new product development?
- What are secondary data sources and uses in a new product development process?

3.1 Market Research Overview

The process of new product development has been the focal point of studies and debate for some time now and never has it been more relevant than in the past 10 years. The advancements in technology and the refinement of development processes have brought about a great number of significant innovations that have changed the way we live our lives from this point forward. As many scholars have suggested and proven, a crucial component to developing successful innovative products and services is integrating the user into the process. The dilemma is sometimes figuring out exactly how to initiate and execute integrating users into the innovative process due to the fact that there are so many methods one could choose from.

The task of integrating users into the development process can be done by analyzing user behavior through conducting research and incorporating the user into the innovative process. Marketing research should result in thorough and detailed knowledge about all factors likely to influence demand for specific products/services (Chisnall, 2005). Conducting the appropriate marketing research during an innovative process should not only help establish criteria for go/kill decisions through-out the process but also establish five major areas of criteria for a new service/product; defining the product or service itself, identifying the users/customers, determining pricing, directing a sales strategy and directing a promotional strategy. The information collected will also provide innovators with data to examine and understand user behavior and discover future areas for innovation.

It should be noted that there are two types of market research; quantitative and qualitative. Quantitative research is statistical analysis of data sets whereas qualitative research methods assess buyer behavior based on observation and interaction to learn about attitudes, thought processes, judgments and experiences (APQC, 2001). Both of these types of market research have suitable applications within the new product development process and will be discussed in more detail as this chapter progresses.

It must also be noted that there are two types of data that will be collected through market research practices; primary data and secondary data. Primary data is data that has to be collected for the first time either by one or a combination of observation, experimentation and questionnaires. This form of data collection is obtained directly from a user/customer. Secondary data is existing information that may be useful for the purposes of specific surveys and is available through either internal records/files or external entities' previously conducted research. In integrating the user/customer to innovation, it will be most beneficial for this analysis to focus on the primary methods for collecting data. It must be acknowledged, however, that secondary methods can play a role in understanding markets and user/customer behavior as well and will be discussed briefly at the end of this section.

The process of primary data collection, while being very relevant for integrating the user/customer in an innovative process, is subject to many sources of bias. Therefore, it is a suitable time to recognize the two main categories of research techniques identified as *reactive* and *normative* in order to prepare for future analysis of bias. Reactive research employs data collection techniques that require interaction between investigators and respondents such as in interviews, questionnaires and experiments, or primary data collection methods. This allows for personal perceptions to sway or alter either an investigators ability to remain neutral and/or a respondent's ability to answer without regard to personal prejudices, beliefs and emotions. Normative research, otherwise known as non-reactive measures, are surveys involving data collection techniques where there is no reliance on respondents directly to give information such as observation or library research. This form of research is considered "unobtrusive" and is recommended for its ability to provide less biased data. However, the normative measures are also less likely to get users directly involved with the innovative process.

The objective in the following sections will be to identify available market research methods and establish the specific knowledge acquired by each method. This will help to determine what information each method would provide for new product development teams and how each would be most applicable during an innovative process. In each method that will be examined, we will further identify the areas of bias to be aware of and suggest ways to attempt to reduce or eliminate the interference of bias in research practice.

3.2 Primary Data Collection

As mentioned before, primary methods of data collection means gathering data for the first time by either one or a combination of observation, experimentation and questionnaires. These forms of marketing research give innovators insightful knowledge about user behavior, provide project and product direction and establish criteria for making go/kill decisions during the innovative process for products that would not satisfy user needs and benefits.

3.2.1 Observation

The normative technique of research known as observation is very common in marketing research practices and can provide innovators with more accurate data than experiments and questionnaires. This is due to the fact that the users' responses will be virtually free of bias because they are unaware that their actions are being monitored and tracked. This technique can also be used in combination with other forms of marketing research to provide innovators advanced insight into user behavior and pathologies. Typically, there are three standard forms of observation in use among marketing researchers; audits, recording devices and watching people's behavior as buyers.

3.2.1.a Audits

Audits can be described as an analysis of consumers' buying behavior and habits through a physical check of selected types of products made every few weeks in order to estimate actual sales and purchase history. With the advent of new electronic recording equipment such as bar coding, scanners and computer based systems, audit data is now easily integrated into retailing audits, panel research and advertising research. One such type of audit that was first introduced in Great Britain in 1989 is the ACNielsen Homescan panel. A panel of 10,500 households in Great Britain and Northern Ireland were provided with a small, hand-held bar-code scanner or 'wand' which was used to record all household purchases. This recorded data on purchases of grocery items, from fresh and pre-packaged food-stuffs to household

products, pet care, toiletries, confectionery and liquor. Purchases are scanned and questions are answered and then the 'wand' is placed in a modem which is linked to the telephone for transfer of the stored data to Nielsen's host computer. The data collected from this method of audit includes the date, items purchased, any promotional offers applicable, price, quantity and store used. To avoid bias in the data collection by excluding consumers that did not have a telephone, Nielsen installed special equipment into panel homes which lacked a telephone. Also, non-bar-code items can be recorded by panelists in special books. This method of data collection would allow new product development experts to gain insight into percentage of household purchasing, percentage of expenditure, average number of visits per buyers, average spend per buyer, average spend per visit, brand comparisons, level of trial of new products, brand loyalty/brand shifting analysis and demographic analysis. The use of these forms has become known as home audits and all of the data gathered is useful market knowledge to have when developing new products. Another form of audit would be store audits where trade stocks are tracked on a monthly basis which gives manufacturers a clear picture of the way in which their products are being bought by users/customers. Store audits can also provide traffic counts which measure the intensity and flow of shoppers.

3.2.1.b Watching People

By simply watching people using products in their natural environment, market researchers can identify problems or issues with current products, areas for potential improvement with current products and user/customer habits or preferences when using specific products. The use of video cameras, which will be discussed in more detail in the following section, has allowed market researchers to observe users/customers without their being aware of it which eliminates the presence of bias.

3.2.1.c Recording Devices

The use of recording devices is becoming more popular and effective as technology progresses. In its simplest form, recording devices may be used to record customers' purchasing behavior as discussed above. By recording and observing peoples' purchasing behavior, a market researcher can analyze body language, selection and eventual purchase of certain products to discover many bits of useful information. Observers can watch people's behavior when they enter a particular department of a store; how many walk around before settling down to consider specific styles or types of products; how important it is to shoppers

to be able to handle goods, to feel their quality or weight; how many approach shop assistants for help, and how soon after entering the department; how carefully shoppers read labels, packaging or 'guarantee cards' attached to products (Chisnall, 2005).

However, the use of recording devices as a means of data collection has become very elaborate as technology has continued to advance. It is now possible for marketing researchers to measure consumer response to products using both pupil dilation and body temperature with telephoto lenses and thermal cameras. "Pupilometrics" is the name given to the method of advertising research in which a study is conducted of the relationship between a viewer's pupil dilation and the interest factor of visual stimuli (Lieberman, 2007). By using hidden cameras, market researchers can measure pupil dilation to determine shoppers' responses as they look at different products and packaging. This form of market research using recording devices such as video camera is closely controlled by the MRS's code of ethics, which states that consumers should not be filmed unless they are in a situation where they could reasonably expect to be seen or heard; this rules out, for instance, the use of cameras in changing/fitting rooms. With the use of thermal recording devices, researchers can observe users'/customers' reactions to specific products based on their increase in blood pressure and body temperature. This form of study has become known as 'Thermography' and is not very common as of yet due to the high cost of equipment and the fact that the technology and usage is still being developed.

Through observation, researchers may identify patterns of typical behavior which could prove valuable in the design of new products. However, it should be noted that the analysis of observations are prone to bias. For this reason, observation analysts should be specially trained to maintain, as far as possible, objectivity and it is highly advisable to have standardized report sheets to help reduce the presence of bias in the analysis portion of observation.

The information gathered by observation alone is usually not very useful; it will supply information at a certain level, but it does not reveal hidden buying motives. When the technique is practiced by skilled observers, it can be an economical method of acquiring additional knowledge about buying behavior which may be unobtainable by other methods (Chisnall, 2005). However, when this method of market research is combined with a second method, such as an experiment or questionnaire, the information provided can be not only

economical but it can expose concealed motives of users/customers that can provide powerful insight for an innovative process.

3.2.2. Experimentation

The general rule for conducting scientific experiments is to hold all conditions constant except for one independent variable in order to test the effects of that one variable. This ideal experimental situation is systematically impossible in the real-life conditions where marketing experiments take place. Given the fact that marketing is deeply involved with human behavior and with the reactions of consumers of a very broad variety of goods and services, marketing experiments are not easy to plan and execute. Every attempt at applying the principals of scientific experimentation should be made, but marketing researchers will inevitably have to account for the possibility that there will be limitations to their research environment. They must consider these limitations when designing their experiments to reduce the influence of uncontrolled variables. An example of limitations for a marketing experiment might be the 'carry-over' effects of advertising which may be significant from one selling period to another and therefore produce higher sales yields not resulting from any variable of the experiment.

Experimentation provides market researchers with normative, quantitative data. Over recent years, more emphasis has been placed on quantifying marketing problems which has encouraged the development of an analytical approach, based on variables which are considered within the framework of a decision model. These modern experimental designs can range from simple to very complex. There are two main types of experimental models; time series analysis and multiple variable analysis using factorial designs and Latin square designs.

The time series analysis method can involve just one treatment and subsequent measurement or several intermittent treatments over a period of time with individual measurements after each treatment. For example, sales of a particular department of a store could be audited over a period of time before adding a point-of-sale display and then again after the introduction of the point-of-sale display to measure the effects. In this instance, the point-of-sale display is the only variable being analyzed and measured. This type of experiment can be conducted either with or without a control group as well. Experiments as market research such as this could be very beneficial for new product development experts to employ in the pre-launch

phase of the innovative process to understand how to best package and promote the products at point-of-sale locations so that they appeal to user/customer purchase preferences.

Time series analysis methods of experimentation may be very difficult and inefficient due to the restricted testing of a single variable. For this reason, multi-variable experiments are more commonly utilized. For multi-variable experimentation, marketing researchers can utilize either factorial designs or a Latin square designs. A factorial designed experiment permits the involvement of combinations of observation of at least two variables to be tested simultaneously. One example of this type of experiment for a new product development expert would be to observe a range of consumers from different market segments utilizing various versions of a product to test several attributes of a product such as design, functionality and ease-of-use according to market segment.

A Latin square design is a modified multi-variable design in which the interaction effects are usually assumed not to be significant. This process is simplified and results in a reduction of both time and cost. For example, let us assume that the table to the right illustrates the results of an experiment testing product usability on two different variables. The experiment

3.1 Example of Latin Square Design Experiment

	1st	2nd	3rd	Final
A	16	22	2	17
B	4	3	33	7
C	20	15	5	16

would measure product preferentiality and final selection when users/customers are given three comparable products to choose from. The first variable, measured on the vertical axis, would indicate which product users/customers selected for examination. The second variable, illustrated on the horizontal axis, would indicate the order in which user/customer chose to inspect each of the products and which was final decision to purchase. This experiment would allow market researchers to compare competitive product preference among consumers as well as consumer product analysis processes in a purchase situation. However, for further understanding of the user/customer's intentions and motivations, a market researcher would need to pair this experiment with another form of research such as a questionnaire.

3.2.3. Questionnaires

The final method of primary data collection is questionnaires which can be conducted in many different ways. A questionnaire is a method of obtaining specific information about a defined problem so that the data, after analysis and interpretation, results in a better appreciation of the problem (Chisnall, 2005). Questionnaires are the preferred method of data collection in

marketing investigations because, unlike observation and experimentation, the process of interviewing is flexible and capable of yielding a very broad variety of valuable new data. However, they must be carefully planned and executed to ensure the collection of only the most relevant, useful data.

As mentioned, there is a great deal of preparation and planning that must go into developing questionnaires. Researchers must define goals and have a clear and concise outline for what type of information they will try to accomplish with their questionnaire before they proceed. The goals set for a questionnaire must determine whether the information to be gathered is to be quantitative or qualitative and what problem statement they will attempt to resolve.

When it comes to determining what information the researchers will try to gather, there are five classes of information that are generally useful for marketing decisions which are as follows:

1. Facts and Knowledge
2. Opinions
3. Motives
4. Past Behaviors
5. Future Behavior

Facts and knowledge will include quantitative data that is gathered in a structured, practical manner. Opinions, motives and future behaviors will most likely be qualitative information while past behaviors can be either quantitative or qualitative depending on the goals of the questionnaire.

Once the innovative team has established goals and decided what type of information they wish to extract from the questionnaire, they will need to outline a set of questions to utilize in their questionnaire. At this time, researchers will establish whether they are to use open-ended questions or closed questioning to gather information. Open-ended questions include those questions that require more than a simple 'yes' or 'no' response requiring the respondent to elaborate on the particulars of why, how and when. Another choice for the type of questions to be asked are checklists and multiple choice questions, which tend to be particularly susceptible to bias given that a limited number of predetermined answers are the only choices offered to participants as response options.

There are three conditions necessary for ensuring a true response to a question which are (1) respondents must be able to understand the questions, (2) they must be *able* to provide the information requested and (3) they must be *willing* to provide the information. Another crucial point to be aware of when developing questions for this method of data collection is to avoid phrasing them in a manner that suggests certain answers are more acceptable than others, otherwise known as 'leading' questions. Lastly, when developing a set of questions for this market research technique, it is imperative to ensure that technical terms are correctly handled and that the area of scientific or technical inquiry is clearly understood by both the interviewers and the interviewees. In other words, questions should be formed avoiding terminology that is so technical, users/customers would have difficulty or be incapable of understanding. In some cases, specific questions may not be outlined but instead a basic script may be developed and a list of information to be gathered will be sufficient. In such cases, the well-trained, experienced interviewer is to determine how to acquire the information from respondents given their general attitude towards participating.

After the careful construction of the goals for the questionnaire and the questions themselves, it must now be determined which technique to use to collect the data. There are many forms of questionnaires and, depending on what type of information researchers are seeking; some methods will be more beneficial than others.

3.2.3.a Personal Interviewing

Personal interviewing involves trained interviewers working with a carefully selected sample of the population that is under survey (Chisnall, 2005). This form of questionnaire is also known as face-to-face interviewing and can be conducted in households, industrial, commercial or public sector organization or in shopping malls. This method of data collection is very popular with marketing researchers; however it is highly susceptible to the forms of bias discussed earlier. The individuals that conduct the personal interviews should be specially selected, trained and motivated but they are often the root of the bias in data, either subconsciously or inadvertently. Interviewers should also have sound, basic knowledge of the industry/products covered by the survey. At the very least, they should have the intellectual capability to acquire sufficient information in a short period of intensive training to conduct the interview effectively. The interviewers' personality must help them to be accepted by the interviewees as well. Professional interviewing skills are necessarily the most important factor, but technical competence alone does not ensure effective interviewing.

As technology has advanced, market researchers have begun to use Computer-Assisted Personal Interview (CAPI) techniques. By means of laptop computers, researchers conduct personal interviews and input data down the telephone (Chisnall, 2005). This reduces the time of the research process, the tendency to give 'extreme' responses and provides higher quality data with added flexibility and faster turn-around times.

Personal interviewing could be most useful through-out the product development process, given access to the appropriate customers, as it allows experts to incorporate the customer's feedback during the entire development of a product. For example, a new product development team selects three individuals to actually participate in the development process. These individuals would be consulted and interviewed at each phase of the process regarding current product problems or short-comings, product idea generation, product development including design and functionality, product launch and product tracking.

3.2.3.b Postal or Mail Surveys

This method involves mailing questionnaires to a sample of the population to be surveyed. They are particularly valuable where the population to be surveyed is large and widely spread geographically. Many marketing researchers continue to use this method preferentially because of its low cost of execution. However, the costs associated with postal surveys can be misleading if the overhead expenses and salaries for preparatory work, such as drafting the questions, and subsequent tasks, like analysis and interpretation, are taken into consideration.

The true cost of postal surveys depends on the effective response rates which can vary significantly (Chisnall, 2005). Consequently, some attempt should be made to evaluate the value of this method of research in comparison with that of various others. This will entail a consideration of not only the comparative costs of these methods but also the quality of the findings. While well executed postal surveys are often void of the issue of bias, they are not always a very successful method given the potential for low response rate. If response rates are low, the integrity of the data may be jeopardized as there may be the presence of serious bias in the data. Non-response is a serious limitation of postal surveys; for this reason, motivating respondents to contribute is a major factor in achieving acceptable response rates.

Another issue that arises with this form of data collection is the lack of ability to probe or clarify answers from respondents. Since no interviewer will be in attendance to interpret the questions, postal surveys must be free from ambiguity. This adds to the difficulty and costs of developing these types of questionnaires.

If postal/mail surveys ask questions of respondents that are open-ended, their response may not be apparent or clear. In this instance, the information gathered from the response may not be useful for the results of the questionnaire. In a new product development process, this type of questionnaire could be helpful in the early stages of product development to identify areas of opportunity based on factors such as competitive product short-comings or current product revision opportunities.

3.2.3.c Telephone Enquiries

Telephone enquiries hold a great deal of value in the pilot-stage of research and in forming sampling lists, however, this form of market research has its advantages as well as disadvantage. Telephone interviews are restricted to verbal communication and, until recently, no visual aids could be used to support the process of questioning. This also reduces an interviewer's ability to read and observe body language that might indicate more than just what is being said verbally. On the other hand, telephone surveys are still considered to possess more advantages than disadvantages. For example, they are convenient, imperative, offer anonymity, attract freer responses, can be used at precise times and are easily controlled and supervised.

This method of questioning has faced a large amount of difficulty and evolution over the last few decades. Firstly, telephones were not always as common in households as they are today and are now seeing a decline with the replacement of cellular phones as primary means of communication. Also, even though the percentage of household telephones around the world continued to increase, there were large portions of the populations that still had unlisted, or exdirectory, telephone numbers. Very little information was known about the owners of these unlisted numbers which caused complications. Bias may result in this form of research as an outcome of collecting a sample from telephone directories for two reasons; (1) the amount to which domestic telephones are installed, and (2) the comprehensiveness of the directory listing. In order to overcome the problem of deficient sampling frames based on domestic telephone lists, the technique of random-digit dialing (RDD) was developed in the United

States and is now widely used (Chisnall, 2005). Using information supplied by the telephone companies, researchers can generate telephone numbers by employing a table of random numbers so that they can dial any telephone number whether listed or not. The use of RDD telephone inquiry techniques proves to be very cost effective in metropolitan areas where the amount of unlisted telephone numbers is disproportionately higher.

However, this method of research became so irritating to consumers in the United States that the government stepped in and developed legislation regarding this issue. While increasing in relevance in the U.K. and other areas of Europe and Asia, this form of market research significantly decreased in the U.S. in 2008 when the Do-Not-Call Improvement Act was passed. This piece of legislation allowed telephone numbers to be registered on a "Do-Not-Call" list and telemarketers that continued to contact a number on the list would face serious fines and other repercussions.

Nonetheless, many market research firms have the ability develop a sample population for conducting telephone enquiries by using customer databases which is not covered under this act and still allows researchers to gain insightful knowledge about their users/customers. This permits researchers to take full advantage of the low costs associated with telephone inquiries while eliminating the possible presence of bias through using directory listing samples.

Telephone inquiries progressed rapidly with the introduction of centralized telephone facilities. With the introduction of Computer Assisted Telephone Interviewing (CATI), this method of data collection has become even more efficient and cost effective. CATI involves a number of basic characteristics: an interviewer is seated before a computer-terminal, reads the questions on the screen to the telephone respondent, and then records the response by means of the terminal's keyboard. Distinct advantages associated with CATI are related to the measure of control exercised in the interviewing process: the computer is programmed so that the interview cannot proceed until a valid answer has been keyed in on the keyboard, so a question cannot be inadvertently omitted, or an answer given which is inconsistent with previous responses (Chisnall, 2005). Also, the sequential sampling techniques interim results of surveys conducted using CATI can be readily available which provides researchers with immediate responses. By using a central location with multiple CATI stations, market researchers can effectively reduce the costs and time associated with contacting

geographically spread samples. Conversely, CATI is inadequate when it comes to the handling open-ended questions.

Another, more recent approach to conducting telephone enquiries is to request that users/customers call a toll-free telephone number to participate in a short survey. This removes the restrictions and costs associated with contacting unwilling participants, but it usually requires some type of incentive for cooperation in order to gather a large enough response sample. This method of questioning is increasingly used in consumer surveys and also in the industrial field.

3.2.3.d Panel Research

A panel, or longitudinal survey, is a type of sample survey from which comparative data from the sampling units are taken on multiple instances. With panel research, sample groups may consist of individuals, households or firms and is especially useful in tracing movements in buying behavior over a period of time. Data is collected from the same sampling units at regular intervals either by mail or personal interview and provide researchers with information used to evaluate products, advertising viewing, consumer behavior, extent of brand loyalty, etc. Manufacturers who subscribe to consumer panel surveys can obtain very valuable information about the types of consumers who buy their products, and their buying behavior (Chisnall, 2005).

Consumer purchase panels are the most commonly used panels by researchers in an attempt to achieve a better understanding of behavioral and attitudinal changes among consumers. The objectives of a panel should be clearly defined. For example, panel coordinators should determine the nature of the population being surveyed, the geographic boundaries and other critical elements prior to recruiting panel members. Another thing to be taken into consideration would be determining the appropriate panel size. In line with general sampling theory, the larger the size of the sample, the greater its precision or reliability, but pragmatic constraints intervene (Chisnall, 2005). The segmentation criteria required for designing a panel should be another factor to establish when developing a panel. For instance, will the sample be determined by the usual demographic such as age, sex, household status, occupation, household size, etc?

One of the biggest challenges is constructing either a systematic (quasi-random) or stratified random sample is to achieve a representative membership of an adequately sized panel. Since people are being asked to provide information of a continuous nature, often times the cooperation and participation of sample members will dwindle as the study progresses affecting the mortality of the consumer panel. The high drop-out rates of panel surveys can be overcome by inflating the size of the original sample in an attempt to compensate for future losses, but this method will, of course, add extra expenses.

Another issue with which to be aware when conducting panel research is the atypical behavior of new members. At times, new members will suddenly change their established patterns of behavior. Panel operators may exclude data from new members for a certain period of time in order to neutralize this bias. There is also the heavy cost of panel member recruitment and maintenance that makes panel research somewhat problematical. The size of the sample is often affected by this issue which can affect the extent to which micro-market analyses is feasible. It is also difficult to investigate attitudes or motivations on a constant or repetitive basis because respondents may become "conditioned."

A few other factors affect panel research which includes the necessity of back-up services and the technological advances. The large amount of information that is gathered over the long-term of a panel research project requires some form of back-up for all that data. The technological advances including the introduction of bar coding, optical mark reading, and electronic point of sale scanning has allowed for new developments in panel research such as scanner store consumer panels and the ACNielsen Scantrak.

Several best practice companies have research panels which are concerned with providing information on a regular basis through-out the innovative process. For example, Kraft Foods has developed a strategic alliance with ACNielsen's BASES which conducts quarterly meetings to discuss their R&D findings. As mentioned earlier, ACNielsen is one of the world's leading providers of panel research data. Kraft sometimes uses a BASES e-panel, which gathers consumer reaction to multiple products or concepts via the Internet, which allows sequential testing of multiple concepts (APQC, 2003). This is a means of cost effectively gathering data to assist in volume forecasts and often have no loss in accuracy. BASES e-panels also allow Kraft to use digital art and concepts which further reduces the cost and time for product concepts.

3.2.3.e Group Interviews/Discussions

Because individual depth interviews are costly and time-consuming, qualitative inquiries tend to take place in groups; this is beneficial as people are generally less inhibited in a group (Chisnall, 2005). One effective method for gather information in a group interview/discussion is the 'funnel' technique - discussions are first opened up on the widest possible level and then slowly narrowed through sequentially more limited channels. This method of qualitative research focuses on studying the interaction of group membership on individual behavior through the free exchange of ideas, beliefs and emotions. Contrasting ideas on the appropriate group size ranges from five to eight participants but it is generally established that a period of no more than one and a half hours is sufficient for topics to be explored. The researcher, also known as a moderator, should guide the conversations so that all of the pre-established principal points are covered adequately. This is to be done without directly influencing the discussion by initiating any formal questioning. Another function of the moderator is to be aware of any attempts by group members to dominate the discussions and to diplomatically intervene to permit everyone in the group an opportunity to contribute their opinions on the matter being discussed

The analysis of this form of qualitative research is a daunting task that requires expert and objective attention. As mentioned, the objective is to analyze consumer behavior as it is affected by a group so this form of qualitative research is best used in areas that are most often the result of group consensus such as product or program development, planning and goal setting, policy making and testing, and as a primary and secondary research tool. Some critics of this method of research claim that the results are subject to the individual analyst's training and background and therefore selection of the moderator, analyst and group are critical to eliminating bias in this form of research.

3.2.3.f Focus Groups

A focus group study is a carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment (Kruegar & Casey, 200). The discussions are relaxed and participants' responses are once again influenced by the responses to ideas and comments of others as in group interviews/discussions. However; unlike group interviews/discussions, a focus group has a specific set of questions to be asked and discussed among the group rather than just topics to be covered. It is the intention of a

focus group to create a permissive environment that encourages participants to share perceptions and points of views without pressuring participants to vote or reach a consensus. The group discussions are conducted several times with similar types of participants so the researcher can identify trends and patterns.

The objective of a focus group is to promote self-disclosure among participants so that researchers can gather qualitative data about what people really think and feel about a particular issue, product, service or idea. The main uses for focus groups are for gathering qualitative information regarding decision making, product or program development, customer satisfaction, planning and goal setting, needs assessment, quality movements, understanding employee concerns, policy making and testing, and as a primary and secondary research tool.

The moderator of a focus group guides the conversations so that a number of pre-established, questions are covered and discussed adequately. The moderator is free to openly influence the discussions in a focus group by directly initiating formal questioning. Again, the selection of the moderator, analyst and group participants is critical to obtaining results free from as much bias as possible.

3.2.3.f Internet Research

Internet research has become extremely popular over the last few years due to several factors including low cost of execution, speed of response and results, ability to analyze results quickly in an electronic format and lack of bias influence from interviewer/moderator. There have been projections and claims that the Internet would provide limitless knowledge on an array of topics, products and services. However, these projections and estimations about the capabilities for such instant access to information and potential for marketing were a bit over exaggerated. While computer skills and literacy are now being acquired during the formative years of schooling and the Internet has increased the accessibility of knowledge to a great many people, there is still a large portion of the population that either does not have access to the necessary equipment or possess the knowledge base with which to access the Internet. These non-users are quite content to live without the Internet and can see no reason to change their traditional habits and are therefore not represented in the sample selections of this method of market research. The largest problem as it may be, lies in securing representative samples of the general population due to inadequate sample frames.

Current methods of Internet research being employed include online focus groups, 'live' depth interviewing and online discussions (both individual and group), and online polling. While these forms of research are in the developmental stages, researchers are working to overcome the drawback associated with the impersonal nature of this methodology. For this reason, this method of qualitative research is limited and has been suggested to be best used as an adjunct to, not a replacement of, face-to-face methods.

3.3 Lead Users

Many methods of primary data collection require a sample group of users to be examined and the most relevant type of consumers for the innovative process are lead users. Lead users are users whose present strong needs will become general in a marketplace months or years in the future (Von Hippel,1986). The idea of lead users and their incredible value in conducting market research was first generated by Eric Von Hippel in 1986. Von Hippel conducted research on how lead users could be scientifically identified and how their insight and preferences could be integrated into industrial and consumer marketing research analysis of emerging needs for new products, processes and services. Since lead users are familiar with conditions which lie in the future for most others, they can serve as a need-forecasting laboratory for market research (Von Hippel, 1986).

Von Hippel proposes that the more familiar a user is with a product and its attributes in the present, the less likely they will be to generate novel product concepts that conflict with the familiar. This is not to say that market research conducted on typical users lessens the ability to identify needs for new products for many slow-moving consumer products. However, in high technology industries where product life cycles are rapidly reducing in length, lead users are familiar with conditions which lie in the future and therefore are in a better position to provide data on needs associated with potential conditions.

There are two main types of lead users to be considered. According to Figure 3.2 below, lead users can be characterized as beginning users/consumers of a *novel* product which is a new product still in phase 1 of the product's life cycle known as Stalled Adoption, or they may also be characterized as those users/consumers that are early responders of a new product as it enters phase 2 of the product life cycle, the rapid adoption phase.

Figure 3.2 Lead User Adoption (Source: Von Hippel, 1986)
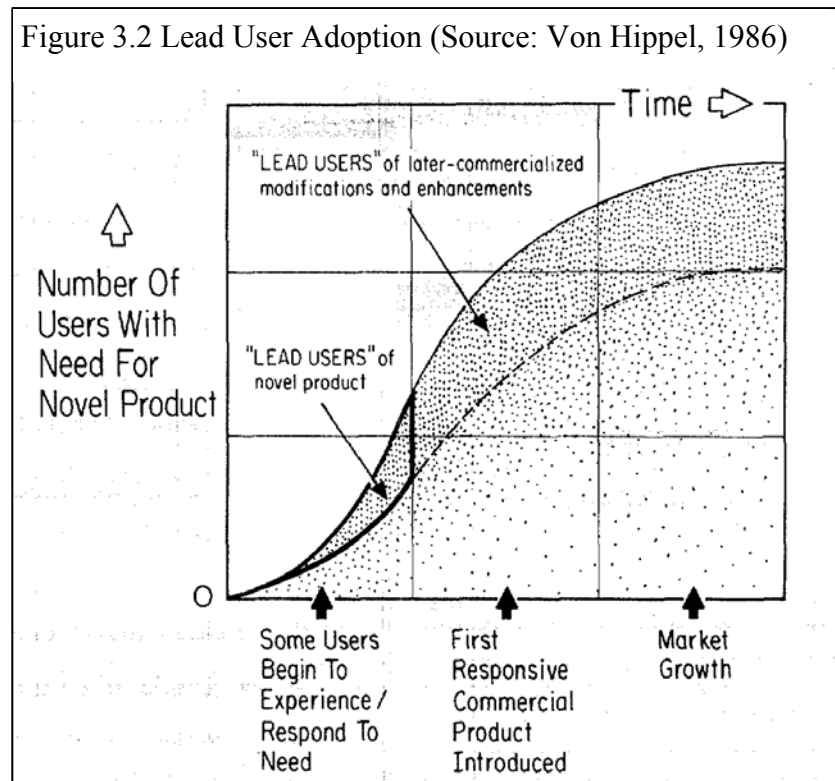
Von Hippel goes on to argue that the greater the benefit a given user can obtain from a needed novel product or process, the greater their effort to obtain a solution which is illustrated in the above figure by the deeper shading. This information will be helpful when trying to identify lead users.

Von Hippel suggests that there is a four-step process for incorporating lead users into marketing research which is as follows:

(1) Identify an important market or technical trend,

(2) Identify lead users who lead that trend in terms of (a) experience and (b) intensity of need,

(3) Analyze lead user data,

(4) Project lead user data onto the general market of interest.

3.3.1 Identifying Important Market or Technical Trends

Since lead users are defined as being ahead of the market with regard to a given important aspect which is changing over time, before lead users can be identified one must identify the principal trend on which these users have a leading position. There are many systems in place at many firms to identify important trends affecting promising markets as part of their corporate strategy. Some businesses use simple intuitive methods of their leading industry

experts while others employ much more complex correlation or econometric models. However, despite the practice of formal trend assessment methods, trend identification and assessment remain something of a fine art.

3.3.2 Identifying Lead Users

Lead users are users that (1) are at the leading edge of each identified trend in terms of related new product and process needs and (2) expect to obtain a relatively high net benefit from solutions to those needs (Von Hippel, 1986). According to this definition, researchers may first begin their search for lead users of consumer goods by employing the appropriately designed surveys. The respondents to a survey that demonstrate a preference for the products or services related to the trends identified would fit this first bit of criteria. From among this group, researchers could spot lead users by executing an additional inquiry concerning the value respondents' place on enhancements to the products and services in question. The respondents that place a significantly higher value than most on such improvements could be identified as the users that anticipate acquiring the highest net benefit from a solution to the need and therefore would be the lead users for that trend.

There are a few important complexities to take into consideration when seeking to identify lead users. The first of which would be to remember that key lead users may not necessarily be found within the usual customer base of the manufacturer performing the market research. It is possible that key lead users may be competitors' users/customers. Next, one should remember not to be restricted to identifying lead users who can enlighten the *entire* novel product, process or service which is desired to be developed. It may be beneficial to seek out lead users with respect to simply a few, or even just one, of the attributes. Lastly, users that possess a high net benefit to forming a solution to a need may very well have resolved their own problem already and would therefore no longer have that need. For this reason, a survey conducted to seek to identify lead users on the basis of high unmet needs may overlook these particular users and be a missed opportunity to gain significant insight.

3.3.3 Analyze Lead User Data

Data derived from lead users and their real-life experience with novel attributes and/or product concepts of commercial interest can be incorporated in market research analyses using standard market research methods (Von Hippel, 1986). If analysts remain more vigilant of the data produced from lead user need statements and the observations of more user-

developed product solutions, then they may find more innovative ideas than through analysis of other user populations.

3.3.4 Project Lead User Data

The lead users of today will not have precisely the same needs as the users who will be the majority of tomorrows predicted market. For this reason, analysts will determine how the lead user data can best be applied to the more typical user in a target market rather than just assuming that such data will be directly transferable. Indeed, the literature on diffusion suggests that, in general, the early adopters of novel product or practice differ in significant ways from the bulk of the users who follow them (Rogers & Shoemaker, 1971). This will require a test of the applicability of the needs of the lead users and the concepts developed to the future general market which is not a simple task. One approach involves prototyping the novel product and asking a sample of typical users to use it (Von Hippel, 1986). The users from the future general market would only be able to evaluate the product and provide new product data if certain conditions could be created; (1) similar conditions could be created in presenting the user the product that are similar to the conditions a future user would face, and (2) enough time was provided to the user to fully explore the new product and adjust usage patterns to it. This method of research would not be appropriate in rapidly moving fields in which the proposed new product would have to interact with many other not-yet-developed products in unforeseen ways and a suitable alternative would have to be orchestrated to test the product's applicability.

3.4 House of Quality

The "House of Quality" is a basic design tool for the management process known as Quality Function Deployment (QFD) which was first introduced in 1972 at the Mitsubishi Kobe shipyard site. Quality function deployment is a set of planning and communication routines that focus on coordinating skills within an organization from the design to the manufacturing and then to market goods. The foundation of the house of quality is the belief that products should be designed to reflect customers' desires and tastes - so marketing people, design engineers, and manufacturing staff must work closely together from the time a product is first conceived (Hauser & Clausing, 1988).

The house of quality functions as an operational map for cross-functional planning and communication so that companies can learn from customer experience and reconcile what

they want with what engineers can reasonably build. This method will take into consideration current position of the product in the market in comparison with competition according to users'/customer's perceptions, the attributes of the product relative to users'/customers' perceived benefit, the characteristics of the product that affect these attributes and the effects of making alterations to a product. Building a house of quality helps marketing, design and manufacturing executives to communicate regarding these factors in an illustration format so this cross-functional team can identify areas of opportunity.

3.4.1 Building a House

Constructing all the elements of house of quality is not a trade secret nor is it particularly difficult; however, it does take some time to become familiar with its elements and how they are presented.

3.4.1 a Customer Attributes

The first element that is to be considered is the customer, whose requirements are called customer attributes (CAs). These are common phrases customers use to describe products and product characteristics and a typical house of quality for a product can range anywhere from 30 to 100 CAs. At this point, companies must employ some form of market research to identify the product's CAs such as focus groups, in-depth qualitative interviews, etc. CAs are usually grouped into bundles of qualities that represent an overall customer concern or function. They are also most often reproduced in the customers' own words so that they can be simultaneously translated by product planners, design engineers, manufacturing engineers and salespeople. While this helps with incorporating the Voice of the Customer through-out the process, it is also stirs the issue of interpretation. CAs are listed down the left side of the house of quality.

The next step for bringing the VoC into a house of quality is to measure the relative importance of each CA to the customers. These perspectives are input as weighted estimates in percentages that are based on team members' direct experience with customers or on survey and should come to a total of 100%. Some companies use statistical techniques to

Figure 3.3 Relative-Importance Weights of Customer Attributes (Source: Hauser & Clausing, 1988)

BUNDLES	CUSTOMER ATTRIBUTES	RELATIVE IMPORTANCE
EASY TO OPEN AND CLOSE DOOR	Easy to close from outside	7
	Stays open on a hill	5
ISOLATION	Doesn't leak in rain	3
	No road noise	2

A complete list totals 100%

allow customers to state their preferences with respect to existing and theoretical products, while others use "revealed preference techniques" that evaluate consumer inclinations by their actions as well as by their words. The latter approach is more expensive and complicated to execute but it yields much more accurate answers. The result of this market research reveals customers perception of the product according to a scale established by the QFD team.

3.4.1.b Customer Perceptions

Those companies producing new products that wish to outperform their competition must first know where they stand relative to said competition. On the rights side of the house of quality is a list of how the product in question stacks up against the competition on each of these CAs. This is widely recognized as a perceptual map based on bundles of CAs which are often used to

Figure 3.4 Customer Evaluations of Competitive Attributes (Source: Hauser & Clausing, 1988)
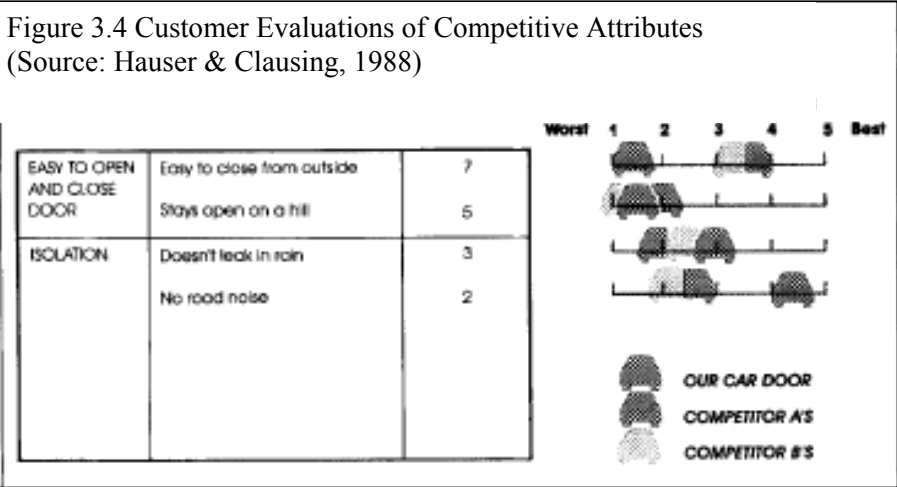
categorize strategic positioning of a product or product line. This form of comparison also helps the product planning team to identify opportunities for improvement.

3.4.1.c Engineering Characteristics

The engineering characteristics (ECs) that are likely to influence one or more of the CAs that have been identified are listed across the top of the house of quality. Symbols can be used signify whether engineers intend to improve a characteristic or if it is acceptable. If a standard EC has no effect on a CA, then it is not necessary to list it on a house of quality. Conversely, a CA unaffected by any EC presents an opportunity to expand on current properties of the product. Also, an EC may affect more than one CA. See Figure 3.5 on the following page for an illustration of the house of quality up to this point.
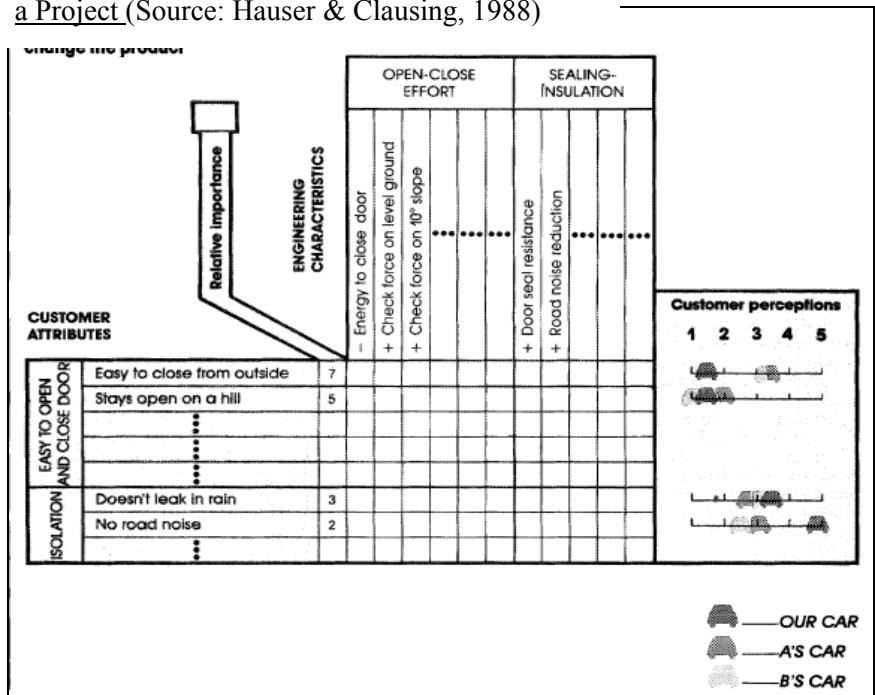
The engineering characteristics should describe the product in measurable terms and should straightforwardly affect customer opinion. If trivial characteristics are included in a house of quality, it may cause the team to lose prospective of the overall design and stifle creativity. At this point, the team should strive for consensus on the evaluations thus far set forth, basing them on expert engineering experience, customer responses, and tabulated data from statistical studies or controlled experiments. Once the team has identified the VoC and appropriately linked to the related EC, it adds objective measures to the bottom of the house beneath ECs to which they pertain. When objective measures are known, the team can ultimately move to set up target values or ideal measures for each EC in a redesign/prototype product.

3.4.1.d Using a House of Quality

When changes are made to one aspect of the engineering characteristics, the house of qualities distinctive roof matrix can help engineers specify the other areas of the EC that will be altered and what affect the change will have on the CAs. Sometimes one targeted attribute or characteristic can weaken such a large number of others when altered that a team must decide to let it remain as it is. The roof of the house of quality contains the most vital information for engineers because they use this portion of the illustration to understand and balance the trade-offs when addressing customer benefits. This comparison of weighted characteristics to actual

component costs, allows the creative design teams to prioritize component improvement. For an illustration of a complete house of quality please see Figure 3.6 below.

Figure 3.6 House of Quality (Source: Hauser & Clausing, 1988)

Engineering Characteristics:
- OPEN-CLOSE EFFORT: Energy to close door, Check force on level ground, Check force on 10° slope, Energy to open door, Peak closing force
- SEALING-INSULATION: Door seal resistance, Acoustic transmission window, Road noise reduction, Water resistance

Relationships
- ✔ Strong positive
- ✓ Medium positive
- ✗ Medium negative
- ✗ Strong negative

Customer Attributes — EASY TO OPEN AND CLOSE DOOR / ISOLATION

Customer attribute	Relative Importance
Easy to close from outside	7
Stays open on a hill	5
Easy to open from outside	3
Doesn't kick back	3
Doesn't leak in rain	3
No road noise	2

Objective measures

	Energy to close door	Check force on level ground	Check force on 10° slope	Energy to open door	Peak closing force	Door seal resistance	Acoustic transmission window	Road noise reduction	Water resistance
Measurement units	ft-lb	lb	lb	ft-lb	lb	lb/ft	—	db	psi
Our car door	11	12	6	10	18	3	.10	9	70
A's car door	9	12	6	9	13	2	.10	5	60
B's car door	9.5	11	7	11	14	2	.10	6	60
Technical difficulty	4	5	1	1	3	1	3	3	5
Imputed importance (%) (all total 100%)	10	6	4	9	1	6	2	4	3
Estimated cost (%) (all total 100%)	5	2	2	9	5	6	6	9	2
Targets	7.5 ft-lb	9 lb	6 lb	7.5 ft-lb	12 lb	3 lb/ft	.10	9 db	70 psi

**Customer perceptions** (1 2 3 4 5): OUR CAR, A'S CAR, B'S CAR

There is no exact set of ingredients for developing a house of quality, it may include as many CAs and ECs as are relevant to your customers and product, but the house of quality will help the development team to set targets which are entered on bottom line of the house. For the engineers on the development team, this is a way to summarize basic data in a usable format. For the marketing professionals on the development team, the house of quality represents the customer's voice which is a critical success factor for new product development. The team managers will use the house of quality to discover strategic opportunities and monitor and ensure the quality of new products. One of the essential functions of the house of quality is to

encourage all of the functional areas of product development to work together to understand one another's priorities and goals which has a direct affect on two other critical success factors; fostering project and team organization and the right environment through a corporate climate and culture that encourages innovation.

The principles of a house of quality apply to any effort to establish clear relations between manufacturing functions and customer satisfaction that are not easy to visualize (Hauser & Clausing, 1988). A good indication that a product development team is truly cross-functional, the "how's" from a house of quality can be made into the "what's" of another house that will be mainly be concerned with detailed product design. This process can continue through each phase of a product development process as illustrated in Figure 3.7 below. These four linked houses implicitly convey the VoC through to manufacturing.

Figure 3.7 Linked House of Quality Illustration (Source: Hauser & Clausing, 1988)
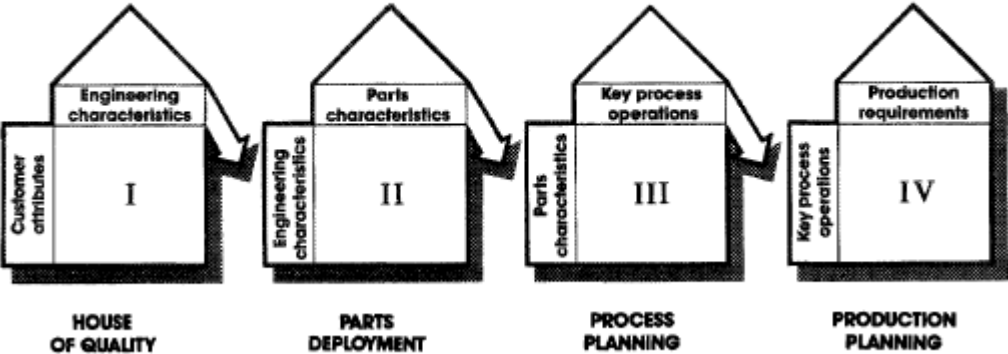
3.5 Secondary Data Collection

As mentioned before, secondary data is existing information that may be useful for the purposes of specific market research. The applicability of secondary data in an innovative process will be limited in comparison to that of primary data, however, there may be some practical applications for gathering this form of data that must be addressed. The two forms of secondary data are internal and external and will be discussed in more detail in following sections.

3.5.1 Internal

Internal secondary data includes any information or records kept by a company or a business regarding their internal records - production, costing, sales and distribution, which can be analyzed to provide market researchers with insight for new product development processes. This form of market research is very economical, comparatively speedy and can be undertaken with complete confidentiality. Several examples of internal secondary data that may be useful during an innovative process may include past NPD projects, past and current customer databases, past sales trends and previously successful distribution methods. All of this information could be helpful when considering new product development idea generation, market research sampling, project portfolio management, and project launch strategies.

3.5.2 External

External sources of data are statistics and reports issued by government, trade associations and other reputable organization (Chisnall, 2005). Market research companies and advertising agencies will often circulate useful information in the form of case studies and market reports. This form of market research can be very useful in many aspects of new product development such target market identification and definition, consumer purchasing behavior analysis, and advertising strategy for product launch.

3.6 Market Research Conclusions

In conclusion, there are many techniques available to set a new product development project going on a strong market oriented path that is customer focused and market driven. Many of these methods of market research can provide innovation teams with the information resources necessary to avoid the four most common reasons for new product failure; poor marketing, technical problems, insufficient marketing effort, and bad timing. By effectively adopting a mix of these techniques at the appropriate stages of the innovative process, NPD teams can successfully integrate the user/customer into the process and realize the critical success factors that are directly relative to market research.

Chapter 4: The Stage-Gate Process

As previously mentioned, there has been a great deal of emphasis on innovative processes and many experts agree that a multi-stage, disciplined framework is a key component to the success of new products. However, this key strategy for innovation stirs debate among industry experts due to the various methods and frameworks available for use in controlling

the development of new products and services. The most widely recognized and accepted framework for managing an innovative process is the Stage-Gate Process created by Robert G. Cooper. This process is currently utilized in some form or other by companies looking to manage, direct and accelerate their product-innovation efforts.

The purpose of this chapter will be to identify a multi-stage, disciplined framework for new product development which will form the base for this thesis, the Stage-Gate Process by Cooper (1994, 2001). First we will explore the contradicting ides that support and negate the use of the Stage-Gate Process for use in an innovative process as well as explore the fundamentals of the stages and gates including activities and efforts for each stage and criteria for go/kill decisions at each gate. There will be brief discussion about how the Stage-Gate Process has evolved into a modern tool for efficient map for new product development. Lastly, I will examine the role of users/customers in Stage-Gate and present opposing theories of how and when to integrate them in the process.

The structure of this chapter will be to subsequently answer the following questions:
- What is the Stage-Gate Process?
- What are the prescribed activities within and role of stages?
- What is the process and function of gates?
- What activities should be performed at each stage and gate?
- What alterations and modifications have been implemented in the modern Stage-Gate Process?
- What is the best way to integrate user/customer through-out this process?
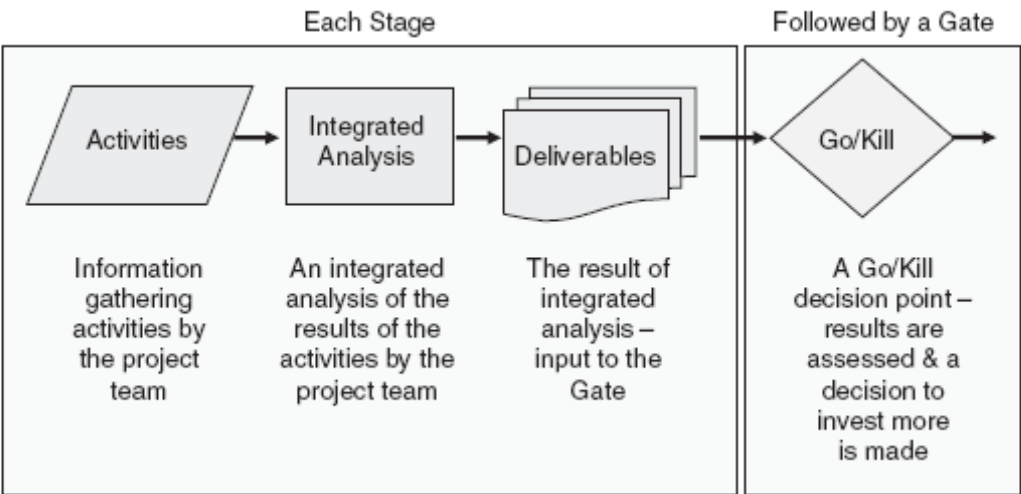
4.1 Stage-Gate Systems

One of the most commonly used models for new product development is Stage-Gate Process developed by Cooper (1994, 2001). In this process, Cooper breaks down the traditional new product development process into a set of discrete and identifiable stages (e.g. preliminary investigation including concept development and testing, business plan development, product development, testing and validation, full production and market launch stages)with each stage consisting of a set of prescribed activities (Sethi & Iqbal, 2008). Each of these stages would be followed by a "gate" in where go/kill decisions would be made to continue to invest in the project or not.

Cooper's conceptual and operational model for moving a new product project from idea to launch is a systematic approach based on eight fundamental points:

1. The new product process must be a quality process

2. The process must be designed to manage risk which a multistage and gate framework is most appropriate

3. Gates are critical to the new product process

4. Parallel processing satisfies the need for a complete and quality process with a desire for a more rapid process

5. The process requires a cross-functional, empowered team lead by a team leader with authority

6. The process must be market-driven and customer-focused

7. Up-front or predevelopment homework is vital to success, and these activities must be built into the plan in a consistent and systematic way

8. The pursuit must be for superior, differentiated products that offer value to the user

He expresses very clearly that these points, along with the critical success factors outlined earlier, provide a blueprint for managing the product innovation process for improved effectiveness and efficiency. In its simplest format, consists of a series of (1) stages, where the project team undertakes the work, obtains the needed information and does the subsequent data integration and analysis, followed by (2) gates, where go/kill decisions are made to continue to invest in the project (Cooper,2008). This idea of Stage and Gate Processes is illustrated in Figure 4.1 below.

Figure 4.1 Detailed Illustrations of Stages and Gates

The model on the previous page is a very simple illustration of the due-diligence-and-decision process that takes place in a Stage-Gate process repeatedly until a product is launched. The standard Stage-Gate system developed for major product development endeavors is illustrated below. The idea generation stage begins the process and it proceeds through a series of gates and subsequent stages until reaching the post launch review. It is important to note that there are three stages, ideation/discover and 2 homework stages (scoping and building a business case), which must be undertaken before serious financial investments are made at the Development stage. This area of the process has become known as the Fuzzy Front-End.

Figure 4.2 Stage-Gate Model (Source: Cooper, 2001)

Stage-Gate® is a trademark of
Product Development Institute
Source: Cooper, 2001.
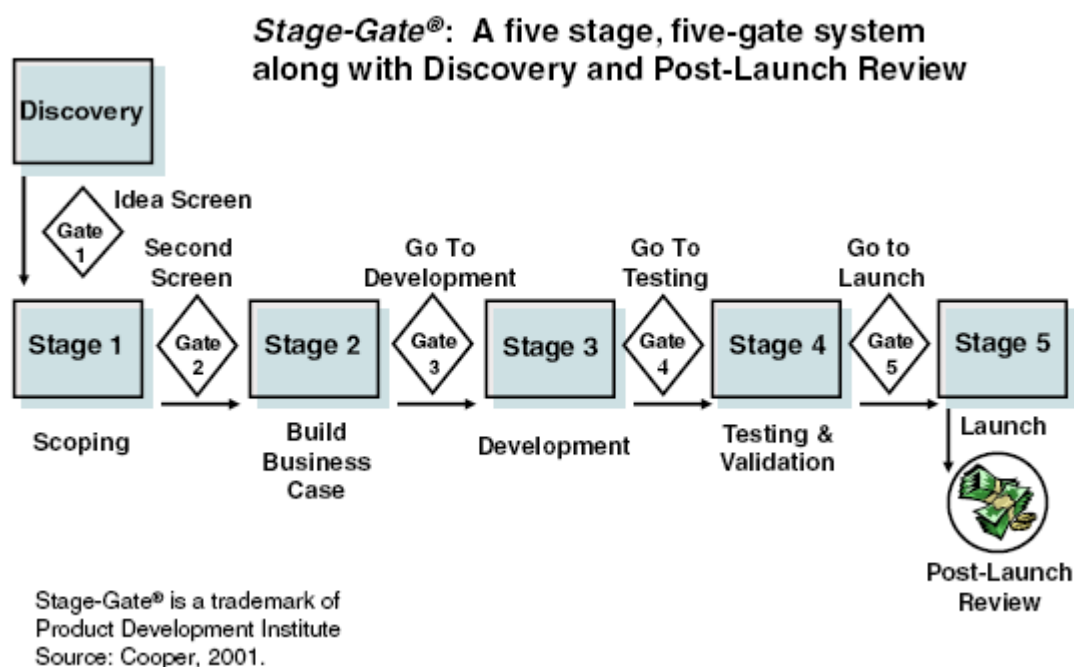
4.2.1 Stages

The Stage-Gate Process usually consists of four, five or six stages, each composed of a set of required or suggested best-practice activities needed to progress the project to the next gate or decision point. These activities are intended to diminish uncertainty and reduce the risk involved in developing the new product. Stages should be well defined and mapped out with clear goals and purpose in order to be executed proficiently. Each stage should:

- Be designed to gather information to reduce key project uncertainties and risks
- Cost more than the preceding one
- Undertake activities in parallel and by a team of people from various functional areas within the company

- Be cross-functional with no one department owning any one stage solely

Because each stage will cost more than the preceding one, the process requires incremental commitment as a project progresses. The team must execute the tasks of various departments concurrently within the stages and share in accountability for the entire project in order for the process to successfully and efficiently progress. These stages are separated by gates, which serve as the control and go/no-go check points (Cooper, 2001).

4.2.2 Gates

The function of the gates is to act as a screening process and quality control check-point to provide go/kill and prioritized product portfolio decisions so that the path forward to the next stage of the project is agreed to and resourced. Only the products that satisfy specific criteria should proceed, and thus "killing" bad/undesirable projects or allowing those projects to "recycle" through the previous stages to offer them the chance to improve. Each gate must also consist of parallel activities undertaken by people from each of the functional areas of the innovative team. Gates should consist of the following:

1. *Deliverables* - these are the results and information that project leaders and teams must bring to the decision point.
2. *Criteria* - this includes "must-meet" or "knock-out" conditions used to judge products which are designed to weed out misfit projects quickly.
3. *Outputs* - these include a defined decision (i.e. go, kill, hold, or recycle) along with an approved action plan for the next stages such as timeline and committed resources.

Gates are usually supervised by senior managers from various functions, who are in charge of the resources necessary for the project leader and team to move forward to the next stage. Gatekeepers are not to be confused with project team leaders and should mentor, oversee and finance the project. A project leader leads the project and team stage-by-stage through the process to achieve goals and fulfill project objectives.

There has been some debate that gate controls are not suitable for all types of products. The contention is that Management Control Systems such as the Stage-Gate model is designed for stable conditions and may not accommodate uncertainty inherent is some context (Akroyd, Narayan & Sridharam, 2009). This argument is easily put to rest by clarifying that Stage-Gate is not a Management Control System. Gates are not implemented as a means to control an

innovative process but rather a tool to assist management in funneling their resources only to the project with the most potential for success.

Another argument against employing gates in an innovative process is that rigorous gate controls have the potential to adversely affect the learning in new product development projects that have high novelty (Sethi & Iqbal, 2008). This claim is further explained by the concern that when gate evaluation becomes rigorous it has the potential for reducing the flexibility needed for product development. The solution offered by these theorists is to make gate controls more conditional - meaning, if a project is allowed to proceed to the next stage even if it meets just part of the gate criteria, subject to meeting the remaining criteria at the next or a subsequent gate (Cooper, 2004). Making gates conditional is an option but one of the major problems firms face in the development processes is the lack of "teeth" of the gates established which leads to allocating resources to projects that are destined to fail. This point substantiates the relevance of establishing appropriate go/kill criteria according to the needs and requirements of users/customers. Depending on the specific project parameters established through discover of these needs and requirements, gate criteria may be more or less rigorous.

4.3 Overview of the Stage-Gate Process

The following will be a step-by-step view of the Stage-Gate Process and a more detailed look at what activities are executed at each stage and gate.

4.3.1 Beginning Stage - Discovery

The discovery stage includes all of the activities that a firm performs when seeking inspiration for new product ideas. It is imperative to impress how critical these initial marketing efforts are to uncovering the very best, most innovative ideas. Companies cannot expect a superb new product process to override a deficiency in good new product ideas (Cooper, 2001). The considerable need for incredible ideas coupled with a high attrition rate of ideas means that the discovery stage is pivotal. Firms need fantastic ideas and plenty of them.

An important point to remember during the discovery or idea generation stage is that a good idea can come from many different sources including both top-down and bottom-up routes. Bottom-up idea generation would be the route an idea might take if someone within an organization realizes an idea through non-research motivated exposure to products being used

in real environment conditions or by uncovering technological possibilities. For example, a sales representative realizes a possible solution to a customer's product problems while on a sales call. Top-down idea generation is when new product ideas are generated by market research that reveals a significant users or customers problem with a product. An example of this form of idea generation would be if a problem existed with a product that was revealed during a panel survey of users/customers and a new product was developed over time to resolve this problem.

While it is important to keep all channels open for idea generation, it is also critical to implement research tools and methods in this stage that will establish a strong market orientation for new product ideas that are market driven and customer focused. By doing so, a development team will begin to realize the first of the critical success factors mentioned earlier. A very effective method of creating a strong market orientation that is market driven and customer focused is capturing the Voice of the Customer (VoC). Through the development and execution of this method, researchers can identify customers' or users' real or unarticulated needs, work closely with *Lead Users* to identify areas of potential breakthrough innovation, clearly and concisely define the product including its requirements, features, functionality and high-level specifications according to users'/customers' needs, determine how to prepare the innovative process so that the user/customer will be an integral part of the development process and conduct thorough market studies and insightful buyer behavior studies. Acquiring this information in the Ideation/Discovery Stage will help development teams in future stages of the innovative process. However, many of the texts fail to provide any *specific* examples of market research techniques that could be employed to obtain this type of information.

A good idea can make or break a new product project. Many best-practice organizations have defined, proactive idea generation, capture and handling systems in place to collect ideas from every source available. For example, the director in 3M 's Construction and Home Improvement department institutionalized first-hand customer experience in his division (APQC, 1998). Every technical employee is required to make at least two trips to customer locations to observe and learn how customers use 3M's products. The director gathers the technical and marketing employees once a year to review what worked during the year and where they can improve. 3M has even developed their own stage-gate process which they call New Product Indicator (NPI). The first stage in this process is opportunity exploration which

is well funded and conducted by a multifunctional team that involves at least two people: one from their marketing department and one from their lab. Not only does 3M have these systems for generating and capturing ideas in place, they also have a Specialty Material Idea Database that catalogs ideas from sales representative and/or customers for handling. The Construction and Home Improvement Team has a database similar to this called the Customer Relationship Management Database which allows teams to input ideas and/or enhancements. The goal is to know of all the relationships the customer has with 3M (APQC, 1998).

3M also has systems in place for managing all external ideas. They have a brochure that outlines the process of taking an idea to market through 3M as well as a toll-free line where customers can request information about a specific need with the assistance of a representative and an extensive database of 3M solutions. If a solution cannot be found, the caller is rerouted to a lab where their issue is researched as being a potential idea for new product development.

4.3.2 Gate 1: Idea Screen

This first gate, Idea Screening, is the first opportunity to decide if a firm is to commit resources to the project or not. Gate 1 is a "gentle screen" and amounts to subjecting the project to a handful of key "must-meet" and "should-meet" criteria (Cooper, 2001). The criteria typically used at this gate pertain to strategic alignment, project viability, degree of opportunity and market attractiveness, product advantage, ability to leverage the firm's resources and strategic fit with company's policies. Firms should establishing a checklist and scoring system that will assist in determining future actions.

At this early gate within the process, it is important that the "must-meet" criteria be met so that future resources are not wasted on projects that are destined to fail. Gatekeepers should include both technical and business people so that both spectrums of the process have input on the feasibility of each project and practicality of leveraging resources. A checklist and scoring system should be facilitated for this gate decision and any idea that receives even one "no" on "must-meet" criteria should be passed over at that time.

4.3.3 Stage 1: Scoping

The Scoping stage is an inexpensive homework stage with the objective of determining a projects technical and marketplace qualities and prospects. At this stage of the Stage-Gate process, marketing team members should focus their market research activities on performing

internal and external secondary data research methods in order to establish a *preliminary market assessment*. This will include information such as markets, sizes and trends that can be gathered from in-house data and trade publications, reports and other public information sources. This will provide initial information regarding how the user/customer will react to the proposed product given their reaction to past products and buying behaviors. While the marketing team members conduct this research, design and manufacturing team members should concurrently focus their efforts on carrying out a *preliminary technical assessment* of the proposed product project. This will provide information about the proposed project that is readily available such as technology capabilities, first-glance financial and business analysis, and legal/regulatory conditions.

4.3.4 Gate 2: Second Screen

This second screening is somewhat more rigorous than the first since its objective is to meet all of the initial must-meet criteria from the first gate as well as additional should-meet criteria. The should-meet criteria will be centered on the sales force and customer reaction to the proposed product and potential legal, financial and regulatory issues that would be considered "killer variables." Again a checklist and scoring system should be facilitated at this gate assessment to aid in deciding what future action to take.

4.3.5 Stage 2: Building the Business Case

Stage 2 is the first stage that requires detailed investigations from every functional area of the new product development process which will open the door to development and eventually mass production and launch. There is considerably more effort involved in Stage 2 than in Stage 1. This stage, Building the Business Case, is ***the critical homework stage*** that is so often under resourced and overlooked. This deficiency in adequate up-front homework has been stated as one of the main causes of product failure mentioned earlier. In order for this stage to be successfully realized, innovative teams must consist of cross-functional members from the different functional areas who will commit to and be held accountable for gathering input from a variety of sources.

As discussed, the activities of stages are to be carried out simultaneously and this particular stage requires a detailed investigation on the part of every functional area that will result in a clearly defined product and verification of the attractiveness of the project. For starters, the marketing team members must gather data to determine customers' needs wants and

preferences. This will be first opportunity for the process to include the Voice of the Customer.

NPD team members must also define the product at this stage which entails target market definition, delineation of the product concept, specification of the product's positioning strategy, identify product benefits to be delivered and determine the value proposition. Team members will also work to define the essential and desired product features, attributes, requirements and specifications as perceived by users/customers. This research may also include concept testing to gauge users/customers reactions to proposed new product ideas.

A thorough competitive analysis must also be conducted during this stage. This will include an evaluation of the current competitive market factors such as market size, number of competitors, competitor market share, advantages/disadvantages of competition and areas of opportunity.

All of these marketing efforts are undertaken to realize many of the critical success factors as outlined earlier such as striving for a unique, superior product, strong market orientation, adequate predevelopment work, sharp, early and stable project and product definition, quality of execution of key tasks, speed, targeting attractive marketing and focus and sharp project selection decisions regarding project portfolio management. Each of these factors can be directly and indirectly affected by the effective execution of marketing activities conducted during this stage.

However, the marketing team members are not the only ones with a significant role to play in realizing these critical success factors. A technical appraisal must be conducted to determine the viability of the proposed project. That is, customer needs and "wish lists" are translated into technically and economically feasible solutions (Cooper, 2001). A manufacturing appraisal must be conducted to address issues such as manufacturability, source of supply, costs to manufacture, and investment required. Whenever appropriate, a detailed legal, patent and regulatory evaluation must be performed to eliminate risks and determine the required actions. The last component of building a business case is to conduct a detailed business and financial analysis including discounted cash flow approach, complete with sensitivity analysis to examine the potential downside of risks.

The result of all of this information gathering and analysis is a complete business case for the project including product definition, project justification and detailed project plan.

4.3.6 Gate 3: Go to Development

Gate 3 is the last check point where a project can be killed before heading to development stage and entering into a commitment of large amounts of resources. For this reason, this gate is crucial to ensuring only the projects with the best chance for success move forward. A thorough review of each of the activities executed in Stage 2 is conducted to verify that the activities were actually undertaken, the quality of execution was sound, and the results were positive. Next, the project should be evaluated based on the must-meet and should-meet criteria as outlined in gate 2. Lastly, because of the heavy spending being committed to projects that proceed to the development stage, the financial analysis is screened.

If the project receives a green light to proceed to development, a commitment to product definition and agreement on the project plan which outlines the path forward must be ensured at this gate. Also, the full project team is designated. This team must be an empowered cross-functional team that is headed by a leader with authority.

4.3.7 Stage 3: Development

In the development stage of a Stage-Gate process, the development plan and the physical development of the product commence. If the development is a lengthy procedure, frequent milestones or periodic project reviews may be built into the development plan to provide project control and management. In order to ensure that the product is meeting requirements under controlled conditions, lab tests, in-house tests or alpha tests can be implemented.

This stage should focus on technical work but the marketing and operations activities will continue to occur as well. For example, customer feedback will be gathered during the technical development of the product as it takes shape to ensure that it continues to fulfill user/customer needs and requirements. The activities during the development stage should go back and forth between technical and market/consumer feedback. The "deliverable" at the end of Stage 3 is a lab-tested prototype of the product (Cooper, 2001). Other required deliverables at the end of this stage besides the results of lab-tests of the prototype will be detailed market

launch plans, production and operation plans, financial analysis, and regulatory, legal and patent resolutions.

4.3.8 Gate 4: Go to Testing

At this post-development review, development work is evaluated and checked to make certain that the work was completed in a quality fashion and the developed product is in fact consistent with the original definition specified at Gate 3. The financial analysis is also revisited at this gate to ensure that the estimates and forecasts of earlier stages are still viable based on new and more accurate data. If the economic situation of the prospective new product proves viable, then a test or validation plan is approved for the next stage so that it may be immediately implemented. The detailed marketing and operations plans are also reviewed for potential future executions.

4.3.9 Stage 4: Testing and Validation

This stage tests and validates the entire viability of the project: the product itself, the production process, customer acceptance, and the economics of the project (Cooper, 2001). This stage will also initiate extensive external validation of the product and project through:

- In-house product testing
- User or field product trials
- Trial, limited or pilot production
- Market pretests, test market or trial sales
- Revised business and financial analysis

If these activities produce negative results, a project may be recycled back to Stage 3 for continued development.

4.3.10 Gate 5: Go to Launch

This last gate will be the last door before full commercialization so the criteria for passing mainly focuses on anticipated financial returns and relevance of the launch and operations start-up plans. Projects can still be killed at this point however.

4.3.11 Stage 5: Launch

The final stage in the process, the launch stage will implement both the marketing plan and the production/operations plan. These two plans should represent a culmination of all the

results of data collected from the execution of all the activities up to this point. If the plan is the direct result of thorough execution of all the activities and can be substantiated and supported by the appropriate resources, the product should stride easily into the market.

4.3.12 Post-Launch Review

About six to nineteen months after the launch of the new product, the project is officially terminated and the team is disbanded. At this point, the product is no longer a new product but a "regular" product and the project's and product's performance is reviewed to determine the outcome. This review will consist of analysis of the latest data such as revenues, costs, expenditures, profits and timing in contrast with predictions in order to gauge the performance of the project and product. A post-audit will also be executed which consists of an evaluation of the project's strengths and weaknesses and a discussion of what experience was gained from the project and how to execute the next project better. This officially marks the end of the process.

4.4 Evolutions of the Stage-Gate Process

Every firm partaking in a product development process that intends to employ the Stage-Gate concepts must be aware that there is no perfect recipe and stages and gates are not a rigid set of ingredients to be followed ad hock but a map guide to encourage innovation. For this reason, several versions of the Stage-Gate have evolved that have provided more appropriate guidelines for product development. Two such evolutions will be discussed in the following sections.

4.4.1 Conversion/Response Stage-Gate Process Model

This model emphasizes flexibility and is a more efficient means of allocating resources to increase responsiveness to change which makes this model ideal for process driven responses to the market environment. Some of the key features of this process model include adaptable, overlapping and fluid stages (Cooper, 1994). Conversion/response stage-gate models approach innovation as a process of converting different types of inputs (such as knowledge and raw materials) into an output (new product). This process model includes activities that are not assigned to specific stages or gates but instead are assumed on an as-needed basis. Organizational members respond to stimulus to generate ideas, conceive of new possibilities, make proposals, which then results in the adoption of new innovation (Akroyd et al., 2009).

However, with greater flexibility and adaptability, this process can be more complex and difficult for executive manager to maintain the decision making authority due to lacking project understanding in relation to project team members. For an illustration of this model of the Stage-Gate Process please see the Figure 4.4 below.

Figure 4.3 Stage Gate Process (Source: Akroyd, Narayan, & Sridharan, 2009)
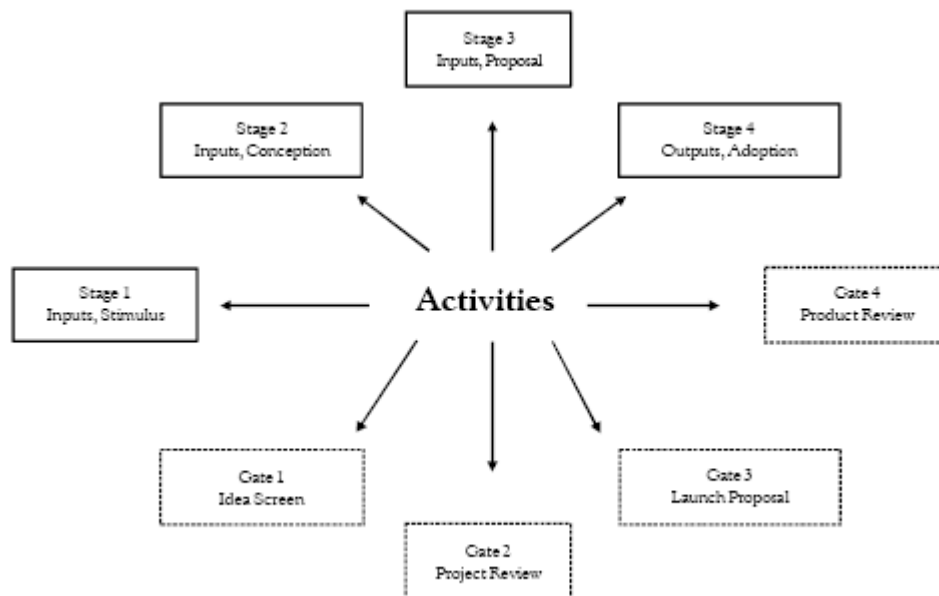
The Conversion/Response Stage-Gate process is an adaptable model for new product development which is ideal, however, it neglects to acknowledge one of the most important factors in innovation; the user/customer. With a lack of input from the users/customers, what was intended to be a flexible process model could present an opportunity for innovative projects to deviate so far out of control they would lose sight of the initial product definition or intent.

4.4.2 Spiral Development Stage-Gate Process Model

This evolution of the Stage-Gate Process adjusts to changing conditions and fluid, unstable information by moving through the development process with a series of "build-test-feedback-and-revise" iterations. This type of spiral development bridges the gap between the need for sharp, early, and fact-based product definition before development begins versus the need to be flexible and to adjust the product's design to new information and fluid market conditions as development proceeds (Cooper, 2008). This process allows developers to continue to incorporate customer feedback into the development process and product design even after the product definition is locked in prior to Stage 3. A set of loops or spirals are built in to the

process from the front-end stages all the way through the development stage in on into the testing stage which ensures that the process will have a strong market orientation that is customer driven from beginning to end. For an illustration of a set of spirals see Figure 4.5 on the following page.

Figure 4.4 Spiral Development Stage-Gate Model (Source: Cooper, 2008)
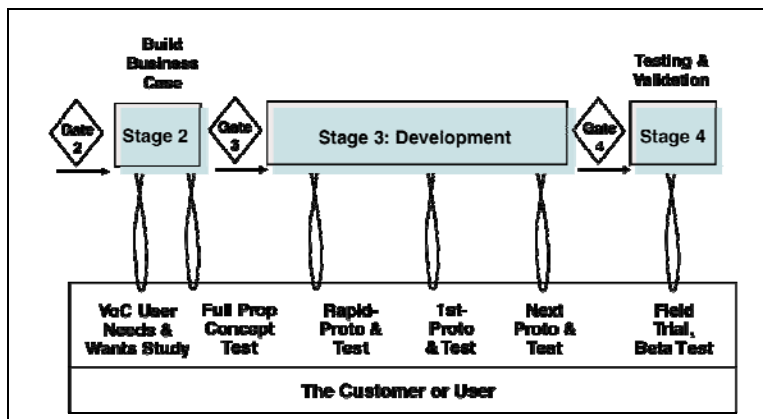
The first spiral in this example illustrates that VoC study implemented early in Stage 2 as part of the homework where user/customer needs and wants are identified. The second spiral represents where the project team would present users/customers with a representation of the proposed product to obtain feedback. The presentation would simply be a computer-generated virtual prototype, a hand-made model or mock-up, a very crude protocept, or even a computer screenshot of new software for users/customers to get a feel for proposed products. Feedback on likes and dislikes so that required changes can be made prior to the project team moving to finalize the product definition for the business case of Stage 2. Using this process, the project team can produce the next, more complete version of the product within a few weeks which will again be presented to the users/customers for feedback. This process is repeated with each successive version of the product getting closer to the final product while also getting closer to the customer's ideal product.

4.4 Role of Users/Customers in Stage-Gate

Now that the Stage-Gate Process has been outlined in great detail, the role of users/customers within this process must be determined.

Even though experts agree and research has proven that having a customer driven process that identifies customers' needs and desires through user/customer integration is a critical element

of a success new product development process, there are still conflicting ideas about the level of involvement of users/customers during the process and when exactly to initiate this involvement. In order to determine how this thesis will define user/customer integration, I will examine two contradictory theories for how best to integrate the user/customer into the innovative process. Then, I will examine several best-practice business cases to identify current methods of involvement being employed today. This analysis will aid in determining how best to define user/customer integration for the intensive purpose of this thesis.

4.4.1 Theories for User/Customer Integration

According to Cooper's Stage-Gate process with a spiral loop concept, the level of involvement should be considerable in the middle stages of the process which allows the VoC to be incorporated early in the process during Stage 2. Customer feedback will be continually sought until Stage 4, Testing and Validation, as illustrated in Figure 4.5 on the previous page 61. This allows the user/customer be an integral part of the homework, development and pre-launch stages of the innovative process. However, it neglects the inclusion of the user/customer during the early and late stages such as Idea Generation, Launch and Post Launch Review stages. Cooper does not provide any empirical data that would support his claims that these are the most effective stages to implement user/customer involvement which limits the validation of this claim until substantiated.

A study conducted by Gruner and Homberg (2000) of the customer interaction during the product development process within the German machinery industry provided empirical evidence to suggests a conflicting theory. Their study proposes that involvement of the user/customer is only beneficial in the early stages, such as Idea Generation and Scoping, and the late stages, such as Testing and Validation and Market Launch, as these activities yield more positive effects and can positively. Conversely, the user/customer interaction conducted while Building the Business Case and Development yielded non-significant results and had very little performance impact. Thus, during the technological development, companies should rely on their own skills and should not expect technical solutions from customers (Gruner & Homberg, 2000). This study also suggested that the selection of the interaction partner should be based on specific characteristics and was, in fact, determined by applying the Lead User concept introduced by Von Hippel. Financially attractive customers and close customers yield similar positive results whereas technically attractive customers do not have a

positive impact on new product success (Gruner & Homberg, 2000). While the empirical evidence from this study strongly suggests inclusion of the user/customer during just the early and late stages is most beneficial, there are several limitations that weaken their case. Perhaps one of the most noteworthy limitations is that it focuses on a limited number of new products. By necessity, this results in data that may not be reflective or considerate of new products with other characteristics. Another limitation for this study is that it did not consider the content of the information that was shared between the user/customer and supplier. Another factor that weakens the case presented by Gruner & Homberg, at least in relation to the applied measurements as outlined by PDMA in their studies, is the framework used to distinguish new product success. This includes the quality of the new product, financial new product success, the quality of the new product development process and the inexpensiveness of the new product ownership but deprives consideration for market share and other factors critical for determining overall new product success as it relates to user/customer adoption.

4.4.3 Current User/Customer Integration Best-Practices

Given the limitations of the two previously introduced ideas about the level and process of integration of user/customers, it has been determined that a further assessment of current best-practices will aid in determining a suitable definition of user/customer integration to be applied. This assessment will include information regarding the new product processes for leading product development corporations including 3M, Kraft Foods and ExxonMobil.

4.4.3.a 3M User/Customer Integration

The first critical element to 3M's product development strategy is evident in their corporate culture that not only encourages radical, innovative thinking but rewards and recognizes it as well through the "Circle of Technical Excellence" recognition program and the "Innovation Award." These programs recognize contributions in the area of technology where the Genesis and Alpha grant programs also recognize innovation and fund the development of products and services.

3M employs the lead-user process which attempts to locate these users/customers and collaborate with them through project definition, needs identification, solution concepts and solution workshops. This is the first touch-point of the user/customer in their innovative process. Lead user concepts bring more new ideas, have higher global market potential, show higher estimated profit at maturity, are cheaper for the customer to purchase than competitive

alternatives, and abolish fewer existing products within the company than compared to traditional research initiatives (APQC, 2001).

While 3M claims to use a multi-stage, disciplined process for innovation, little information was located regarding the specifics as to how they integrated the user into this process. As mentioned before, 3M has several structured processes in place for managing the generation of new product ideas and maintains very close relationships with customers to remain aware and knowledgeable about their needs and requirements. There is also mention of incorporating lead users in this stage as well as the project definition stage, but it is unclear if they are incorporating these users in any additional stages of their innovative process.

4.4.3.b ExxonMobil Chemical Company User/Customer Integration
ExxonMobil Chemical Company is a division of Exxon Mobil Corp. that focuses on technology, product quality and customer service. This global organization has petrochemical manufacturing and/or marketing operations in more than 150 countries. This globally dispersed organization results in a new product development challenge. Their solution is to decentralize product development processes within individual business units. ExxonMobil Chemical Company's three new product development best-practices are: a long-term commitment to its customers, work process and strategic objectives; using a global scale; and being data driven.

The company has a Stage-Gate program for new product development called Product Innovation Process (PIP) which has very little deviation from the original Stage-Gate model developed by Cooper. The front-end activities, called pre-PIP or Knowledge Build, are not overly prescriptive and effectively balance the flexibility and the project management needed for early-stage work. There are nine elements that are evaluated in detail at each stage:
1. strategic fit of the project with the company's objectives or strengths;
2. market attractiveness;
3. technical feasibility;
4. supply and entry point;
5. sources of competitive advantage;
6. legal/public policy/safety, health, and environmental aspects;
7. financial attractiveness;

8. killer variables, which are those events or changes in market conditions or new technologies that could dramatically alter the situation for the project; and

9. plan to proceed, at least to the next stage and gate (APQC, 2003).

There are four main activities used to assess customer needs, problems, and market opportunities that are conducted prior to idea generation and concept development. This includes long-term customer/supplier relationships where the same group, often the same person, is the main point of contact for customers/suppliers which provides a an opportunity for in-depth understanding of customer issues prior to idea generation and concept development. They also occasionally use a VoC strategy through customer alliances. These alliances provide regular exchanges and face-to-face meeting with key customers. ExxonMobil Chemical uses the data from customer surveys to create a House of Quality and rate the aspects of a proposed product. Conjoint analysis or market surveys provide quantitative input about the value customers place on product elements. There is often the opportunity for customers to be involved in the development phase and beyond through the customer alliances which have been formed, sometimes even being a part of the NPD team. The main point to note that differentiate from the original Stage-Gate are the removal of Gate 5 and replacement with a Commercial Product/Process step with no go/kill criteria.

ExxonMobil Chemical Company manages their new product development process through the employment of the PIP and portfolio management. One key to ExxonMobil Chemical's NPD success may lie in the fact that their marketing manager is often their portfolio manager. Marketing translates the general, overall strategy into specific targets such as market targets and market volume growth targets (APQC, 2003). This strategic appointment of the portfolio manager helps to ensure that the portfolio projects are in alignment with the company's vision and business strategy.

4.4.3.c Kraft Foods User/Customer Integration

Kraft Foods is one of the largest food and beverage companies in the world and they manage a company culture that fosters new product development among a wide range of category-specific divisions or segments. There is also a Consumer Insights and Strategy (CIS) corporate group that conducts new product activity for projects that cut across these divisions and involves wholly new product segments. They have made a great amount of success by targeting fast-growing demographic and economic segments of the market. Kraft is also able to leverage its capabilities across multiple new product areas.

Kraft attempts to identify new product opportunities by understanding consumer needs and specific market segments through understanding the key drivers of consumer interest or appeal. For starters, Kraft conducts ConsumerCast, an annual study of demographic trends and changes in consumer tastes to identify strategic growth areas. Kraft also uses ongoing activities to assess consumer needs and problems including: Learning Labs, TrendCast, Consumer dissatisfaction studies and Syndicated studies. Learning Labs are monthly focus groups hosted by Kraft to explore topical food-related issues. TrendCast explores consumer problems while Consumer dissatisfaction studies examine specific problems consumers are facing. Lastly, Syndicated studies observe industry trends in food or nutrition and studies the effect of the macro economy on spending behavior, consumer confidence and employment rates. This information has proven invaluable in Kraft's innovative development efforts through the success of a wide range of new products.

Kraft also employs the House of Quality technique which provides them with qualitative information for their innovative process. They use focus groups, retailer interviews, and in-depth consumer interviews to explore the value triggers and other key pillars of their "house." The results of this technique are documented in a one-page summary of these value triggers, problems, and potential solutions to be used during idea generation and concept development. In an attempt to avoid the inherent bias created from only asking "positive" questions, they have proposed improving this process by adding "negative" questions in the information gathering activities for building their House of Quality.

The focus is on integrating consumer touch points through qualitative approaches (APQG, 2003). The Idea Generation typically begins with internal brainstorming but at times they may also resource "creative consumers" or consultants during this stage. This attempt to develop deeper consumer insights results in spending more time in the area of tight concept development by conducting ethnographic research, observing people and doing store intercepts. During the concept development stage, the R&D department at Kraft may develop a prototype of products or packaging to gather feedback from users/consumers regarding the look or taste. This provides Kraft with qualitative data on initial reactions to concepts and identifies key areas of improvement to make the concept better. During the Testing and Validation stage, Kraft conducts concept testing to estimate the volume of business a new product initiative is likely to return. At times, they employ the BASES e-panel of ACNielsen

to gather consumer reaction to multiple products or concepts via the Internet. This allows for sequential testing of multiple concepts and reduces the time-to-market. Every test Kraft conducts involves consumers, including product/concept testing and naming (APQC, 2003). At times, their tests will include retailers to ensure that the product meets their needs as well. Once the product has been launched, Kraft continues to engage the consumer by conducting awareness, attitude, and usage studies as well as in-market qualitative research investigating brand loyalty.

4.4.4 User/Customer Integration Defined

Taking into account the two contrasting theories on how best to integrate users/customers into the innovative process and the examples of several best-practice activities of successful product development corporations, it is the opinion of this study that user/customer integration should be considered and approached as every stage of the innovative process. User/customer understanding should be an organizational goal and not just a NPD process goal in order to ensure that there is a base of knowledge for innovation managers to build upon when seeking new product ideas. The stronger the relationship between an organization and its users/customers, the more inept a NPD team will be at discovering opportunities for the organization to leverage their current capabilities to satisfy user/customer needs and requirements.

The integration of users/customers in early stage processes could reduce the necessity for intensive involvement during the Development and Test and Validation stages, but this is not to say that feedback and involvement should not be ascertained during these stages. As previously mentioned, studies have proved that a thorough execution of early stage activities can result increase the likelihood for new product success which could explain the results of the study conducted by Gruner and Homberg. There is invaluable knowledge to be gained from user/customer involvement at each stage of the process which is critical to successful new product development.

However, there should be some consideration to the selection of the users/customers to involve as suggested by the study conducted by Gruner and Homberg. For this reason, it is the opinion of this researcher that in the instance of developing novel new products, only lead user input should be evaluated in the process until the Testing and Validation stage. At this

point, it is critical to investigate whether the novel product being proposed can be understood and ultimately adopted by the general public without extensive effort or difficulty.

Chapter 5 – An Enhanced Model for Innovation

The purpose of this chapter is to introduce the new model for innovation. Included in this introduction will be a detailed outline of which market research tools to employ at each stage of the process along with what kind of information these recommended tools will provide and how it will affect the following stages.

The structure of this chapter will be organized to answer the following questions:

1. What is the Product Innovation Bloom Model?
2. How does this model differ from past Stage-Gate models?
3. How is it similar to past Stage-Gate models?
4. What market research tools should be used at each stage and why?
5. What kind of gate criteria should be established at each gate?
6. How can this theoretical model for innovation improve the NPD process?
7. What are the limitations to this theory?

5.1 Introduction to the Product Innovation Bloom Model

Using the Spiral Development Stage-Gate model, the Conversion Stage-Gate model, and the User/Customer Integration Definition as inspiration, an enhanced model for innovation has been developed that will provide a clear map for innovative product development teams to use. This model will illustrate a natural process for gathering the user/customer data necessary to realize all of the critical success factors directly and indirectly related to market research thereby alleviating the opportunity for the product to fail. Under the steps outlined in the clarification of this model, NPD process managers will have the marketing research tools necessary to integrate users/customers needs through-out the process. Therefore, they will increase the likelihood of product success by ensuring the product will be developed using a multi-stage, disciplined new product development framework that will produce a unique, superior product as perceived by the user/customer, have a strong market orientation that is market driven and customer focused, execute all necessary predevelopment work, have a sharp, early and stable project and product definition, target attractive markets, and have all the information resources required to properly plan and resource the launch.

This new model, called the Product Innovation Bloom Model, employs the same stages and gates as identified by Cooper in the various models he developed and adds the idea of integral user/customer involvement at every stage of the process. Essentially, the user/customer is consulted in some form at every stage either during the stage or just prior to moving to the next gate to track the progress of the product's development in accordance with user/customer needs and requirements. The concept of this model, illustrated in Figure 5.1 below, is to create a natural flow of information between the development team and the user/customer through strategic communication methods. Centering all stage activities around the user/customer integration concept will allow innovative product ideas to bloom into successful new products. This method will require four factors for success:

1. A dedicated, multi-dimensional team including lead user/customer representative(s) committed to the project and held accountable for the product's success or failure.
2. Open flow of communication between all functional areas of the team that allows flexibility and balanced sharing of ideas/solutions.
3. A strong leader that can guide the process without implementing 'control'
4. Clear and firm gate criteria for portfolio project management effectiveness

Figure 5.1 Innovative Product Bloom Model
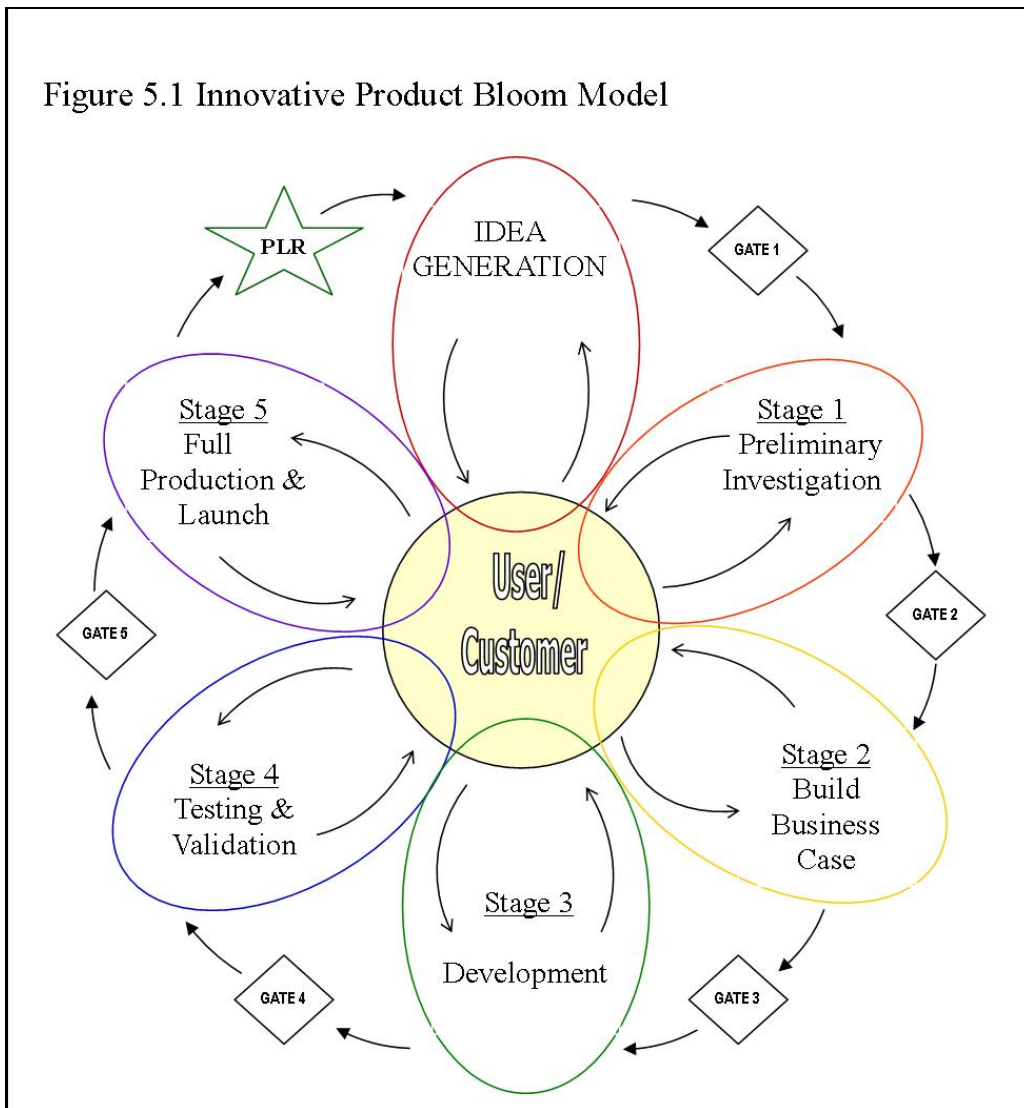
The fundamental difference between this model and previous Stage-Gate models is the essential role of the user/customer. In the Product Innovation Bloom Model, the user/customer integration plays a critical role in the process much like each stage and gate. Each stage requires a sharing of information between project development teams and the user/customer before proceeding to the next subsequent gate. This will reduce deviation from product definition, ensure user/customer needs and requirements are adequately satisfied before proceeding, and essentially reduce cost of making later changes and time-to-market. Another pivotal difference in the execution of this model is the lead user/customer as a member of the innovative team. Having a lead user/customer on the development team will help provide user/customer insight during internal discussions where specific decisions are made regarding concept, design and planning which can help increase the efficiency of the team during stages and reduce the project recycle rate.

There are several key ways that this model is similar to previous Stage-Gate models. Most apparent is the use of structured stages and gates. The activities prescribed by Cooper for each stage will remain the same with only the addition of supplementary user/customer feedback as a requirement before moving to the next gate. As well, in the event that a product does not require an intensive development process, stages can be condensed. Conversely, if a product requires a highly intensive development process, additional stages can be added to suit the increase in activities. The gate criteria will follow the same prescribed requirements as in a typical Stage-Gate. There are several features of this model that closely resemble the Conversion/Response model in that it is highly adaptable to shifting conditions through increased responsiveness to changes in the market. Essentially, there are various types of input being converted into output at each stage only in this model the inputs are user/customer needs as they directly apply to the concept being proposed. The outputs are either a concession or a refusal of product attributes as the process moves forward. Other forms of input may exist in this model as well which might include market conditions that become apparent through close user/customer involvement. The Conversion/Response process model was only partially responsible for the development of the Innovative Product Bloom Model. The other variation of the Stage-Gate process that aided in the development of this enhanced innovation process is the Spiral Development Stage-Gate Process Model. Each stage will consist of all the prescribed activities with the inclusion of "build-test-feedback-and-revise" iterations implemented in a Spiral Development. This form of user/customer integration allows innovative teams to adjust the product to new information and be more fluid as conditions come to light and change. This also allows for product ideas that may generate during the process to spontaneously spin off and create a new project.

5.2 Executing the Process

The essential role of market research has been explained in great detail so now I must elaborate on which research tools can be implemented at each stage and how they will help to increase the efficiency and reduce the risk involved with the innovative process. Before entering the discussion about the activities and criteria for the stages and gates, it must be mentioned that there are particular corporate cultures and standard business practices that would greatly increase the effectiveness of an innovative system such as this. For instance, a company that employs standard market research practices and information gathering activities

as a general business operation will have more information resources available to draw from when preparing to embark on a new product development venture.

5.2.1 Stages

Each stage has a specific set of activities to be executed before moving to the next gate and with the Innovative Product Bloom Model these activities are increased in the early stages and decrease incrementally as the product becomes more established through-out the process. If a marketing research tool is used at one stage, this does not mean that it cannot be used again in either the same stage under different pretenses or in another stage to compare the results. In the following sections, I will briefly review the activities to be carried out at each stage and provide specific examples of marketing research tools to be utilized during that stage. I will also explain what information this would provide and how it will be helpful in the stages that follow.

5.2.1.a Discovery/Idea Generation

This stage, being the launching point for initiating a novel product idea, will be one of the more research intensive stages. Keeping all channels open for idea generation, NPD teams must initiate methods for identifying areas of opportunity for leveraging core competencies in order to begin the process of identifying lead users. Identifying opportunities could include panel research studies of centrally related markets or product categories with positive trends and analysis of internal secondary data. Once a market trend has been identified for targeting, the NPD team must identify the lead users for that market or product category. This is done by conducting marketing surveys, either through in person interviews, mail surveys, internet surveys or telephone surveys, to identify product problems as perceived by customers and then ask follow-up questions that will measure the user/customer's desire to resolve the problem. The users/customers with the highest desire to resolve the problem are presumably the ones that will benefit the most from the creation of a solution and are therefore the lead users for the identified market or product category.

Once you have identified a qualified group of lead users for your market and product category, a brainstorming period should ensue that would open the floodgates for problems and possible solutions where there will be a free flow of ideas between the NPD team and the lead users. While all channels of idea generation should remain open, it is critical that the focus of all ideas remain relative to the intent of resolving a user/customer need. In doing so,

the project can begin to demonstrate a strong market orientation that is market driven and customer focused by incorporating the VoC in product ideas.

5.2.1.b Stage 1: Scoping

The scoping stage was previously noted as an inexpensive homework stage with the objective of determining a project's technical marketplace qualities and prospects. This remains true within the scope of the Innovative Product Bloom Model, except in that in this stage, a number of lead users will be selected to form a focus group that will be consulted through-out the remainder of the project.

5.2.1.c Stage 2: Building the Business Case

This stage will be the most research intensive of all the stages requiring the NPD team to conduct standard market research to execute the necessary *homework*. Market research initiatives at this stage should include in-depth interviews of lead users in focus group to define essential and desired product features, attributes, requirements, and specifications as perceived by users/customers. Market analysis will also be conducted through panel research data and secondary external data to define the target market, delineation of the product concept, specification of the product's positioning strategy, identify product benefits to be delivered and determine the value proposition. Another powerful market research tool to use during this stage is group discussion. This form of data collection performed by the appropriately skilled moderator will provide qualitative data for use in this and all following stages as it will help define user/customer problems in their own words.

A competitive analysis will be conducted by employing several primary data techniques to determine user/customer perceptions of competitors' products. Such techniques as recorded video observation of general user/customers incorporated with some experimentation to identify user/customer preferences. This might be a good time to employ an experiment where lead user/customers are recorded when given several competitive products to use to determine competitors problems or areas of opportunity for improvement. An execution of these marketing research techniques along with the panel feedback from lead users will provide the NPD teams with the information they need to establish sharp, early and stable project and product definition and continue to set the project on the path of a strong market orientation.

5.2.1.d Stage 3: Development

During the development stage, experiments with the panel of lead users will be crucial to the verification of a proposed product's technical ability to meet user/customer needs, wants and preferences. Multi-variable lab tests, in-house tests and alpha test will ensure that it meets the user/customer criteria under controlled conditions, but observation of product prototypes being used in natural environments by the panel of lead users followed by some form of questionnaire will help yield the best qualitative data of how proposed products perform in regards to user/customer needs, wants and preferences. No general user/customer research should be conducted at this stage as it is highly likely that the lower interest in resolving the problem will cause some less motivated user/customers to disconnect from the project due to lack of technical understanding or interest in exerting themselves to understand. If the firm had the capabilities, this would be the ideal stage to implement the House of Quality analysis to determine user/customer perceptions of the attributes in relation to Customer Attributes and Engineering Capabilities to determine what 'trade-offs' might give the product higher user/customer perceptions.

5.2.1.e Stage 4: Testing and Validation

The Testing and Validation stage will be where general user/customers perceptions and ability to adapt to novel products will be experienced. In order for researchers to discover whether user/customers that will experience the needs of lead user/customers in the future will be able to adapt and accept the novel new product. Of course, this type of testing cannot be done in a controlled experiment-type setting as some of the development research. Instead, this stage will require user or field trials where general user/customers use the product in their actual conditions to verify that the product functions under these conditions, to gauge reactions, and establish purchase intent. Another useful experiment during this stage would be to trial sell the product to a small geographic or demographic segment of the market with favorable, unfavorable and moderate market conditions to measure the effectiveness of marketing and launch plans in various markets and determine expected market share and revenues.

Thus far, the research tools discussed for this stage have been focused on measuring product variable but there is another factor to test in this stage; the advertising and marketing plan. During Stage 4, research should also be conducted to measure the effectiveness of the marketing and advertising plan to measure brand recall and brand awareness as well as particular campaign effectiveness and reaction. This calls for focus groups, market surveys

and in-depth group discussions. This provides qualitative data from general user/customers for product launch and potential market penetration forecasts

5.2.1.f Stage 5: Launch

At this point in the process, the VoC should be well determined and established in every product attribute, advertisement and marketing tool so that the product can now successfully be launched. If all other stages and gates have been executed effectively, this stage should be a breeze to execute.

5.3 Gates

In contrast to the stages, the gates should become less intensive as you proceed through the Innovative Product Bloom Model. There will be new criteria for the proposed new product to meet at each gate including the "must-meet" and "should-meet" criteria from all previous gates. However, it should become less likely as you move through the Innovative Product Bloom Model that the proposed product should deviate from meeting the criteria of earlier gates such as are defined by user/customer needs if it has already successfully satisfied this criteria. As the name suggests, this model should start to witness the product taking shape which would require less and less regulatory criteria for go/kill decisions at the gates and begin to bloom into a refreshing, novel product.

The one thing that should be noted in discussing the gates is that the review and criteria of this process does not end after the launch of the new product. On the contrary, the process should begin to evaluate the success, failure or areas of opportunity of having produced the new product. This might be an opportune time to consult a group of lead users that were not involved with your focus group panel to gather their non-bias feedback regarding the products overall ability to meet user/customer needs, wants and preferences. In some cases this may mean that the process is actually recycled and begins again forming a cyclical pattern in the innovative processes of a firm.

5.4 Innovation Yields Innovation

As technology continues to grow and product life cycles continue to shrink, researchers and NPD experts will continue to look for ways to make the innovative process more efficient and cost effective without jeopardizing the quality of the execution of key activities. The Innovative Product Bloom Model is an evolution of past and current innovation theories that

just might take the field of product development to the next level. It offers NPD teams the flexibility and adaptability to stay fluid in such fast-paced markets while offering the structured, multi-stage process that allows for some necessary planning and functional organization. The key to how the Innovative Product Bloom Model will improve NPD processes is in the integration of the user/customer as a central touch-point for basing decisions on innovative product development. After the many years that NPD experts have been attesting to the importance of this crucial factor in innovation, there is now a model that can be easily interpreted and implemented to guide organizations to a more powerful, efficient process that represents the free, even flow of information between critical stakeholders in the innovative process.

5.5 Limitations

As with all theories, there are limitations to be taken into consideration. For starters, this is a theory that has yet to be applied and tested in real-world situations. Until this happens, there will be areas of the process that can only be assumed. Another limitation would be that this theory has only been derived for use with novel product ideas. While some facets of the process may be applicable to other types of product development, there may be some suggested practices that would have no bearing on the activities or decisions for these alternative types of product development.

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