THE CRITICAL ROLE OF INTERNAL MARKETING R&D COLLABORATION IN PRIVATE ORGANIZATION TOWARDS NEW PRODUCT PERFORMANCES

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A THEMATIC PAPER SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MANAGEMENT COLLEGE OF MANAGEMENT MAHIDOL UNIVERSITY 2018

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Thesis
entitled

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ABSTRACT

It is essential for new product developer to understand a relationship between resources and new product development outcome. Previous research has long been attempting to seek for potential resource factors. Although the collaboration of internal marketing R&D team is normally acknowledged as a critical factor for new product's accomplishment, this study presents not only the effectiveness of the internal collaboration between marketing and technologically new product development department in private organization but related potential performances is also discussed. With specifically applied results obtained by target employees, the author proposes that the internal collaboration between marketing and R&D is predominantly effective moderator combining with high levels of new product development's resources towards new product performances. Therefore, a strong co-created norm or closely working together between the marketing and R&D departments tends to have a lot of advantages with respect to new product and service performances being effectively launched to serve both direct and indirect customers with fast speed and high satisfaction.

KEY WORDS: New Product Development Resource/ New Product Development Performance/ Internal Collaboration

69 pages

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CHAPTER I
BACKGROUND

1.1 Introduction

The survival and development of private firms certainly depend on their capability to continuously growth and market successful in innovative products and services. Thus, firms need to accumulate, protect, and effectively use critical new product development resources and capabilities that potentially maximize their return in terms of profits and outcomes (Day, 1994; McEvily, Eisenhardt, & Prescott, 2004; Nerkar & Roberts, 2004; Sorescu, Chandy, & Prabhu, 2003). At a fundamental level, a firm must ensure an adequate level of technological and marketing resources applied within the organization. However, new products are always essential sources of revenue and competitive strength, their failure rate is still high that consequentially leads to financial loss in firms, especially firms being in a dynamic environment (Yli-Renko & Janakiraman, 2008). To create value in the marketplace, these resources have to be combined into new capabilities to be effectively exploited (Sirmon, Hitt, & Ireland, 2007).

There are many drivers of new products and services accomplishment, including customer input, market orientation, technological collaboration and company resources (e.g. Evanschitzky, Eisend, Calantone, & Jiang, 2012; Henard & Szymanski, 2001; Montoya-Weiss & Calantone, 1994). Normally, a firm's contributions of internal resources i.e. human and technological resources, have been of specific interest to new product development concepts (e.g. Evanschitzky et al., 2012; Henard & Szymanski, 2001). Resources used within the organization such as technological and human capital, together with a company's business network, are essential sources of knowledge for new product initiative. Resources are classified to be the tangible and intangible assets that enable a company to initiate and to market innovative products that serve a strong value to specific market segment (e.g., Day, 1994). It is shown that both technological and marketing resources demonstrated the positive impacts on new product performance (see, for example, Dutta, Narasimhan, & Rajiv, 1999; Nerkar & Roberts, 2004). Sorescu

et al. (2003) also claimed that for private companies with more marketing and technological contribution, the financial value of new products and services is greater.

Though, previous studies have generally concerned the corresponding effects of many internal and external resources while relatively overlooking the effect of their interplay on the development of new products (Henard & Szymanski, 2001). Resource-interplay refers to a mechanism that involves a natural selection process in which some less efficient resources may be replaced by more efficient ones. Scholars tend to contend that resources embedded in business networks complement internal resources and enhance their effectiveness and efficiency in new product development activities (e.g. Cassiman & Veugelers, 2006; Noordhoff, Kyriakopoulos, Moorman, Pauwels, & Dellaert, 2011; Rindfleisch & Moorman, 2001; Yli-Renko & Janakiraman, 2008). The resource-based view suggests that a firm's capability to use resources translates the benefits of individual resources (e.g., a particular internal resource) into superior performance (e.g., Amit & Schoemaker, 1993; Mahoney & Pandian, 1992; Peteraf, 1993).

Our study also focused on one of the most important factors that is expected to play a key role in the combination and exploitation of new product development (NPD) resources, namely the integration of marketing with R&D. Various terms are used in earlier research to describe the notion of how people working together to accomplish new product tasks, for example “integration,” “collaboration,” “cooperation,” and “harmony”. The common denominator is the joint behavior toward some goal of common interest (Pinto, Pinto, & Prescott, 1993). However, the integration of marketing with R&D does not come without effort, and organizational measures and investments are often required to accomplish more integration; examples of such measures include interdisciplinary project teams, training programs, the hiring of cross-functional specialists, job rotation, relocation and physical facilities design, and collaborative ICT systems (Griffin & Hauser, 1996).

Practitioners, consultants, and scholars believe that integration across functional and disciplinary specialties has a positive effect on new product performance (e.g., Griffin & Hauser, 1996; Hoopes & Postrel, 1999; Ittner & Larcker, 1997). This effect has received considerable attention in the marketing literature. For example, Gupta, Raj, and Wilemon (1985, 1986) showed that there is an “integration gap” between R&D and marketing (i.e., a difference between the need for integration and the integration achieved), and

that the larger the gap, the lower the innovation success. Studies such as Pinto et al. (1993) found that higher levels of integration lead to better task outcomes and to more desirable psychosocial outcomes. The studies on the marketing–R&D interface, Griffin and Hauser (1996) concluded that higher levels of integration (also called "collaboration," "cooperation," or "harmony") between R&D and marketing produce better new product performance.

In the research so far, there seems to be a lack of attention to the conditions that make internal collaboration more or less valuable for firms. The studies mentioned above mostly studied collaboration in relative isolation. Many did not include the underlying NPD resource, let alone the interaction between internal collaboration and NPD resource.

1.2 Research Question

1. Do NPD resource influence new product performances?
2. Does the collaboration between internal marketing and R&D moderate the relationship of R&D expense and new product performances?
3. Does the collaboration between internal marketing and R&D moderate the relationship of human capacity and new product performances?
4. Does the collaboration between internal marketing and R&D moderate the relationship of technological capital and new product performances?
5. Does the collaboration between internal marketing and R&D moderate the relationship of NPD resource and new product performances?

1.3 Objective

The objective of this specific study is to fill a gap in the literature and to consequently enhance the new product performances in term of both financial and non-financial approaches. Our main premise is that the effect of internal collaboration between marketing and R&D is embedded in the organizational context of NPD resource, and that the way in which the resources are exploited (in term of R&D expense, technological capital and human capacity) affects the interaction between internal collaboration and NPD resource towards new product performances.

1.4 Research Contribution

1. To make an effective guidance of internal working collaboration among different background and viewpoint of employees within a privately energetic organization, which frequently launches new products and services to a competitive market.

2. The research's outcomes are able to contribute several implications especially for managers, who work in marketing, strategy, product development for consultants, who work on improving innovative product performances and services.

1.5 Research Methodology

The company in construction material industry is selected for this specific research context. New products significantly play a very essential role in this industry. It is a huge and competitive industry in which many firms are highly active. It is also a very transparent and well-documented industry. The author specifies the population in this study, which is comprised of male and female in sale & marketing, operation and R&D departments, who are involved in new product development process. Samples of population are collected in 275 samples at least with 95% confidence. In questionnaire, respondents are asked to assess the performance of their company over the period of last five years and also asked about the expected scores used for evaluating new product performances in currently, which are then used as a good guidance of new product portfolio. This questionnaire's format of seeking performance information related to similar firms in the industry tends to produce findings that are consistent with factual measures. So a score of 5 on the item "The performance of new products that have been launched in the last five years" means that the company is in the top 20% compared within the specific industry of similar size. The duration of research study is between January 2018 and April 2018.

1.6 Research Hypothesis

There is a strongly interaction effect between NPD's resources and new product performances in conjunction with the moderating effect of internal collaboration especially internal co-creation account. Higher level of internal collaboration between marketing and R&D people causes much more efficiently than lower one in term of new product performances and exploited resources.

H1: R&D expense is positively related to new product performances.

H2: Human capacity is positively related to new product performances.

H3: Technological capital is positively related to NPD performance.

H4: NPD resource are positively related to NPD performance

H5: Internal collaboration of marketing with R&D positively moderates the relationship between NPD's resources and new product performances.

1.7 Research Variable

1. Dependent variable :

New product performances i.e. cost to serve, time to market, sales, profitability, business impact, customer satisfaction, ROA & ROI and etc.

2. Independent variable :

- New product development resources i.e. R&D expense, human capacity and technological capital and etc.
- Internal collaboration between marketing and R&D

1.8 Research Framework

A research's model or research framework depicted in Figure 1.1 shows how the interaction of NPD resource and the collaboration of R&D with marketing are expected to influence NPD performance.

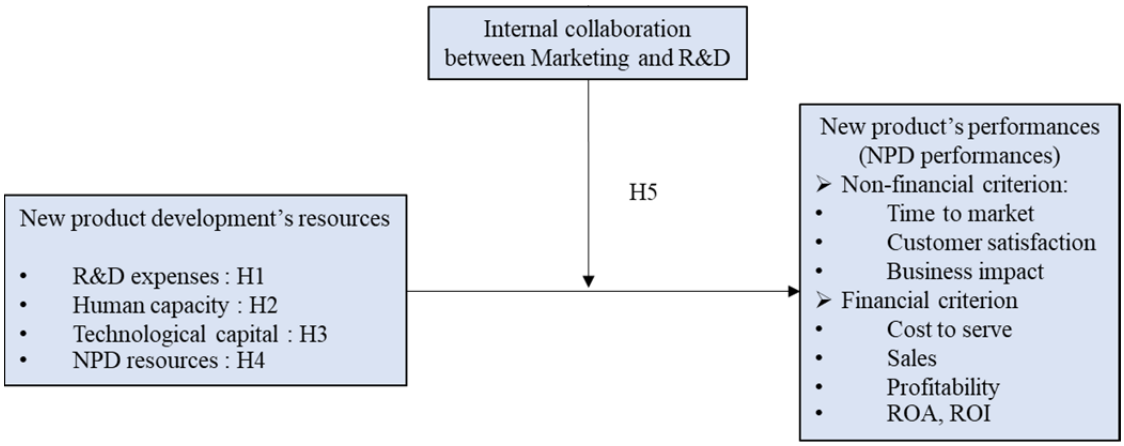

Figure 1.1 Research framework: The critical role of internal marketing R&D collaboration in private organization towards new product performances

1.9 Definition

New product development (NPD)'s resources: NPD resource are the tangible and intangible assets that enable a firm to produce and market new products that have value for some market segment (e.g., Day, 1994).

R & D expense: All expenses are occurred during a new product development's process started from idea initiation to product's post-launched step or simply means any expenses associated with research and development of a firm's goods or services.

Human capacity (HC): HC is the overall skills, expertise and knowledge of a firm's NPD employees.

Technological capital (TC): TC is a firm's technology-related resources such as engineering and technological knowhow.

Internal collaboration (IC): IC is joint effort or ability of multiple individuals or work groups to contribute and accomplish a task or project over a network within organization.

Co-creation (CC): is a management initiative, or form of economic strategy, that brings different parties together, in order to jointly produce a mutually valued idea or outcome to the organization.

New product performance (NPP): NPP is defined as the extent to which a company has output and market success with its new products (see, for example, Griffin & Page, 1993). “New” was defined in the most general sense as new-to-the company, including the full range of me-too products and new to-the-world innovations.

CHAPTER II
LITERATURE REVIEW

2.1 Introduction to New Product Development

A new product is a multi-dimensional concept with need-satisfying capacities not previously experienced by the stakeholders interested in it (Thomas, 1993). Some authors defined new product as "any product that is new to the sponsoring organization" (Souder, 1987), while others gave detailed categories of new product classifications (Booz Allen-Hamilton, 1982). It depended on the perspective from which the product is viewed. Normally there are three perspectives:

- The newness of the product for the developer or the firm;
- The newness of the product for the marketplace;
- The newness of the product as perceived by users or buyers.

Crawford (1983) concluded from these criteria that "a new product is one which is new to the firm". This definition means that newness of a product is unaffected by the fact that other firms are marketing an identical product, or that consumers fail to perceive that the product is new, or that there are only minor changes in packaging or merchandising. According to this definition, an old product marked under a new brand should be viewed as a new product (Crawford, 1983) Scheuing's definition (1974) of a new product classified largely to the marketplace's viewpoint shown below.

- An unchanged product that is marketed in a new way;
- An existing product whose features are altered;
- Variations of existing products are marketed;
- Addition of new product lines;
- An existing product where there is use of different modes of promotion and distribution to stimulate higher sales volume in the present market;
- An existing product where new markets that are different from existing ones in a personal, geographical, or functional way are located and developed.

Booz Allen-Hamilton (1982) classified six characteristics of new products based on the level of newness to the company and to the market, which can be evidently observed in Figure 2.1, i.e.

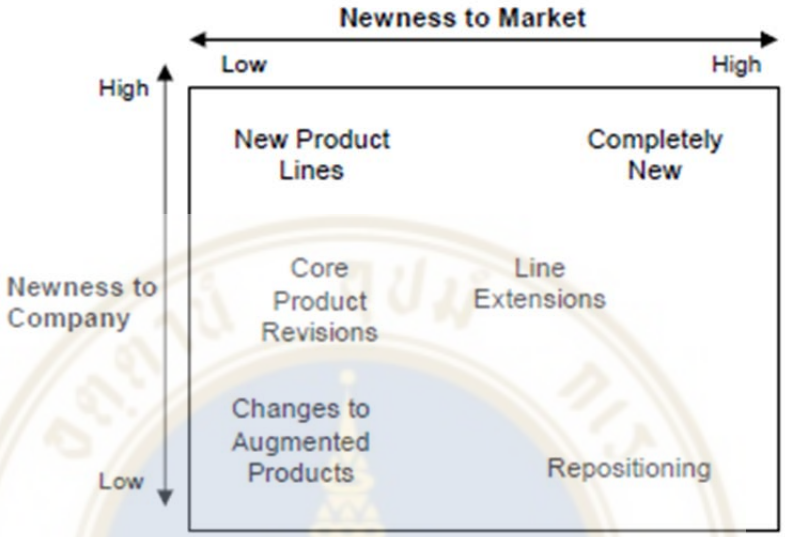

Figure 2.1 New product characteristics

- New-to-the-world products (Completely New): new products that are the first of their kind and create an entirely new market. They only represent 10 percent of all new products.
- New product line: new products that are quite new to a particular firm, but not new to the marketplace. They allow a company to enter an established market. 20 percent of all new products fit into this category.
- Additions to existing product lines (Line Extension): new products that supplement a company's established product lines. They may represent a fairly new product to the marketplace. This is one of the largest categories of new products, about 26 percent of new product launches.
- Improvements in and revisions to existing products (Core Product Revision): new products that offer improved performance or greater perceived value, and replace existing products. Such new products also make up 26 percent of all new products.

- Repositioning: existing products that are targeted to new markets or market segments. They are essentially new applications for existing products. Only 7 percent of all new products represent this category.
- Cost reductions (Changes to augmented product): new products that offer similar benefits and performances at lower costs. They are not new to markets, but they could represent significant changes to the firm. Cost reductions account for 11 percent of all new product launches.

It needs to be noted that most companies feature a mixed portfolio of new products. Additions to existing product lines and improvements in or revisions to existing products account for more than half of all new product introductions. By contrast, the most innovative products, those new-to-the-world and new-to-the-firm product lines constitute 30 percent of all new products, but represent 60 percent of new products viewed as most successful. Researching in moderate-to-high technology industries, Cooper and Kleinschmidt (1991) found 58 percent of new products launched were in these two product categories. It means that higher technology industries launch proportionately more products that are innovative.

According to Rudder (2003), practitioners and researchers used the term new product development (NPD) to describe a range of product developments. However we think there is little agreement as to what actually is a “new product”. Rudder (2003) continued with believing that a broad definition is the most useful and should include either the development or introduction of a product initiative to the manufacturer or the introduction of an old product into a new market. The types of innovations that can be undertaken are:

- Brand reformulations: When a brand product have been largely unchanged over the past years. The company can reformulate the brand strategy.
- Line extensions: When a company decides to extend a successful product through for example a new flavor or color.
- New markets: Find new market for old ideas.
- New products: Find new product ideas for new markets or old markets.
- Imitation products: Produce a product similar to an existing one.

However, to quote Rudder (2003) who stated “only 10 per cent of the entire new products introduced over the last five years were truly innovative or new to the

world". If these numbers are true, then in actual practice the introduction of "new" products is rather rare to the world, this would suggest that 90 per cent of the "new" products are not new. However they are in the most cases new to the manufacturer and probably went through both a planning process and a development process.

2.2 The Role of NPD Performance Measurement

A performance measure plays three simultaneous roles as shown in Figure 2.2. One role is that of an objective (a goal or a target). This represents the disaggregation or statement of a strategy or a plan. For example, one objective is to "complete the development project within 180 days." The second role is as a metric (an actual measurement tool or instrument). This represents a defined and agreed upon way to measure the managerial construct of interest. For example, one metric to capture project duration is "the number of days elapsed between formal project approval and first customer shipment of completed product." The third role is as a reward mechanism (a means for apportioning benefits and advancement to individuals or groups). For example, a group-based salary bonus could be made contingent on successful timely completion of the project (that is, within the 180 day target). The three roles of a performance measure are distinct but highly inter-related. The statement of an objective publicly presents a goal, a direction to work towards, and a constructive challenge to organizational personnel. The reward role is inherently incenting (or punishing) and indicates accountability of development personnel (individual, group or unit level). For instance, the "objective" and "reward" roles serve important motivating and behavioral functions. The "metric" role reflects the desire and ability to collect information to monitor development progress and outcomes. This also allows data-supported business planning and execution, rather than seat-of-the-pants, adhoc decision making. Importantly, the metrics role makes individual and organizational learning and improvement possible, and supports fair awarding of rewards.

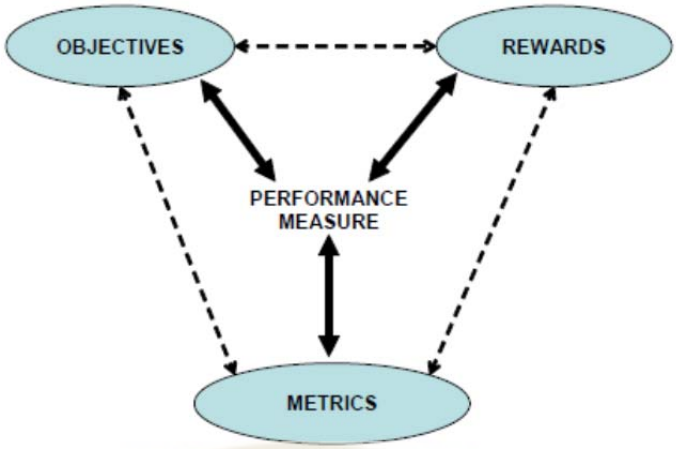

Figure 2.2 Three roles of a performance measure

The organization that does not recognize the three roles of a performance measure will also neglect the essential interrelationships among the three roles. For example, consider how rewards interact with objectives and metrics. Rewards can be given more fairly when objectives are clear and metrics are in place to assess achievement of those objectives. But if rewards are given separate of or in competition with the stated objectives, then the organization is not truly working towards achieving those objectives. And if metrics are not in place, or are deemed irrelevant or unreliable, then again the motivating effect of rewards is lost. An organization that does not recognize the linkages is likely to have disconnected or incongruent objectives, metrics and rewards where each is developed and stated in isolation. This is dysfunctional – its causes organizational actions that are at cross-purposes. The organization does not ultimately state, motivate or measure the desired targets and actions.

Each of the three roles has a second face as well. Regarding objectives, have we selected the right objective? Have we put in placed the most appropriate goals? This reflects the quality of the strategic planning process. Regarding metrics, are we measuring the right things and in the appropriate manner? It is often said “you get what you measure.” Individuals and organizations can “game” a measure or work towards high achievement of a measure to the detriment of other (perhaps unmeasured or unrewarded, but critical) organizational objectives. Regarding rewards, have we put in place the right rewards? Are our rewards congruent with the objectives? And are the rewards perceived as sufficiently material and unbiased to motivate the appropriate behaviors? In conclusion, the organization

benefits most from understanding the existence, purpose and interactions of the three roles, and from putting in place the appropriate manifestations of each role.

2.3 Measures of New Product Performance

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.

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, 2001). 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. 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 (Cooper, 2001). These findings are illustrated in the Figure 2.3. However, the top four factors that contributed to a products failure mentioned by product development managers remain fairly constant.

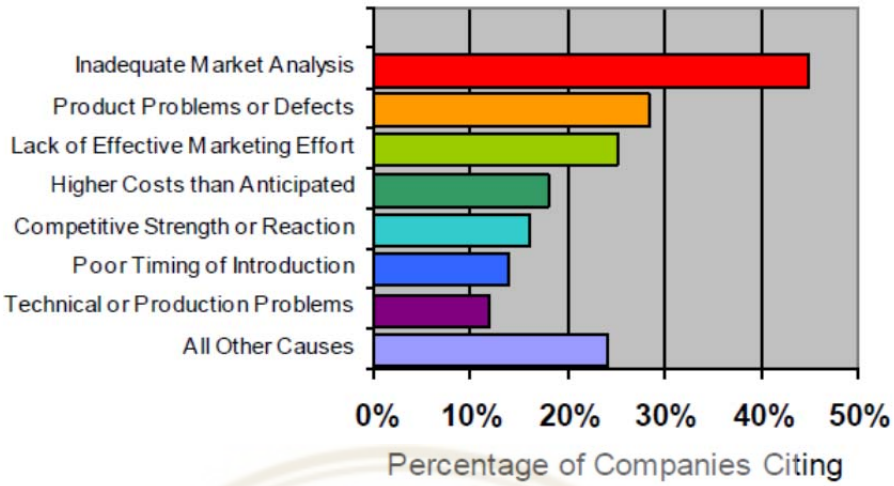

Figure 2.3 Main causes of new product failure

Source: Cooper (2001)

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).

Research in the area of new product success and failure extends back to the 1960s (Meyers and Marquis, 1996). Each research project used different measures for analyzing success and failure in new product development. While that may be because of the nature of studies (project-level or program-level), it makes it difficult to draw generalizations across the investigations. Cooper and Kleinschimdt (1987) developed 11 measures of new product success for their project-level research:

- Financial success/ failure
- Profitability level
- Payback period
- Domestic market share
- Foreign market share
- Relative sales
- Relative profits
- Sales vs. objectives
- Profit vs. objectives
- Opportunity windows on new categories
- Opportunity windows on new markets

Griffin and Page's research (1993 and 1996) which looked at studies on new product success and failure, as well as at the perspectives of managers from companies, tried to identify all currently used measures. Seventy-seven research articles were reviewed and 46 different success and failure measures were identified. From an open-end survey of industries, thirty-four success and failure measures that were currently used, and 45 measures that were desired to be used, were obtained. A total of 75 measures of new product success and failure were generated; and they were statistically grouped into five independent categories:

- Customer Acceptance measures
- Financial Performance Measures
- Product-level Measures
- Firm Benefit Measures
- Program-level Measures

Only 16 of the 75 measures were common across academics and company sources, and they were identified as the “core” success and failure measures. The core measures in each category are shown in Table 2.1. Note that there was no core measure belonging to the program-level category. The possible answer is that most research projects reviewed in this research were project-level rather than program-level (Griffin and Page, 1993).

The categories of measures showed that measuring new product success and failure was multi- dimensional, but most previous research projects in this area only investigated a portion of this structure of categories. The study also indicated that academic researchers used about three measures of success and failure per study, and firms used about for measures on average. Academics tended to investigate product development performance at firm level, whereas companies focused on the success and failure of individual projects.

The results of this study suggested the most appropriate sets of success and failure measures for determining the individual success of different types of product development projects, and for judging the overall success of product development programs at companies with particular business strategies.

Table 2.1 Core measures of new product success and failure

Customer Acceptance Measures	Customer Acceptance Customer Satisfaction Meet Revenue Goals Revenue Growth Meet Market Share Goals Meet Unit Sales Goals
Financial Performance Measures	Break-even Time Attains Margin Goals Attains Profitability Goals Internal Rate of Return/Return on Investment
Product-Level Measures	Development Cost Launched on Time Product Performance Level Meet Quality Guidelines Speed to Market
Firm Benefit Measures	% of Sales by New Products
Program-Level Measure	(None)

Source: Griffin and Page (1993)

A project strategy typology formed by Booz Allen and Hamilton (1982), based on newness to the market and newness to the company, was used to assess the hypothetical measures. The recommended measures for project-level product development success varied by project strategy Table 2.2, however there were some measures commonly important in most project strategies. For example, 'degree to which the project met profit goals', and 'degree to which the project provided a competitive advantage' were two of the most useful measures which indicated the level of success of project's financial and marketing performance. Customer satisfaction and/or acceptance were also very important measures.

On the other hand, the useful program-level success and failure measures for judging overall product development performance were upon the company's strategy approach toward innovation. Companies with low innovative strategies focused on measuring the efficiency of their product development program, and companies with moderately innovative strategies measured both the efficiency and effectiveness of

their product development program, while highly innovative companies assessed the program's contribution to company's growth (Griffin and Page, 1996).

Table 2.2 Suggested success and failure measures for project research

	Newness to the Market Low		High
Newness to the Company High	**New to the Company**		**New to the World**
	Market Share Revenue Customer Satisfaction Met Profit Goal Competitive Advantage		Customer Acceptance Customer Satisfaction Revenue Met Profit Goal Competitive Advantage
	Product Improvements	**Additions to Existing Lines**	
	Customer Satisfaction, Market Share Revenue Growth Met Profit Goal Competitive Advantage	Market Share, Revenue Growth Customer Satisfaction Customer Acceptance Met Profit Goal Competitive Advantage	
	Cost Reductions	**Product Repositioning**	
Low	Customer Satisfaction Customer Acceptance Revenue Met Margin Goal Performance or Quality	Customer Acceptance Customer Satisfaction Market Share Met Profit Goal Competitive Advantage	

Source: Griffin and Page (1996)

2.3.1 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 review of previous research summarized a large number of factors that influenced new product success and failure. They are grouped in Table 2.3 in sections: market, company, consumer, product development process, and new product. Moreover, 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

Table 2.3 Factors in new product success and failure

Market	• Marketing proficiency • Marketing knowledge • Marketing synergy • Marketing potential – market size and growth • Marketing competitiveness • First on market – speed to market • Market attractiveness
Company	• Top management support • Technological synergy • Organizational communication

Table 2.3 Factors in new product success and failure (cont.)

Company (cont.)	• Technical and marketing skills and resources • Effective use of outside technology and science resources • Cross-functional development team • Proficiency of technological activities • Marketing and managerial synergy • Actions and attributes of company as a whole • Seniority of responsible managers • Perceived risk • Timing
Consumer	• Consumer needs, wants and specification • Customer price sensitivity
Product development process	• Management of launch execution • Efficiency of development • Good product idea screening • Up-front homework prior to the development phase • Logical plan • A high quality new product development process • Prototype test with customer • Test market • Individuals in development • Structure of new product organization • Understanding buyer behavior and purchase decision forces
Product	• Product advantage (superiority) • Product quality • Product uniqueness • Product fits with internal functional strength • Technical superiority of product • Price of product

Of those factors, product advantage and product development process execution were widely viewed as critical determinants of new product success. Not surprisingly, new products would be more successful in the market, if they had superior quality, offered unique features that benefited the customers, solved a problem that customer had with existing products, or reduced cost compared with competitive products. Thus creating a superior new product is the top priority in a project screening model or checklist (Cooper, 1993). In fact, developing a new product with real advantages and customer benefits was a top objective in the new product process, so the development team needed to build in extensive market research and work closely with customers/ users to identify customer needs, wants and preferences.

There were several activities in the new product development process underlying the more important impacts on new product success. For example, the definition of the product prior to commencing the development phase was a cornerstone of successful product development. A pivotal step in the new product process was to define the target market, product concept, customer needs and wants, product requirements and benefits to be delivered before development gets under way. This definition also served as communication tool and guide (Cooper, 1984)

A strong market orientation was critical to new product success. A thorough understanding of customer needs and wants, the competitive situation and the nature of the market were found to be a major ingredient in new product success. A market orientation began with idea generation, and prevailed throughout the entire new product project. And market research was used as an input into the design decisions, not solely as an after-the fact check (Cooper, 1993).

It was also found that synergy was vital to new product success (Mishra, Kim and Lee, 1996). Two types of synergy were relevant: Technological synergy and marketing synergy. Technology synergy showed the degree to which the new product project was compatible with the company's existing technological resources. Successful projects featured strong fit between the needs of the project and the firm's R&D or product development resources, its engineering resources and skills, and its production resources and skills. When new technology arenas seem exciting and replace with new opportunities, the risk and odds of failure can be high (Mishra, Kim and Lee, 1996). Market synergy means project/company fit in terms of sales forces, advertising resources and skills,

customer service capabilities, and market intelligence resources and skills. It was worthwhile to pay attention to marketing synergy when launching a product in a new or unfamiliar market (Mishra, Kim and Lee, 1996).

Balachandra and Friar (1997) noticed that the list of significant factors for new product success and failure was very long, and the factors were contingent because depending on the situation, different factors became more or less important. The lack of clear definitions of factors might lead to confusion, as in some cases the factors were considered self-evident.

2.3.2 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 (Kahn, 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:

- offer unique features not available in competitive products
- meet the customer's needs better than competitive products
- have higher relative product quality
- solve a problem the customer has with a competitive product
- educe the customer's total costs, high value in use
- 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-Customers (VoCs) 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.

2.3.3 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 (Kahn, 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.

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 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.

2.3.4 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 (Kahn, 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).

Effectively executed marketing activities in the front-end can have a major impact on the success of a new product. Figure 2.4 illustrates the difference in the quality of execution of early-stage activities between best, average and worst performers in the new product development game (Kahn, 2005).

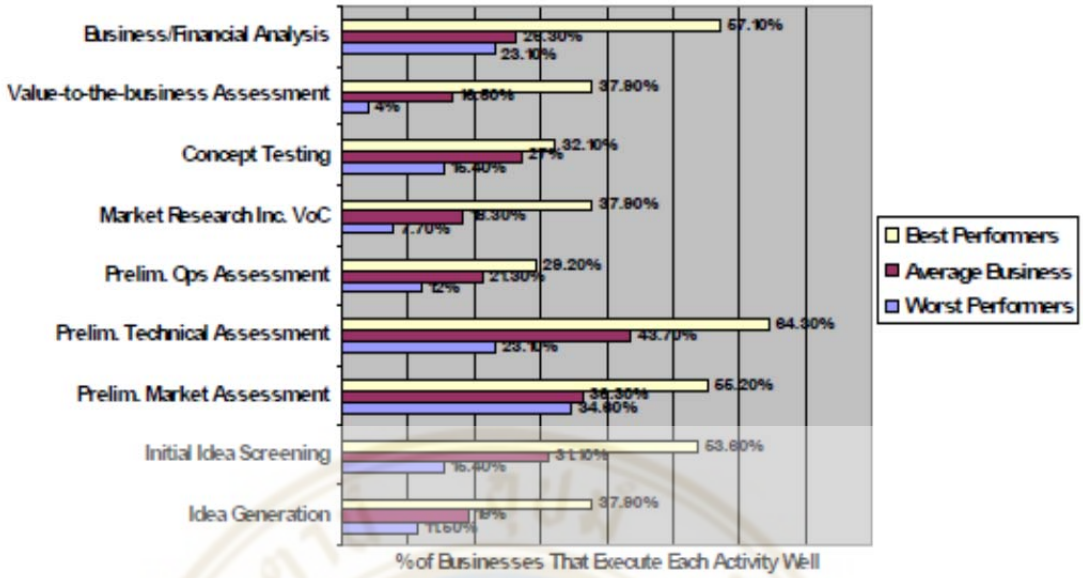

Figure 2.4 Quality of execution of key early-stage activities

Source: Kahn (2005)

2.3.5 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 (Kahn, 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.

2.3.6 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 (Kahn, 2005). This idea supports the integration of employing the proper marketing research at the predevelopment stages and through-out.

2.3.7 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.

2.3.8 Target Attractive Markets

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.

2.3.9 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.

2.4 Resources Exploited in Process of New Product Development

Normally, a firm's contributions of internal resources i.e. human and technological resources, have been of specific interest to new product development concepts (Henard and Szymanski, 2001). Resources used within the organization such as technological and human capital, together with a company's business network, are essential sources of knowledge for new product initiative. Resources are classified to be the tangible and intangible assets that enable a company to initiate and to market innovative products that serve a strong value to specific market segment (Day, 1994). It is shown that both technological and marketing resources demonstrated the positive impacts on new product performance. Teece (1980) also provides several examples to demonstrate the interdependence of R&D and marketing in the development and marketing of new products ranging from medicines to new cars. This interdependency suggests

that the integration of marketing with R&D has a positive effect on the effectiveness of NPD resource. Pinto et al. (1993) define integration as the degree to which there is collaboration, communication, and good relationships between marketing and R&D. Sorescu et al. (2003) also claimed that the financial value of new products and services is greater in case of private companies with more marketing and technological contribution.

Additionally, technological and human resources exploited within a firm establish an important part of its knowledge base and they are critical to creating and refreshing the firm's dynamic capabilities (Teece et al., 1997). Technological capital is technology-related assets (e.g., engineering technologies, technology stock) that can be used in new product development. NPD human capital describes the skills, expertise and knowledge of an organization's NPD employees. The configuration of these internal NPD resource can provide a knowledge base from which a firm can sense and seize new product opportunities in a changing environment. A firm's technological resources may provide a good platform to sense and seize new opportunities. The effectiveness of this platform can be further increased by human resources in which human resources strongly assist the firm to take better advantage towards technological asset in enhancing the sensing and seizing capabilities being available in private organization. A firm with both hardware (technological capital) and software (human capital) has a greater ability to recognize and assimilate new technologies beyond its existing firm’s stock, which enhances its ability to sense and seize up-coming new opportunities. Additionally, the tacit knowledge that emerges from the interactions among skilled NPD employees helps firms comprehend and interpret existing technologies more effectively (Kogut & Zander, 1992), thus making them more able to swiftly sense new opportunities and generate new knowledge within organization. Thus, we expect that a firm's internal technological capital and its human capital have a synergetic effect on its dynamic capability.

2.5 Effects of Internal Collaboration between Marketing and R&D towards new product development performances

New product development team comprises the staffs coming from both marketing and R&D divisions, which they are now working together in term of internal collaboration or cross-functional integration to enhance the effectiveness and achieve

significant, novel and creative innovation towards firm's performance as a whole. Cross-functional integration refers to information sharing, communication and level of innovation participation of departments of research and development, marketing and manufacturing in the process of product development, production and commercialization belonging to the concept in team level (Troy et al., 2008). Information processing view looks at the interface activities of departments of research and development, marketing and manufacturing from the perspective of information exchange, and thinks that successful development of new product requires inter departmental information integration (Shermam et al., 2005).

Moreover, Barczak et al. (2007) explained that occasional communication among the members of research and development and marketing departments frequently has strong linkage with the failure in new product development, while close communication and information sharing among team staffs would enhance the success rate of new product development. The studies of (Atuahene and Evangelist, 2010) have demonstrated that effective cross functional integration can speed-up a new product development process, shorten the period of listing, and enhance the collaboration degree of product line. Souder and Moenaert (2007) explained a longitudinal study for 289 new product development projects, and concluded that internal collaboration between R&D and marketing division is closely related to the success of new product development.

2.6 Co-Creation between Marketing and R&D in New Product Development

New products created through customer participation or co-creation concept used between firm's staffs and customers will more closely meet customer needs than products created solely internally (Hoyer et al., 2010). Essentially, customer participation across multiple NPD stages has been discovered to positively impact NPD performance. (Chang and Taylor, 2016). Within the same private organization, internal customers of R&D department are marketing staffs who are working closely with direct consumers in which most of beneficial requirements will be obviously transferred to R&D staffs for further developing highly satisfied new product. During idea screening process, marketing team are such a good source of new product idea generation since they are

closed to direct customers who are able to convey first aid solutions to the actual problems they encounter (Yli-Renko and Janakiraman, 2008).

Additionally, internal participation has been suggested to impact the innovativeness of new products, which it is deemed an important mediating factor between internal participation and NPD performance. However, external customers or direct customers still can contribute several good and fast advises in external knowledge and are not susceptible to organizational inertia and oftentimes provide 'outside-the-box' thinking (Yli-Renko and Janakiraman, 2008), thus their ideas should be more innovative (Chang and Taylor, 2016). Also, ideas obtained within organization may be less innovative as they are more likely to rely on the existing firm's resources and development of current product in pipeline to avoid product cannibalization (Chandy and Tellis, 1998). This is essential as highly innovative products can provide a firm with a differentiated market position that less innovative products cannot, thus enabling higher product performance (Rubera and Kirca, 2012).

Previous literature has shown that innovative products can be sold successfully based primarily on technological advantages and uniqueness from competitive offerings (Avlonitis and Salavou, 2007). Thus, we definitely agree that product innovativeness may be a mechanism through which customer participation positively impacts product performance. When firms become overly embedded in their processes, they fail to meet changing market demands (Atuahene-Gima and Ko, 2001) that could be met by integrating customers into NPD (Coviello and Joseph, 2012). Substantively, internal co-creation in new product development will lead to differentiated product attributes and increased product innovativeness, thereby enhancing NPD performance on both financial and non-financial benefits.

CHAPTER III
RESEARCH DESIGN AND METHODOLOGY

This chapter discusses the research design and methodology, which will be used for testing the research hypotheses developed in the previous chapter. Issues covered in this chapter mainly include research design, conceptual framework development, sample and data collection, questionnaire development and data analysis.

3.1 Research Design

The research design in marketing viewpoint is a framework or blueprint for conducting the research project that specifies the procedures necessary to obtain the information needed to structure and solve the research problem. This research is specifically designed as an exploratory study to map the characteristics between NPD resource and collaboration of marketing with R&D influencing towards NPD performance. The research method used in this study is a preliminary interview and survey questionnaire. The measurement survey is developed based on the results of construct analysis. Web-based questionnaires are distributed to the target sample group.

Multiple regression analysis is applied to explore the major factors and testing the statistical significance. Finally, the research's finding is then summarized. There are six stages of research, which are literature review, questionnaire development, pilot test, survey and data collection, data analysis including conclusion and recommendation.

3.2 Conceptual Framework Development

A conceptual framework depicted in Figure 3.1 shows how the interaction of NPD resource and the collaboration of R&D with marketing are expected to influence NPD performance.

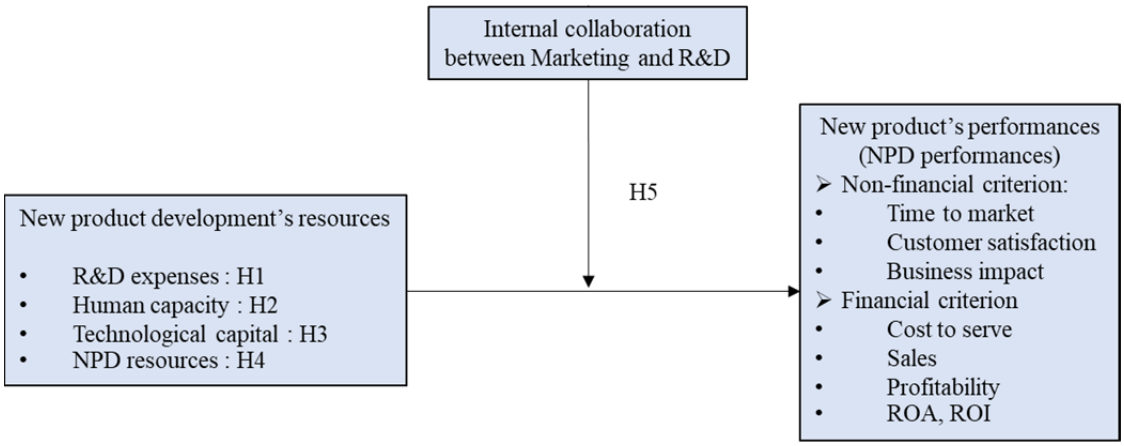

Figure 3.1 Research framework: The critical role of internal marketing R&D collaboration in private organization towards new product performances

3.3 Sample and Data Collection

The sample size in this study is calculated based on the formulation of Fink, 2000 that is normally used in case of unknown size of population, unknown ratio of sample size with respect to number of population and unknown variance. The claimed formulation is described as below:

$$n = (Z/2E)^2$$

$$n = (Z2 \times p\ (1\text{-}p)) / M^2$$

or when $p = 1/2\ (0.5)$

$$n = (Z)^2 / 4M^2$$

Z = level of confidence according to the standard normal distribution (for a level of confidence of 90%, z = 1.64, 95%, z = 1.96 and 99%, z = 2.575)

E = tolerated margin of error (for example we want to know the real proportion within 5%, 0.05)

P = estimated proportion of the population that presents the characteristic (when unknown we use p = 0.5)

M = tolerated margin of error (for example we want to know the real proportion within 5%)

To calculate a proportion with a 90% level of confidence and a margin of error of 5% we obtain n = (1.64)2 / 4(0.05)2= 268.96

The sample consisted of 275 people who are active in the fields involving R&D in science & technology and sale & marketing divisions from Cement and Construction Solution Business of Siam Cement Group, Thailand. The respondents were senior managers, middle managers, department manages, assistant managers and related staffs in R&D and marketing division. Using the researcher's social network, senior executives in this specific business unit are contacted personally and given a letter describing the objective in this research study with attached questionnaire. The survey was conducted in two months, started from March 2018 to April 2018. A cover letter explaining the significance of the study and assuring the confidentiality of responses accompanied the survey instrument. The organization were assured that all individual responses would be kept confidential, with the records being kept in a locked file; only the researcher would be able to access the records and results would be only reported with special permission. To avoid the bias issue, the executives were asked to advise the participants that were no risks or benefits associated with participation in the study, and the decision whether or not to participate would not affect a respondent's current or future relations with the organization. In addition, the respondents were instructed to return the completed surveys to organizational coordinators in sealed envelopes.

3.4 Questionnaire Development

The research study was initiated by exploring the essential factors affecting to new product performance by interviewing R&D director and another one is marketing director in the organization. Two directors coming from different divisions were interviewed to figure out ideal determinants influencing new product performance in term of both financial and non-financial approaches. During the interview, the discussion covers the relevant information beneficial to a research study. These interviews support the preparation of questionnaire development.

To ensure the questionnaire satisfies the content validity, the scale items are modified from relevant prior research. Measurement scale of the constructed research is mainly closed-ended questions which are classified into two types; personal information

questions and 5 point Likert rating scale questions. All questions from Part II to Part IV were measured by using five-point scales, Likert 5 point method, anchored from "strongly disagree" to "strongly agree". The questions were made as easy to understand as possible in order to minimize potential bias in responses and to reduce doubted meaning throughout the designed questionnaire. All measurement items were drawn from prior research study. Questionnaire has been divided into four parts shown as followings:

- Part I: Personal information or demographic data
- Part II: Measures of internal collaboration of marketing with R&D
- Part III: Measures of NPD resource
- Part IV: Measures of NPD performance

To calculate the statistical construct reliability of the questionnaire, the pilot study shall be done prior to actual data collection. In this research study, the pilot test will be executed with 30 respondents to see whether they well understand the questions based on constructed questionnaire. The exploratory factor analysis was done to classify the group of each construct and validate the item for calculative commitment in which items for moral commitment were deleted from a scale.

3.5 Data Analysis

Hypotheses are constructed based on a prior research, quantitative survey was then used for collecting the empirical data and the analysis was done by using SPSS, which is a special software used for examining collected survey data in term of statistical method shown in the Table 3.1.

3.5.1 Correction Analysis

The analysis used to find the relationship among all variables is claimed as below:

3.5.1.1 Dependent variable:

New product performances i.e. cost to serve, time to market, sales, profitability, business impact, customer satisfaction, ROA & ROI and etc.

3.5.1.2 Independent variable :

- New product development's resources i.e. R&D expense, human capacity and technological capital
- Internal collaboration between marketing and R&D

3.5.2 Multiple Regression Analysis

The analysis is a flexible method of data analysis that may be appropriate whenever a quantitative variable (the dependent or criterion variable) is to be examined in relationship to any other factors (expressed as independent or predictor variables). Researcher uses this analysis to find out the factors of independent variables that has influenced on new product performances.

Table 3.1 Statistical tools for data analysis

Statistical Tool	Purpose
Data Preparation Stage	
Descriptive Statistics (Frequencies)	To examine and present the sample characteristics
Cronbach's Alpha Coefficient	To measure the internal consistency and investigate how closely related a set of variables are as a group
Hypothesis Verification Stage	
Multiple Group Analysis	To compare the differences among two or more group samples of respondents using similar models

CHAPTER IV
RESEARCH RESULTS

This chapter presents data analyses and reports the study's results through developed hypotheses. The raw data collected from the 288 completed questionnaires was converted by the application of SPSS. The results from this study are organized into two parts, which are composed of descriptive and interferential statistics.

4.1 Sample Characteristics

To identify the respondent characteristics of the sample i.e. gender, age, job's position/department and work experience, the related descriptive statistics such as mean and standard deviation are employed. The collected samples are presented through the gender distribution of 228 male or 79% and 60 female or 21% of the total samples. All respondents are in the age range from 23 to 53 years while the mean age of respondents is approximately 32.6 years.

The respondents are the current employees at Siam Cement Group and are in the division of research & development, sales & marketing and related fields who are currently assigned for contributing the development of innovative products and services in both domestic and regional schemes. 63% and 37% of respondents are working in the area of 1. R&D – manufacturing – technology planning & commercialization and 2. Sales & marketing in respectively. Average working experience of technological and marketing staffs are 7.5 and 8.4 years in respectively. The job's level of respondents are from the top executives to assistants or technicians in these specifically related divisions.

4.2 Descriptive Statistics

4.2.1 Attitudes of Respondents towards NPD

In this part, there are several items that are measured by using five-point scales, Likert 5 point method, anchored from “strongly disagree” to “strongly agree”. The characteristics of respondents’ attitudes in account of NPD resource, R&D expense, technological capital, human capacity including internal collaboration being used as moderator influencing towards NPD performance are demonstrated in Table 4.1 to Table 4.3 in term of % frequency, average score, and standard deviation. The author divides the level of agreement into 5 levels of agreement as shown in the followings:

- The average score of 1.00-1.80 implied strongly disagree;
- The average score of 1.81-2.60 implied disagree;
- The average score of 2.61-3.40 implied neutral;
- The average score of 3.41-4.20 implied agree;
- The average score of 4.21-5.00 implied strongly agree.

Table 4.1 Average score and S.D. of respondent rating scale on NPD resource measures

Measures	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Mean	S.D.
Sophistication of R&D equipment	0 0%	22 8%	88 31%	131 45%	47 16%	3.70	0.83
Accessibility at research institutes	0 0%	7 2%	77 27%	160 56%	44 15%	3.83	0.70
Database and library facilities	18 6%	37 13%	119 41%	85 30%	29 10%	3.24	1.01
Contacts with universities	1 0%	15 5%	102 35%	124 43%	46 16%	3.69	0.81
Worldwide market information	14 5%	62 22%	146 51%	46 16%	20 7%	2.98	0.92
Top scientists	10 3%	46 16%	97 34%	97 34%	38 13%	3.37	1.01

Table 4.1 Average score and S.D. of respondent rating scale on NPD resource measures (cont.)

Measures	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Mean	S.D.
Contact with top external specialists	19 7%	11 4%	97 34%	105 36%	56 19%	3.58	1.05
Cooperative R&D relationships	8 3%	27 9%	104 36%	115 40%	34 12%	3.48	0.91
Relationships with governmental bodies	17 6%	34 12%	91 32%	116 40%	30 10%	3.37	1.01
Knowledge of competitors	12 4%	37 13%	103 36%	105 36%	31 11%	3.36	0.97

Table 4.2 Average score and S.D. of respondent rating scale on R&D expense, Technological capital and Human capacity measures

	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Mean	S.D.
R&D's Expenses							
Your company had sufficient expenses for purchasing high technological equipment used in our research institute	11 4%	23 8%	77 27%	153 53%	24 8%	3.54	0.89
Your company had sufficient expense to cover all new product development's process, started from idea initiation to product's post-launched stage	0 0%	50 17%	71 25%	142 49%	25 9%	3.49	0.87
Your company had sufficient expenses for acquiring upcoming technology to contribute innovative products and shorten development's time as a whole	18 6%	63 22%	76 26%	123 43%	8 3%	3.13	0.99

Table 4.2 Average score and S.D. of respondent rating scale on R&D expense, Technological capital and Human capacity measures (cont.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	S.D.
	1	2	3	4	5		
Your company had sufficient budget to make a strong collaboration with external renowned academic researchers or world-class research institutes	0 0%	27 9%	76 26%	135 47%	50 17%	3.72	0.85
Technological capital							
Your company had sufficient engineering and manufacturing technologies for our product development	7 2%	23 8%	93 32%	134 47%	31 11%	3.55	0.87
Your company had sufficient resources to develop technologies that help us develop new products and related processes	0 0%	38 13%	103 36%	122 42%	25 9%	3.46	0.82
Your company possessed a sufficient technological base for our product development	0 0%	28 10%	76 26%	142 49%	42 15%	3.68	0.83
Human capacity							
Our staffs in product development are widely considered the best in our industry	2 1%	54 19%	125 43%	95 33%	12 4%	3.21	0.81
Our staffs in product development are creative and bright	8 3%	10 3%	111 39%	100 35%	59 20%	3.66	0.93
Our staffs in product development are expert in their particular jobs and functions	0 0%	63 22%	78 27%	138 48%	9 3%	3.32	0.84
Our staffs in product development develop new ideas and knowledge	14 5%	28 10%	107 37%	129 45%	10 3%	3.32	0.88

Table 4.3 Average score and S.D. of respondent rating scale on Internal collaboration measures

Measures	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Mean	S.D.
A friendly attitude exists between R&D and marketing	1 0%	50 17%	103 36%	120 42%	14 5%	3.33	0.83
Open communication of relevant information occurs between R&D and marketing	1 0%	78 27%	65 23%	94 33%	50 17%	3.39	1.07
R&D and marketing intentionally provide each other with misleading information	58 20%	108 38%	89 31%	28 10%	5 2%	2.35	0.96
R&D and marketing search for solutions that are agreeable to each other	8 3%	42 15%	98 34%	123 43%	17 6%	3.34	0.89
R&D and marketing are more like teammates than competitors	0 0%	46 16%	75 26%	120 42%	47 16%	3.58	0.94
If disagreements arise between them, R&D and marketing are usually able to resolve the disagreements	21 7%	36 13%	113 39%	104 36%	14 5%	3.18	0.96
R&D and marketing openly share their ideas with each other	32 11%	30 10%	68 24%	105 36%	53 18%	3.40	1.22
R&D and marketing help each other to more effectively perform their tasks	14 5%	64 22%	68 24%	106 37%	36 13%	3.29	1.09
R&D and marketing often fail to communicate information to each other	21 7%	94 33%	65 23%	70 24%	38 13%	3.03	1.18
R&D and marketing are always blaming each other for failures	23 8%	151 52%	67 23%	37 13%	10 3%	2.51	0.93
It is difficult for R&D and marketing to contact each other	62 22%	90 31%	56 19%	64 22%	16 6%	2.59	1.20

Table 4.3 Average score and S.D. of respondent rating scale on Internal collaboration measures (cont.)

Measures	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Mean	S.D.
Conflicts between R&D and marketing are of a constructive kind	12 4%	24 8%	131 45%	99 34%	22 8%	3.32	0.89
R&D and marketing perceive their problems as mutual problems	27 9%	46 16%	129 45%	86 30%	0 0%	2.95	0.91
R&D and marketing recognize each other's talents and expertise	16 6%	35 12%	90 31%	123 43%	24 8%	3.36	0.98
R&D and marketing share resources to complete tasks	34 12%	62 22%	58 20%	122 42%	12 4%	3.05	1.13

Table 4.4 Average score and S.D. of respondent rating scale on NPD performance measures

Measures	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Mean	S.D.
The achieve performance of the products that your company has been launched in the last five years in term of:							
• Cost to serve	2 1%	50 17%	130 45%	87 30%	19 7%	3.24	0.84
• Time to market	7 2%	67 23%	130 45%	79 27%	5 2%	3.02	0.82
• Sales (i.e. target sale, market share and sale growth)	8 3%	62 22%	135 47%	62 22%	21 7%	3.09	0.90
• Profitability	10 3%	39 14%	159 55%	65 23%	15 5%	3.12	0.83
• Business impact	13 5%	22 8%	180 63%	69 24%	4 1%	3.10	0.73
• Customer satisfaction	2 1%	69 24%	124 43%	74 26%	19 7%	3.13	0.87

Table 4.4 Average score and S.D. of respondent rating scale on NPD performance measures (cont.)

Measures	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5	Mean	S.D.
• ROA, ROI	0 0%	56 19%	168 58%	56 19%	8 3%	3.05	0.70
The number of new products launched in the last five years	8 3%	48 17%	104 36%	88 31%	40 14%	3.36	1.00
The number of breakthroughs in the last five years	56 19%	76 26%	142 49%	9 3%	5 2%	2.41	0.89
New products at your firm generally achieve customer use objectives in last five years	24 8%	74 26%	98 34%	87 30%	5 2%	2.91	0.97
New products are successful in the last five years	2 1%	50 17%	136 47%	67 23%	33 11%	3.27	0.90

4.3 Interferential Statistics

To effectively establish the internal consistency of measures, the author computed Cronbach's Alpha coefficients to calculate the reliability of the items as shown in Table 4.5, which their values are in the level of .684 to .708. There are two constructs (i.e. technological capital and human capital) which their values are slightly lower than 0.7 and may be questionable. However, these constructs were adopted from past studies which were tested and well accepted. In addition, the values are very closed to 0.7 and thus the researcher proceeds further with the original number of items.

Table 4.5 Cronbach's Alpha of measures

Measures	Cronbach's Alpha	No. of items
NPD resource	.713	10
R&D expenses	.739	4
Technological capital	.684	3
Human capacity	.699	4
NPD performance	.770	11
Internal collaboration	.708	15

To examine the correlation throughout the four independent variables, the correlations among all variables are observed to be not extremely high correlation as shown in Table 4.6.

Table 4.6 Pearson correlation applied to independent variables

		NPD Achievements	NPD Resource	R&D Expense	Technological Capital	Human Capacity	Internal Collaboration	ModcResoIC
Pearson Correlation	NPD Achievements	1.000	.570	.467	.166	.208	-.216	.249
	NPD Resource		1.000	.354	.276	.105	-.220	.157
	R&D Expense			1.000	.612	.285	-.274	-.151
	Technological Capital				1.000	-.034	-.171	-.306
	Human Capacity					1.000	-.057	-.065
	Internal Collaboration						1.000	.319
	ModcResoIC							1.000

The 11 measures of NPD performance were developed from the research study of Leenders & Wierenga (2008), Atuahene-Gima & Ko (2001), Song & Parry (1997) and discussion with experts working in the field of technological management and commercialization at Siam Cement Group. They thought that only four measures proposed by Leenders & Wierenga (2008) are likely inadequate to evaluate new product performance and achievement due to unspecific and too broaden measures being shown in followings:

- The performance of the products that have been launched in last five years
- The number of new products in the last five years
- The number of breakthroughs in the last five years
- The quality of the R&D pipeline in the last five years

Consequently, they intentionally proposed some of additional measures based on their past experiences such as cost to serve, time to market, sales, profitability, business impact, customer satisfaction and return on investment. All of these measures suggested by the experts are similar to measures quoted in the study of Atuahene-Gima & Ko (2001) and Song & Parry (1997) i.e. sales, market share and return on investment. Additional measures in NPD performance, from 4 items to 11 items, adopted from Atuahene-Gima & Ko (2001) and Song & Parry (1997) are added in term of financial and non-financial approaches.

4.4 Hypothesis Testing

Table 4.7 Standardized coefficientsa of NPD resource, Human capacity, Technological capital, R&D expense and Internal collaboration affecting on NPD performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.957	.198		4.825	.000
	NPD Resource	.453	.045	.478	10.012	.000
	R&D Expense	.335	.049	.428	6.861	.000
	Technological Capital	-.173	.045	-.227	-3.863	.000
	Human Capacity	.021	.036	.028	.581	.561
2	(Constant)	1.383	.274		5.041	.000
	NPD Resource	.373	.046	.393	8.031	.000
	R&D Expense	.305	.048	.390	6.378	.000
	Technological Capital	-.094	.046	-.123	-2.048	.042
	Human Capacity	.045	.035	.061	1.297	.196
	Internal Collaboration	-.123	.049	-.120	-2.495	.013
	ModcResoIC	.536	.107	.251	5.003	.000

a Dependent Variable: NPD Achievements

*Significant at p < .01, **Significant at p < .05

According to result analysis in Table 4.7, R&D expense (X1), human capacity (X2), technological capital (X3) and NPD resource (X4), present beta coefficient equal to .428, .028, -.227 and .478 in respectively, which p value of the first three significantly independent variables are lower than .01 but beta coefficient of human capital is greater than .01 (i.e. .561, it is insignificant). The most impact independent factor compared within a group of specific variables is NPD resource owing to the highest significant coefficient (beta = .478) being obtained. As a results, hypothesis, H1-H4 being tested by Model 1, can be made a conclusion that: (Y = .335X1+.021X2-.173X3+.453X4)

- Accept H1: R&D expense is positively related to NPD performance.
- Reject H2: Human capacity is positively related to NPD performance.
- Accept H3: Technological capital is positively related to NPD performance.
- Accept H4: NPD resource are positively related to NPD performance.

4.5 Testing the Moderating Effect of Internal Collaboration Between NPD Resource and Performance

After testing the moderator interacted with Model 1, the results are expressed that there is merely an independent factor that is not significant i.e. human capacity (beta = 1.297, p ⩾ .05). The others are significant with p value less than .05 as shown in Table 4.7. The most impact independent factor compared within a group of specific variables is NPD resource and R&D expense owing to the highest significant coefficient (beta = .393 and .390 respectively) being obtained. Also, internal collaboration used as moderator (X5) and the interaction (X6) or simply called moderating effect between NPD resource (X4) and internal collaboration (X5) affecting towards new product performances present significant coefficient equal to -.120 and .251 in respectively, which their p values are lower than .05. As a results, hypothesis, H5 being tested by Model 2, can be made a conclusion shown as followings: (Y = .305X1+.045X2-.094X3+ .373X4-.123X5+.536X6)

Accept H5: Internal collaboration of marketing with R&D positively moderates the relationship between NPD resource and new product performances.

4.6 Post-Hoc Testing

Post-hoc 1: Use the terms of NPD resource' measures to explain NPD performance

Leenders and Wierenga (2008) have employed the measures through a critical role of new product development resources in account of R&D equipment, accessibility at research institutes, database and library facilities, contacts with the universities, worldwide market information, top scientists, contacts with top external specialists, cooperative R&D relationships, relationships with governmental bodies and knowledge of competitors. They claimed that the measures in NPD resource are able to explain 36% of the variance in new product development performance (adjusted R2 = 34%). Post-hoc 1 is then proposed by the author in the similar concept to evaluate NPD performance by means of using similar effective NPD resource and new set of NPD performance measures that is composed of 11 items in totally. After increasing NPD performance measures, R^2 is 32.5% (adjusted R^2 = 32.2%) and significant coefficient beta = .570 in accordance with $p < .01$ as presented in Table 4.8 and Table 4.13 to 4.15.

Post-hoc 2: Use the terms of R&D expense, technological capital and human capacity measures to explain NPD performance

In order to increase the effective explanation through new product development performance, the author employs the alternative terms of NPD resource measures that may be better explain NPD performance i.e. R&D expense, technological capital and human capacity measures instead of NPD resource measures claimed in Post-hoc 1. The model analysis is presented in Table 4.9 to 4.11. Post-hoc 2 explains 24.2% (adjusted R^2 = 23.4%) of the variance in NPD performance, all three independent measures i.e. R&D expense, technological capital and human capacity can explain 24.2% (adjusted R^2 = 23.4%) of NPD performance. The results for Post-hoc 2 also provide specific evidence for contributing the significance of R&D expense (beta = .563, $p < .01$), technological capital (beta = -.177, $p < .01$) and human capacity (beta = .041, $p \geqslant .01$) upon NPD performance. As a result, only R&D expense and technological capital are accepted in this model.

However, R^2 of Post-hoc 2, 24.2% (adjusted R^2 = 23.4) is lower than that of Post-hoc 1, 32.5% (adjusted R2 = 32.2%), then author concludes that the use of NPD resource measures applied in Post-hoc 1 are able to more effectively explain NPD

performance. Therefore, NPD resource and NPD performance measures proposed in Post-hoc 1 are then used for testing the hypothesis of H4 including the effect of moderator in H5. The testing results of internal collaboration between marketing and R&D used as moderator in Post-hoc 1 are demonstrated that NPD resource interacted with internal collaboration can better explain the variances in NPD performance, which R^2 increases from 32.5% to 37.8% (adjusted R2 = 37.1%) and significant coefficient of specifically related independent factors is shown in Table 4.12. The NPD resource with moderating effect provide a positive significant coefficient, beta = 0.229, with $p < .05$. It is likely implied that the internal collaboration between R&D and marketing seems to have a limited direct influence on NPD performance; however, increased internal collaboration does have a significant effect in conjunction with NPD resource.

Consequently, "internal collaboration of marketing with R&D positively moderates the relationship between NPD resource and new product performances" is supported by means of Post-hoc 1. Figure 4.1 is expressed that increased NPD resource with higher level of internal collaboration between marketing and R&D causes a greater NPD performance. However, increased NPD resource with low internal collaboration tends not to have much effect towards NPD performance.

Table 4.8 Result analysis of Leenders & Wierenga (2008)'s Model and Post-hoc 1

Variables	Leenders & Wierenga (2008)	Results analyzed by author (Post-hoc 1)
NPD resource (beta)	.51*	.570*
N	121	288
R^2	.36	.325
Adjusted R^2	.34	.322
F-value	13.26	137.563
*Significant at $p < .01$		

Table 4.9 Model summary of Human capacity, Technological capital, R&D expense and Internal collaboration affecting on NPD performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
2	.492[a]	.242	.234	.40836	.242	30.251	3	284	.000
2+Mod	.594[b]	.353	.337	.37989	.111	12.039	4	280	.000

a. Predictors: (Constant), Human Capacity, Technological Capital, R&D Expense

b. Predictors: (Constant), Human Capacity, Technological Capital, R&D Expense, Internal Collaboration, ModcTCIC, ModcHCIC, ModcRDEIC

Table 4.10 ANOVA a of Human capacity, Technological capital, R&D expense and Internal collaboration affecting on NPD performance

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	15.133	3	5.044	30.251	.000[b]
	Residual	47.358	284	.167		
	Total	62.492	287			
2+Mod	Regression	22.083	7	3.155	21.860	.000[c]
	Residual	40.408	280	.144		
	Total	62.492	287			

a. Dependent Variable: NPD performance

b. Predictors: (Constant), Human Capacity, Technological Capital, R&D Expense

c. Predictors: (Constant), Human Capacity, Technological Capital, R&D Expense, Internal Collaboration, ModcTCIC, ModcHCIC, ModcRDEIC

Table 4.11 Standardized coefficientsa of Human capacity, Technological capital, R&D expense and Internal collaboration affecting on NPD performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	1.990	.197		10.120	.000
	R&D Expense	.440	.055	.563	7.959	.000
	Technological Capital	-.135	.052	-.177	-2.609	.010
	Human Capacity	.031	.041	.041	.739	.461
2+Mod	(Constant)	2.847	.282		10.091	.000
	R&D Expense	.498	.056	.637	8.869	.000
	Technological Capital	-.144	.050	-.188	-2.862	.005
	Human Capacity	-.013	.043	-.018	-.307	.759
	Internal Collaboration	-.284	.060	-.276	-4.766	.000
	ModcRDEIC	.101	.158	.069	.643	.521
	ModcTCIC	-.431	.136	-.243	-3.176	.002
	ModcHCIC	.512	.125	.356	4.106	.000

a. Dependent Variable: NPD performance

Table 4.12 Model summary of Post-hoc 1 and Post-hoc 2 interacted with moderator

Variables	Model 1	Model 2
NPD resource (beta)	.494*	
R&D expense (beta)		.637*
Technological capital (beta)		-.188*
Human capacity (beta)		-.018
Internal collaboration (beta)	-.180*	-.276*
ModcResolC (beta)	.229**	
ModcRDEIC (beta)		.069
ModcTCIC (beta)		-.243**
ModcHCIC (beta)		.356**
N	288	288

Table 4.12 Model summary of Post-hoc 1 and Post-hoc 2 interacted with moderator (cont.)

Variables	Model 1	Model 2
R^2	.378	.353
Adjusted R^2	.371	.337
F-value	57.439	21.860
*Significant at $p < .01$, **Significant at $p < .05$		

Table 4.13 Model summary of NPD resource and Internal collaboration affecting on NPD performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.570[a]	.325	.322	.38411	.325	137.563	1	286	.000
1+Mod	.615[b]	.378	.371	.37006	.053	12.058	2	284	.000

a. Predictors: (Constant), NPD Resource

b. Predictors: (Constant), NPD Resource, ModcResoIC, Internal Collaboration

Table 4.14 ANOVA a of NPD resource and Internal collaboration affecting on NPD performance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.296	1	20.296	137.563	.000[b]
	Residual	42.196	286	.148		
	Total	62.492	287			
1+Mod	Regression	23.599	3	7.866	57.439	.000[c]
	Residual	38.893	284	.137		
	Total	62.492	287			

a. Dependent Variable: NPD performance

b. Predictors: (Constant), NPD Resource

c. Predictors: (Constant), NPD Resource, ModcResoIC, Internal Collaboration

Table 4.15 Standardized coefficientsa of NPD resource and Internal collaboration affecting on NPD performance

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.269	.161		7.878	.000
	NPD Resource	.540	.046	.570	11.729	.000
1+Mod	(Constant)	2.119	.266		7.957	.000
	NPD Resource	.468	.047	.494	9.981	.000
	Internal Collaboration	-.185	.053	-.180	-3.490	.001
	ModcResoIC	.489	.109	.229	4.495	.000

a. Dependent Variable: NPD performance

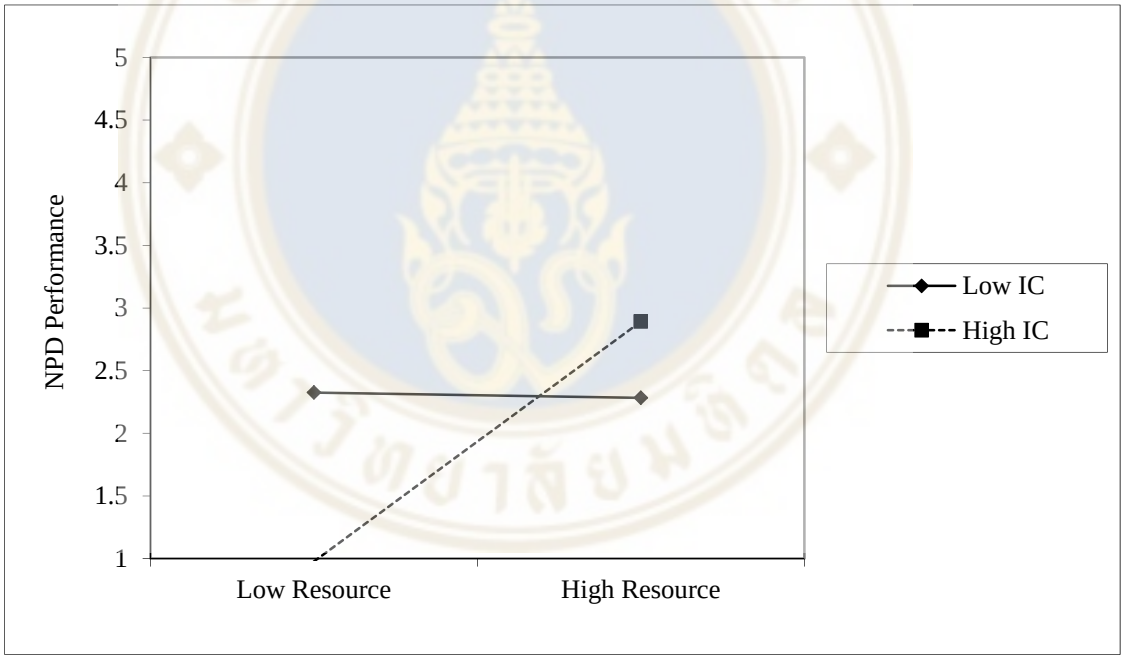

Figure 4.1 The relationship between NPD resource interacted with Internal collaboration and NPD performance

CHAPTER V
CONCLUSION, DISCUSSION AND RECOMMENDATIONS

This chapter presents conclusion, discussion, implication, limitations and recommendations that can be drawn from the research. It begins with the part of research summary and follows by academic contributions. In addition, the implication for theory and practice including recommendation about limitation and future research are provided respectively.

5.1 Conclusion and Discussion of Findings

There are many drivers of new products and services accomplishment, including customer input, market orientation, and technological collaboration and company resources. This research focuses on one of the most important factors that is expected to play a key role in the combination and exploitation of NPD resource, namely the internal collaboration of marketing with R&D. Many scholars believe that integration across functional and disciplinary specialties have a positive effect on new product performance (Griffin and Hauser, 1996). This effect has received considerable attention in the marketing literature. Studies such as Pinto et al. (1993) found that higher levels of integration lead to better task outcomes and to more desirable psychosocial outcomes. The studies on the marketing and R&D interface, Griffin and Hauser (1996) concluded that higher levels of integration between R&D and marketing produce better new product performance.

Normally, a firm's contributions of internal resources i.e. human and technological resources, have been of specific interest to new product development concepts (Henard and Szymanski, 2001). Resources used within the organization such as technological and human capital, together with a company's business network, are essential sources of knowledge for new product initiative. Resources are classified to be the tangible and intangible assets that enable a company to initiate and to market

innovative products that serve a strong value to specific market segment (Day, 1994). It is shown that both technological and marketing resources demonstrated the positive impacts on new product performance. Teece (1980) also provides several examples to demonstrate the interdependence of R&D and marketing in the development and marketing of new products ranging from medicines to new cars. This interdependency suggests that the integration of marketing with R&D has a positive effect on the effectiveness of NPD resource. Pinto et al. (1993) define integration as the degree to which there is collaboration, communication, and good relationships between marketing and R&D. Sorescu et al. (2003) also claimed that the financial value of new products and services is greater in case of private companies with more marketing and technological contribution.

In previous research, there seems to be a lack of attention to the conditions that include the impacts of internal collaboration for private firms. Previous studies mostly discuss these collaboration in isolation. Many do not include the underlying NPD resource, let alone the interaction between internal collaboration and NPD resource especially in Thailand's cement and construction business unit, which is such a slow cycle industry in new product development compared to a fast cycle one e.g. pharmaceutical or cell phone industry Leenders & Wierenga (2008).

The primary objective of this specific study is to fill a gap in the literature and to consequently enhance the new product performances in term of both financial and non-financial approaches. The main premise is that the effect of internal collaboration is embedded in the organizational context of NPD resource, and that the way in which the resources are exploited (in term of R&D expense, human capital and technological capacity) affects the interaction between internal collaboration and NPD resource towards new product performance.

The result of this research demonstrated that with high levels of NPD resource, there is a strong positive effect of internal collaboration on new product performances as shown in Figure. 4.1. It is strongly supported by the study of Leenders & Wierenga (2008), they also claimed that the positive effect of internal collaboration between marketing and R&D is conditional upon certain factors, and that these factors have to be taken in to account when studying and managing the marketing and R&D interface. According to the author's results, the incremental levels of NPD resource with low internal collaboration do not effect new product performances. The result is also implied that NPD performances

with high level of internal collaboration is still very low in case of low NPD resource being used.

The results obtained from post-hoc are concluded that the measures used in NPD resource i.e. sophistication of R&D equipment, accessibility at research institutes, database and library facilities, contacts with universities, worldwide market information, top scientists, contact with top external specialists, cooperative R&D relationships, relationships with governmental bodies and knowledge of competitor can better explain the variance and provide strong evidence for the significance of the interaction between NPD resource and internal collaboration affecting towards new product performances compared with the measures used in R&D expenses, technological capital and human capacity as observed. Thus, Post-hoc 1 is chosen to be a primary research model to further evaluating the effect of moderator. However, the author's conclusion contradicts with the study of Zang & Wu (2017), which they claimed that technological capital and human capacity moderated with network power could properly explain new product success with strong evidence of significant coefficient.

According to the result analysis in Table 4.13, the interaction between NPD resource and internal collaboration used as moderator can better explain the variance of NPD performances than that of merely NPD resource due to greater R-square with $p < .01$ as observed in Table 4.15. As a results, resources utilization with internal collaboration applied throughout organization is directly related to new product performances and definitely essential for enhancing related performances as a whole.

5.2 Implications

Results obtained from this study have several implications for managers or directors in sales & marketing, R&D and product development and for consultants who are working on improving the new product performances of private firms especially in construction business. The primary managerial implication is that management people should not robotically think of increasing the internal collaboration between marketing and R&D in the case of unfortunate new product performances. Instead, there are specific criteria with respect to NPD resource that regulate what priority management should provide to enhancing the internal collaboration throughout organization. It would be

more advantage to utilize resources for achieving more internal collaboration including improved new product performances such as networking with top universities and scientists or establishing the relationship with governmental bodies in order to become more dominant in terms of NPD resource.

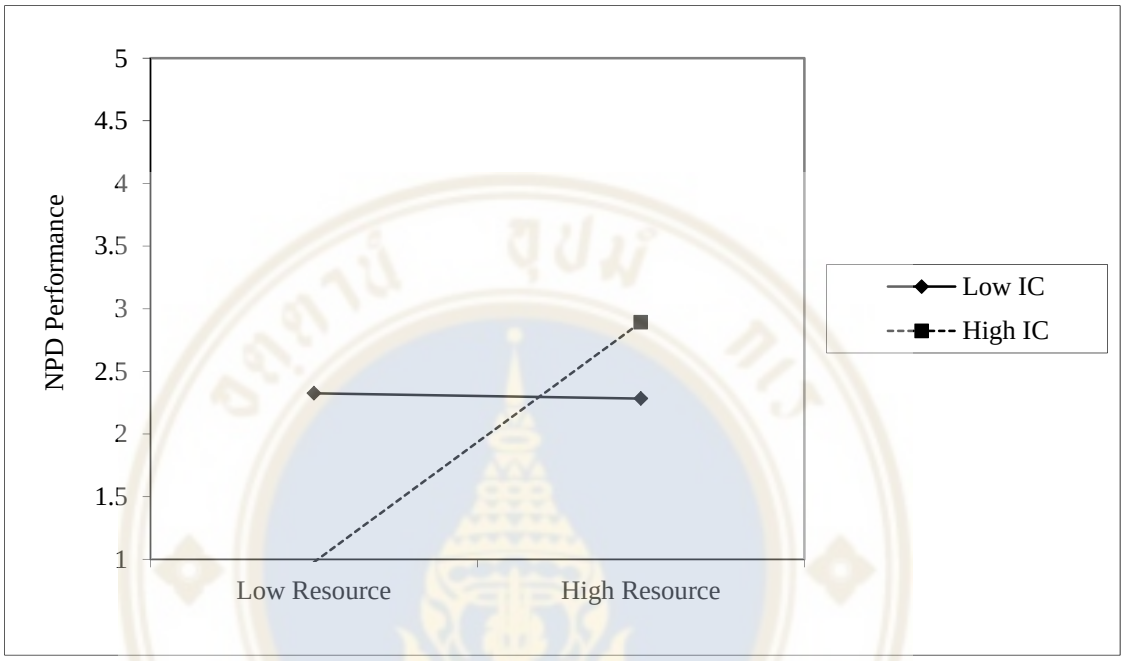

Figure 5.1 The relationship between NPD resource interacted with Internal collaboration and NPD performance

According to results obtained in Figure 5.1, the author is able to explicitly explain that whenever the company provides a high level of exploited resources, the greater level of internal collaboration should be effectively executed throughout the organization. However, the company should not motivate or support the incremental of internal collaboration in case of low resources exploited since NPD performance do not be significantly enhanced. This result seems sensible since when an organization has relatively low resource, it should have been utilized to develop new product, rather than collaborating among staffs. It is also implied that a small company with low exploited resources is more likely effective than a larger one with higher level of exploited resources in term of NPD performance, which might be explained in the reason of individualism and agile organization.

5.3 Limitations

The findings of this study need to be qualified by recognizing the limitations associated with the way it was conducted. The limitations must be identified in order to caution users about the manner in which the findings can be used shown as below. However, the limitations also provide opportunities for the future research discussed in next section.

1. The scope of study is limited in Siam Cement Group (SCG), Thailand especially concentrated in business of cement and construction materials, so the obtained results may not be applicable to other irrelevant businesses. Also, the studied model is very specific, which is based on industry-specific knowledge and cannot easily be experienced in a broad range of industries.

2. Environmental factors such as technological or economic turbulence are able to cause some influences, even among firms in the same industry but this research doesn't pay attention.

3. This study does not concern the costs of collaboration, which would give an investment perspective to the question of whether or not to track more internal collaboration.

5.4 Future Research

Several following implications for future research are derived directly from the limitations discussed above in order to enhance the generalizability and quality of the research results. Future studies are needed on the role of the marketing and R&D collaboration in affecting new product performances. Additionally, the objective taken in this study can be extended to different industries and countries. The effects on new product performance do not come from single factors, the combination of several single factors to be multiple factors used as independent variable or moderator is likely better explain the new product performances in advance perspective dimensions and its implications.

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APPENDICES

Appendix A: Questionnaire

Questionnaire: The Critical Role of Internal Marketing R&D Collaboration in Private Organization towards New Product Performances

Instruction: Please complete the following questions to reflect your opinions as accurately as possible.

Your information will be kept strictly confidential.

The questionnaire is divided into four part shown as followings:

- Part I: Personal information
- Part II: Measures of internal collaboration of marketing with R&D
- Part III: Measures of NPD resource
- Part IV: Measures of NPD performance

Part I: Personal Information

- Gender: ……. Age: …….
- Company's name: …….…….
- Division or Department: R&D or Marketing or …….
- Job's position: ……
- Working Experience: ……. years at SCG
- Workplace (Headquarter or factory's location): ……..

Part II: Measures of internal collaboration of marketing with R&D Internal collaboration of marketing with R&D

Internal collaboration of marketing with R&D	**Level of Agreement (1 = strongly disagree, 5 = strongly agree)**				
	1	**2**	**3**	**4**	**5**
1. A friendly attitude exists between R&D and marketing					
2. Open communication of relevant information occurs between R&D and marketing					

Internal collaboration of marketing with R&D	**Level of Agreement (1 = strongly disagree, 5 = strongly agree)**				
	1	**2**	**3**	**4**	**5**
3. R&D and marketing intentionally provide each other with misleading information					
4. R&D and marketing search for solutions that are agreeable to each other					
5. R&D and marketing are more like teammates than competitors					
6. If disagreements arise between them, R&D and marketing are usually able to resolve the disagreements					
7. R&D and marketing openly share their ideas with each other					
8. R&D and marketing help each other to more effectively perform their tasks					
9. R&D and marketing often fail to communicate information to each other					
10. R&D and marketing are always blaming each other for failures					
11. It is difficult for R&D and marketing to contact each other					
12. Conflicts between R&D and marketing are of a constructive kind					
13. R&D and marketing perceive their problems as mutual problems					
14. R&D and marketing recognize each other's talents and expertise					

Internal collaboration of marketing with R&D	**Level of Agreement (1 = strongly disagree, 5 = strongly agree)**				
	1	**2**	**3**	**4**	**5**
15. R&D and marketing share resources to complete tasks					

Co-creation activities between marketing and R&D

How do marketing and R&D team participate in the following activities	**Level of Agreement (1 = very superficially, 5 = very deeply)**				
	1	**2**	**3**	**4**	**5**
1. Idea generation					
2. Concept screening					
3. Product specification					
4. Business evaluation					
5. Product design					
6. Product engineering					
7. Prototyping					
8. Product testing					
9. Formation of cross-functional new product development team					
10. Controlling and monitoring of the development process					

Part III: Measures of NPD's resources

(1 = among the top 20% with the fewest resources, 5 = among the top 20% with the most consumed resources)

Measures of NPD's resources	Level of Agreement				
	1	2	3	4	5
1. Sophistication of R&D equipment					
2. Accessibility at research institutes					
3. Database and library facilities					
4. Contacts with universities					
5. Worldwide market information					
6. Top scientists					
7. Contact with top external specialists					
8. Cooperative R&D relationships					
9. Relationships with governmental bodies					
10. Knowledge of competitors					
R&D's expenses					
1. Your company had sufficient expenses for purchasing high technological equipment used in our research institute					
2. Your company had sufficient expense to cover all new product development's process, started from idea initiation to product's post-launched stage					
3. Your company had sufficient expenses for acquiring upcoming technology to contribute innovative products and shorten development's time as a whole					
4. Your company had sufficient budget to make a strong collaboration with external renowned academic researchers or world-class research institutes					
Technological capital					
5. Your company had sufficient engineering and manufacturing technologies for our product development					

Measures of NPD's resources	Level of Agreement				
	1	2	3	4	5
6. Your company had sufficient resources to develop technologies that help us develop new products and related processes					
7. Your company possessed a sufficient technological base for our product development					
Human capacity					
8. Our staffs in product development are widely considered the best in our industry					
9. Our staffs in product development are creative and bright					
10. Our staffs in product development are expert in their particular jobs and functions					
11. Our staffs in product development develop new ideas and knowledge					

Part IV: Measures of NPD's performances

(1 = among the top 20% with the worst performance, 5 = among the top 20% with the best performance)

Measures of NPD's performance	Level of Agreement				
	1	2	3	4	5
1. The achieve performance of the products that your company has been launched in the last five years in term of:					
• Cost to serve					
• Time to market					
• Sales (i.e. target sale, market share and sale growth)					
• Profitability					
• Business impact					
• Customer satisfaction					
• ROA, ROI					

Measures of NPD's performance	Level of Agreement				
	1	2	3	4	5
2. The number of new products launched in the last five years					
3. The number of breakthroughs in the last five years					
4. New products are successful in the last five years					
5. New products at your firm generally achieve its market share objectives.					
6. New products at your firm generally achieve its sales and customer use objectives.					
7. New products at your firm generally achieve its sales growth objectives.					
8. New products at your firm generally achieve its profit objectives.					
9. Your new products meets the performance objectives set for them.					
10. Overall, your new products are successful.					

Product innovation performance	Level of Agreement (1 = strongly disagree, 5 = strongly agree)				
	1	2	3	4	5
1. Sales relative to stated objectives					
2. Return on assets relative to stated objectives					
3. Return on investment related to stated objectives					
4. Profitability relative to stated objectives					

Market growth	**Level of Agreement (1 = strongly disagree, 5 = strongly agree)**				
	1	**2**	**3**	**4**	**5**
1. The growth rate of this industry in the past five years is very high					
2. The market demand in this industry is growing rapidly					
3. There are many potential customers in this industry to provide mass-marketing opportunities					

NPD speed	**Level of Intensity**				
	1	**2**	**3**	**4**	**5**
1. Far behind our time goals(1) – far ahead of our time goals(5)					
2. Slower than the industry norm(1) – faster than the industry norm(5)					
3. Much slower than we expected(1) – much faster than we expected(5)					
4. Slower than our typical product development time(1) – faster than our typical product development time(5)					