

**A MODEL FOR THE FUZZY FRONT END OF NEW PRODUCT DEVELOPMENT
PROCESS**

by

Md Nizam bin Abd Rahman

**Thesis submitted in fulfillment
of the requirements for the degree
of Master of Science**

January 2003

ACKNOWLEDGEMENTS

In the Name of Allah, the Most Beneficent, the Most Merciful. Praise to Allah who has given me the most precious gift, to be born as a Muslim. Praise to Prophet Muhammad s.a.w whose well I hope to drink from, in the Day of Judgment.

I would like to sincerely convey my greatest appreciation to Prof. Madya Mohd Razali Muhamad for all the coaching, guidance, and freedom he has given throughout the year. Most of all, thank you for giving the opportunity to work on the research topic that has deepened my believe in Al-Quran. One of the renounced researchers in the field of strategic planning stipulated that a perfect strategic plan should possess three characteristics, stable (relevant forever), supportable (people can performed the required actions), and clear (people can understand the message); and to him such a plan is impossible to exist. Such characteristics are the main features in the Al-Quran. My sincere appreciation also to Prof. Madya Dr Hj. Zainal Alimuddin bin Zainal Alauddin for the “chat” that convinced me to enroll as a Masters student in USM. To the librarians, thank you for making my “literature review phase” a pleasant experience.

Not forgetting heartiest appreciation to my personal support organization, my family, especially my parents. To my significant other, Liza Suryani, thank you for enduring the effects of my decision to be a full time student; to my children, thank you for not minding my spending more time with all of you.

Lastly, to the companies that participated in the case study and those who directly or indirectly contribute to the completion of this dissertation, I pray to Allah for your success in this world and hereafter. My hope is that this work will in someway contribute to the betterment of this world.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF ABBREVIATIONS

ABSTRAK

ABSTRACT

CHAPTER 1 INTRODUCTION

- 1.1 Background to the Problem
- 1.2 Objectives of the Research
- 1.3 Research Methodology
- 1.4 Significance of the Research

CHAPTER 2 LITERATURE REVIEW

- 2.1 Introduction
- 2.2 Strategic Planning
 - 2.2.1 Strategic planning hierarchy in corporations
 - 2.2.2 Corporate/business-level NPD strategic plan
 - 2.2.3 NPD functional-level Strategic Plan
 - 2.2.4 Summary of NPD Strategic Planning
- 2.3 Idea Generation
 - 2.3.1 Idea Generation Techniques
 - 2.3.2 Summary of NPD Idea Generation

CHAPTER 3 RESEARCH METHODOLOGY

- 3.1 Introduction
- 3.2 Establishing Benchmark Reference Data
 - 3.2.1 Strategic Planning
 - 3.2.2 Idea Generation
- 3.3 Comparing Benchmarked Strategic Planning and Idea Generation Process Against Selected Malaysia SMEs' Practices.

CHAPTER 4 ESTABLISHING BENCHMARK REFERENCE DATA

- 4.1 Introduction
- 4.2 Background of the companies
- 4.3 Product innovation classification.
- 4.4 Strategic Planning
 - 4.4.1 Presence of strategic planning outcomes
 - 4.4.2 NPD Strategy Drivers
 - 4.4.3 Influence of product classification and company size on the selection of strategy driver.
- 4.5 Idea generation techniques
 - 4.5.1 Factors influencing idea generation approach in soliciting market needs
 - 4.5.1.1 The influence of product innovation classification and company size
 - 4.5.1.2 Influence of strategy drivers and market segmentation
 - 4.5.2 Factors influencing idea generation approach in generating product concept

- 4.6 Proposed guidelines of Strategic Planning and Idea Generation techniques selection
 - 4.6.1 Guideline for NPD Strategic Planning Process
 - 4.6.2 Guideline for Idea Generation Process
- 4.7 Summary

CHAPTER 5 CASE STUDIES

- 5.1 Company A
 - 5.1.1 Company Background
 - 5.1.2 Strategic Planning
 - 5.1.3 Idea generation phase
 - 5.1.4 Current situation
 - 5.1.5 Future Plan
 - 5.1.6 Discussion
- 5.2 Company B
 - 5.2.1 Background
 - 5.2.2 Strategic Planning
 - 5.2.3 Idea generation

5.2.4 Current Situation and Future Plan

5.2.5 Discussion

5.3 Company C

5.3.1 Background

5.3.2 Strategic Planning

5.3.3 Idea Generation

5.3.4 Current Situations and Future Plans

5.3.5 Discussions

5.4 Summary

CHAPTER 6 CONCLUSIONS

REFERENCES

APPENDICES

APPENDIX A: PROCESS FLOW DIAGRAM NOMENCLATURES

APPEDDIX B: INTERVIEW: QUESTIONNAIRES FOR LOCAL SME

PUBLICATION LIST

LIST OF TABLES AND FIGURES

Table 2.1: Idea generation techniques and their objectives

Table 3.3: MITI definition of Small and Medium Enterprise

Table 4.1: Background information of the thirty companies

Table 4.2 European Union definition of SMEs

Table 4.3: Strategic Planning outcomes of the benchmarked companies

Table 4.4: Examples of Radical Product Innovation Originated from Market Needs

Table 4.5: Idea generation techniques to solicit market needs and the corresponding targeted market segments

Table 4.6: Idea generation techniques with the corresponding intended benefits of the new products.

Table 4.7: Matrix showing the relationship between idea generation techniques and product benefits

Table 5.1: Summary of comparative study between local SME companies' strategic planning and idea generation practices against the proposed model

Figure 1.1: Overall approach of the research work

Figure 2.1: NPD Process Methodology Evolution (Crawford, 1997)

Figure 2.2: Single business company: The typical three level strategy

Figure 2.3: NPD strategic planning process flow diagram

Figure 2.4: Idea generation process flow diagram

Figure 4.1: Product classification of the benchmarked companies

Figure 4.2: Relationship between the size company and the type of product innovation

Figure 4.3: Strategy driver classification of the benchmarked companies

Figure 4.4: Influence of company size to either technology or dual strategy selection

Figure 4.5: Relationship between product innovation categories and strategy drivers

Figure 4.6: Influence of product innovation classification to the idea generation technique to solicit market needs

Figure 4.7: Comparison of idea generation techniques based on company size

Figure 4.8: Idea generation Techniques to Solicit Market Needs

Figure 4.9: The Influence of Product Innovation Classification on the Idea Generation Techniques

Figure 4.10: Relationship between company size and idea generation techniques.

Figure 4.11 Flow chart of the proposed strategic planning process

Figure 4.12: Flow chart of the proposed strategic planning process.

Figure 5.1 Company A's Product Roadmap

Figure 5.2 Company A revenue forecast based on financial analysis

Figure 5.3: Company A's current revenue forecast.

Figure 5.4: Company A's strategic planning process

Figure 5.5 Company A's idea generation process flow

Figure 5.6: Company B's Strategic Planning Process

Figure 5.7: Company B Idea Generation Process

Figure 5.8: Company C's strategic planning process

Figure 5.9: Company C's Idea Generation Process

LIST OF ABBREVIATIONS

- NPD : New Product Development**
- SME : Small and Medium Enterprise**
- ROC : Return of Capital**
- PIC : Product Innovation Charter**
- MITI : Ministry of International Trade and Industry**
- EU : European Union**
- EUC : European Union Currency**
- DFE : Design for Environment**
- RM : Ringgit Malaysia**
- ROI : Return on Investment**
- IT : Information Technology**

MODEL UNTUK PERINGKAT HADAPAN PEMBANGUNAN PRODUK BARU YANG KABUR

ABSTRAK

Secara umumnya, metodologi Pembangunan Produk Baru (PPB) boleh di pecahkan kepada lima fasa iaitu perancangan strategik, penjanaan idea, penilaian pra-teknikal, pembangunan teknikal, and pengkomersilan. Tiga fasa pertama dikenali juga sebagai peringkat hadapan metodologi PPB dan dua fasa terakhir dikenali sebagai peringkat belakang metodologi tersebut. Skop penyelidikan ini tertumpu kepada dua fasa yang pertama iaitu perancangan strategik, dan penjanaan idea. Objektif kajian ini adalah untuk 1) menyusun langkah-langkah yang perlu dibuat dalam melaksanakan perancangan strategik PPB supaya ianya efektif, dan 2) menentukan garis panduan dalam memilih teknik penjanaan idea yang sesuai untuk sesuatu keadaan. Analisis kes terhadap tiga puluh syarikat yang telah terbukti berjaya didalam program PPB telah di lakukan untuk mengesahkan faktor-faktor yang penting dalam memastikan keberkesanan perancangan strategik PPB dan untuk menentukan garis panduan dalam memilih teknik penjanaan idea yang sesuai. Hasil daripada perancangan strategik PPB yang baik adalah pengenalpastian segmen pasaran dan segmen produk yang disasarkan, teknologi atau keupayaan dalaman, dan sasaran kewangan dan tempoh masa. Proses penjanaan idea boleh di pecahkan kepada dua bahagian iaitu, proses untuk mendapatkan maklumat tentang kehendak pasaran and proses untuk membangunkan konsep produk. Faktor utama dalam pemilihan teknik penjanaan idea untuk menentukan kehendak pasaran adalah jenis pasaran sasaran itu sendiri; dan faktor utama dalam menentukan pemilihan teknik penjanaan idea untuk membangunkan konsep produk ialah “manfaat produk yang diharapkan”. Berasaskan penemuan-penemuan

tersebut, model untuk perancangan strategik dan proses penjanaan idea PPB telah di bangunkan. Kajian perbandingan di antara model yang telah dicadangkan dan amalan Pembangunan Produk Baru oleh tiga syarikat kecil dan sederhana tempatan telah di jalankan. Keputusan yang diperolehi menunjukkan model yang dicadangkan bersesuaian dengan amalan PPB oleh syarikat-syarikat tempatan berkenaan.

ABSTRACT

In general, New Product Development (NPD) methodology can be broken down into five phases, *Strategic Planning*, *Idea Generation*, *Pretechnical Evaluation*, *Technical Development*, and *Commercialization*. The first three steps are known as the front end and the last two are known as the back-end of the NPD methodology. The scope of this research work is limited to the first two steps of the NPD methodology, which are strategic planning and idea generation. The objectives of this research work are 1) to piece together the various steps required in executing strategic planning process to ensure its effectiveness and 2) to define guidelines in selecting idea generation techniques that are suitable for a given set of conditions. Through analyzing case studies on thirty companies that have been proven successful in NPD programs, the main factors that have significant impact on the success of NPD strategic planning process are verified and guidelines for selecting suitable idea generation techniques for a given set of conditions are developed. The main outcomes of a well executed strategic planning process are the identifications of the targeted market and product segmentations, the internal technology or capability strategy, and the financial and timeline targets. The idea generation process indicates that the idea generation process can be divided into two steps, the solicitation of market needs and the development of product concept. The main factor influencing the selection of idea generation technique to solicit market needs is market segmentation; and the main factor influencing the selection of idea generation technique to develop product concept is “the intended benefit of the product”. Based on these findings, a proposed NPD strategic planning and idea generation process models were developed. A comparison between the proposed process model and the NPD practice of local small and medium enterprises was

conducted. The results indicate that the proposed strategic planning and idea generation models are applicable to the local SME companies.

CHAPTER 1

INTRODUCTION

1.1 Background to the Problem

For many years industries in Malaysia had been focusing on operational efficiencies so that they can reduce cost, increase productivity, improve quality, and shorten the time to market in order to remain competitive in the global market. The bottom line objective of the operational efficiency drives is low product cost. The assumption is, product of lowest cost will be the product of choice among its rivals. There is no denying of the importance of operational efficiency for the survival of a company. However, as Malaysia develops, labor cost increases and at some stage diminishing return in operational efficiencies investment will occur. At this stage the resources put in to improve operational efficiencies can't offset the increase in labor cost anymore. To worsen the situation is a stiffer cost competition from new emerging low cost countries like China. As a result, many Malaysian companies have already lost the "price war" to China.

The question that Malaysian companies must answer is, "If we can not win the price war, can we escape it?" Many companies in developed nations such as Japan and United States, asked the same question years ago because they were facing similar issue, i.e., high labor cost. And many of them had already figured out the answer, that is why they still survive and in fact become market leader in their respective fields. This answer was echoed by Andrew Serwer (1994) in Fortune magazine. He stated that the primary answer to "How to escape price war" is *product innovation*. Not surprisingly, this is also aligned to the sixth challenge of Malaysian Vision 2020, "establishing a scientific and

progressive society, a society that is innovative and forward-looking, one that is not only a consumer of technology but also a contributor to the scientific and technological civilization of the future”.

For their long term survival and in support of Malaysian Vision 2020, it is imperative for local companies to start allocating their resources in pursuit of product innovation activities rather than only focusing on operational efficiencies. The benefits of this strategy is exemplified in a study done on Europe’s most dynamic entrepreneurs (Thackara, 1997), Europe’s 500. These companies grew by an average of 21 percent per annum and increased in employment levels by almost 160 percent during a recession period (early 1990s) when the number of jobs in the economy fell. When compared to their competitors, the majority of Europe’s 500 companies emphasized on product differentiation rather than cost in their strategies – in marked contrast to the strategies pursued by their competitors- cost leadership. Product differentiation can only be achieved through innovation.

Embracing product innovation as a company strategy is not an easy task and not without risk. Companies have to deal with new complexities in running their business, initial investment on resources needed to carry out the development activities has to be allocated and decisions made during the development phase have to be done with far less information than desired. In addition, the reported failure rate of new products is high. The failure rate often quoted in the press is 90%, research reports put it at 40%, and sometime claimed by the companies 10% (Crawford, 1997). All these will shift the companies from their comfort zones. To manage those risks, researchers and practitioners in the field of New Product Development (NPD), have already and still are developing

methodology to best execute this activity. Many companies that are successful through product innovation have already established internal NDP programs that are proven. For companies that are at the beginning stage of their journey into NPD activities, there are a lot of case studies and examples available that will give them some guidance on what to look out for.

In general the NPD activities can be broken down into five steps. They are Strategic Planning, Concept Generation, Pretechnical Evaluation, Technical Development, and Commercialization (Crawford, 1997).

Strategic planning phase is essentially to ground the NPD team of its missions and objectives. The team needs to address crisply what their focus, goals and boundary conditions would be. And this information can be documented in the form of charter document and sometimes being referred to as Product Innovation Charter (PIC).

Concept Generation phase is when the team defines the problem that they are trying to address and the hopeful solutions. Usually the end results of this activity are pools of interesting ideas and concepts.

Pretechnical Evaluation phase is when the team screens the pool of concepts by answering the intended buyers' questions; what is the product's purpose and is the benefits worth the price. This is the first step to confirm if the concept or ideas can be turned into a quality product.

Technical Development phase is when the ideas or concepts are turned into a tangible product, marketing plan is firmed up, and evaluations are conducted at various stages (prototype, end user product test, etc). By the end of this phase the

team needs to be sure that the new product does solve the problem the team defined at the concept generating phase.

Commercialization phase is the time where the firm decides to market the products. This decision will initiate the capital spending needed to ramp up production, marketing the products, and selling the product.

The five phases described above do not happen sequentially, but overlapping of each other. The first three stages constitute what is popularly called the *fuzzy front end* (Crawford, 1997). During these phases the product concept is fuzzy and hopefully most of the fuzz would have been removed after *pretechnical evaluation* phase.

Most of the practitioners in New Product Development are adopting the widely practiced Cooper's NPD methodology (Adcock, 2000). However, Cooper's stage-gate approach (Cooper, 1990) does not deal with the strategic planning and idea generation stages of the NPD Methodology. Recent studies indicate that successful innovation program is attributed to the front-end process of the new product innovation process. A benchmark project by Miller (1998) was carried out to study sixteen major industrial products, involving more than 40 NPD professionals and executives from 22 business units and corporate development group, to understand why some companies succeed and others fail at internal NPD. This study revealed that techniques to manage effectively the *front end* NPD process is a key factor for successful product innovation that in turn delivered significant new business. Study by Dooley, Subra, and Anderson (2002) on 39 companies indicates that little attention given to the front end of NPD process, despite a strong call in the management literature. This front-end process steps are strategic planning, idea

generation, and pretechnical evaluation stages. Since Cooper's thirteen NPD process step methodology does not cover strategic planning and idea generation process, the scope of this research project will only focus on the two steps of the front end NPD process, strategic planning and idea generation.

1.2 Objectives of the Research

The objective of this research work is to propose guidelines for local SME companies on how to perform NPD strategic planning and idea generation process. To accomplish this, the critical elements that must exist in strategic planning process to ensure its effectiveness and the influencing factors that should be considered when selecting idea generation techniques have to be defined. The other objective of this study is to assess if the proposed guidelines are applicable to local SME companies.

1.3 Research Methodology

The qualitative research method has been adopted as an overall paradigm for this study. This approach is also termed as constructive approach (Lincoln, 1985) or interpretative approach (Smith, 1983). Throughout this research work the author follows the inductive qualitative research methodology, that is to gather information, ask questions, form categories, look for patterns, and develop theories or compares pattern with other theories (Creswell, 1995).

There are two stages in this research work. The first stage is to define a proven conditions that must exist in ensuring successful strategic planning and factors behind

selecting idea generation techniques that resulted in successful NPD program . The second stage is to use the conditions and process identified as a benchmark against which selected Malaysia SMEs' practices in NPD will be compared. At both stages, case studies of companies that are involved in NPD activity are analyzed. The use of case study method for this research is supported by Yin (1994), who claimed that case studies is a qualitative research method and best suited for "how" and "why" research questions when the researcher has no control over behavioral events and wants to focus on contemporary events.

The overall approach of this research is reflected by Figure 1.1, where initially literature review on the NPD strategic planning and idea generation approached are carried out. The next step is to establish the benchmark reference data based on the practices of thirty proven successful companies. The last step of the study is to compare practices of three local companies to that of the benchmark reference data. More detail explanation on this approach is discussed in chapter three.

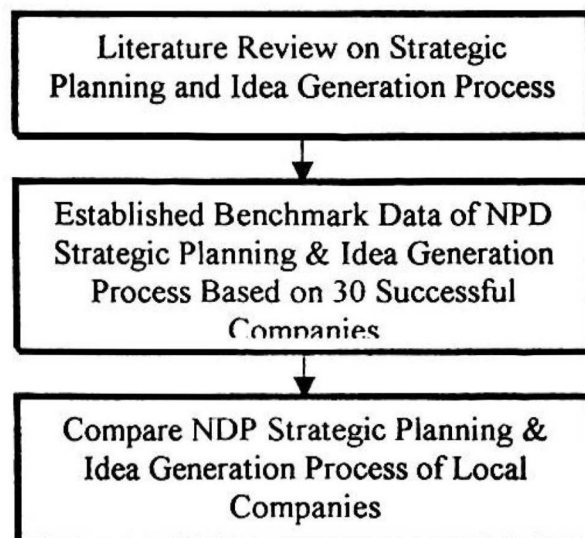


Figure 1.1: Overall approach of the research work

1.4 Significance of the Research

During a correspondence with an expatriate who is also the General Manager of a local major telecommunication company, he said that “ Malaysia has plenty product design and manufacturing talent, the problem is the shortage in product owners. Unless you have an inflated government contract or official monopoly, being a contract manufacturing have very low profit margin”. As a contract manufacture, not only the profit margin is low, the company is also at the mercy of the product owner. The product owner can move the manufacturing of the product somewhere else. With the emergence of low labor cost country on world manufacturing map such as China, trend can be seen in lower capital investment by multinational companies in Malaysia especially in electronic manufacturing sector. Statistics published by MITI indicated sharp decline in foreign investment application in this sector; up to September 2002 only 2.9 billion RM worth of capital investment application was received compared to 7.3 billion RM in 2001.

In order to increase profit margin and reduce the dependency on foreign companies, local companies have to be the product owners. To be a product owner, local companies have to involve in design and development of products. This approach is expected to ensure sustainable economic well being of the local companies and the nation in the long run. In line with this argument and also with the sixth challenge of Malaysian Vision 2020, this research work is to establish guideline of the front-end of the NPD activity for Malaysia companies, especially SMEs, that are embarking into or already embracing new product development activity.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter looks into the current practice of NPD strategic planning and idea generation process adopted by the practitioners and researchers. Based on the information available, the author summarized the strategic planning and idea generation practices in a form of process flow diagrams.

2.2 Strategic Planning

Strategic planning is a collection of planning activities to support company's vision, implemented throughout the entire organizational levels within the company. The outcome of this activity would be missions, objectives, and strategies from the different organizational levels that support corporate vision (Thompson, 1999). Thompson and Strickland (1999) said that every manager has a strategy making and strategy implementing role for the area he or she supervises. Managers farther down the hierarchy have a narrower, more specific strategy making/implementing role than the manager close to the top.

As shown in Figure 2.1, initially, strategic planning and idea generation were not part of NPD process methodology. As the methodology evolves, practitioners and researchers started to realize the importance of the upstream process which significantly affecting the end product. With that realization pre-technical evaluation, idea generation,

and strategic planning phases were added as part of the NPD methodology. Hence, today's more widely accepted NPD process model begins with strategic planning.

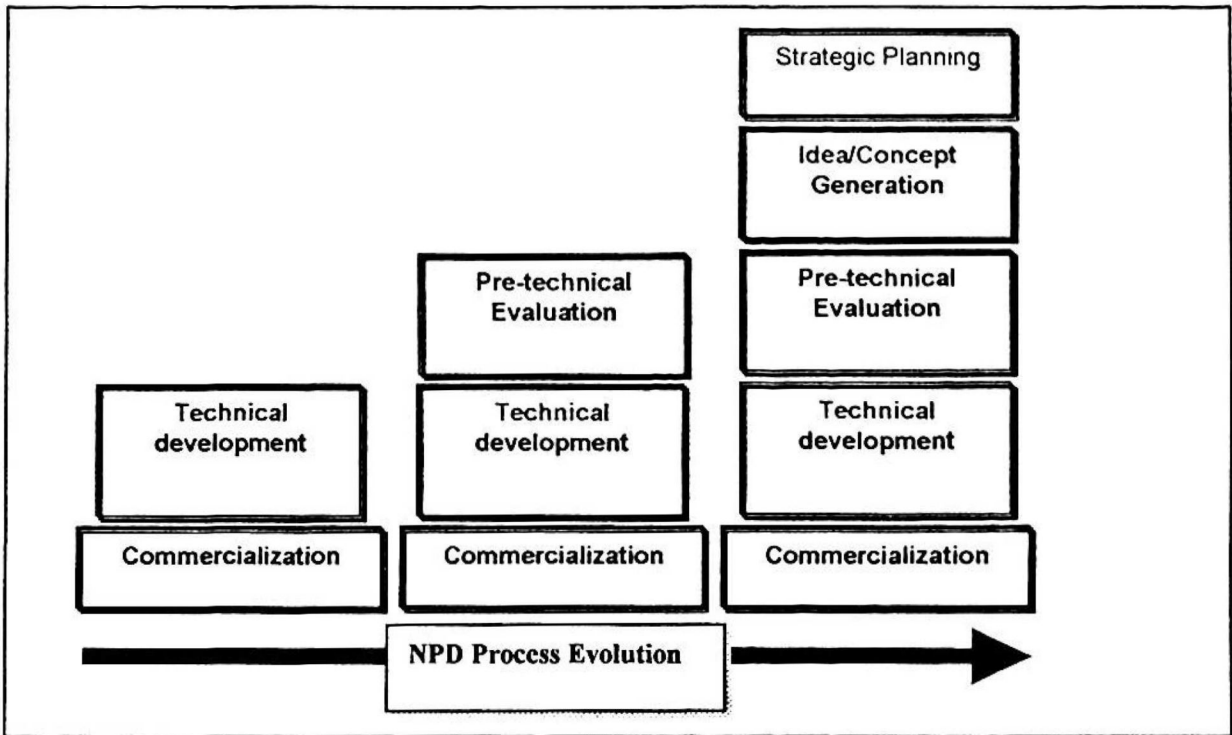


Figure 2.1 NPD Process Methodology Evolution (Crawford, 1997)

A recent study showed that firms that have a good record in the development and commercialization of new products are more likely to have well balanced corporate strategy with long-term innovation focus (Crawford, 1997). Long-term innovation focus can only be achieved if top management is serious enough in making it as part of the corporate strategy. In order for the strategy to be effective, it must be clear, supported by others in the organization, and stable (Hamel, 1989). This indicates that the strategy must come from top management and be supported by the organization. The management must

be committed in supporting this program in the long run because the success will not happen overnight.

To further understand the NPD strategic planning process, the understanding of the strategic planning hierarchy in a typical company and in-depth discussion on NPD strategic planning at corporate/business and functional-level are necessary. This discussion covers the factors to be considered in forming up NPD strategy, the importance of synergy among multi-level strategy within a firm, and what end result should be expected from each planning stage.

2.2.1 Strategic planning hierarchy in corporations

As mentioned before, every manager has strategy making and strategy implementing roles for the area he or she supervises. Manager farther down the hierarchy has a narrower, more specific strategy making/implementing role than the manager closer to the top. For a diversified company, there are four levels of strategy and for a single business company there are only three levels (Thompson, 1999).

There is a strategy for the company and all of its business as a whole (corporate strategy); a strategy for each separate business units (business strategy); a strategy for specific functional units (e.g. production, marketing, finance, R&D) within a business (functional strategy); and finally a strategy for basic operational units that exist within the functional area (operating strategy), as shown in Figure 2.2. For a single business company corporate and business strategies are the same. To simplify future discussion, this report will treat corporate and business strategy as one.

NPD strategy falls under functional strategy and it must be aligned with the corporate and business strategy. The process of defining the strategy among the corporate,

business, functional, and operational groups are both top-down and bottom-up process. This is where synergy among the strategic plans is ensured throughout the organization.

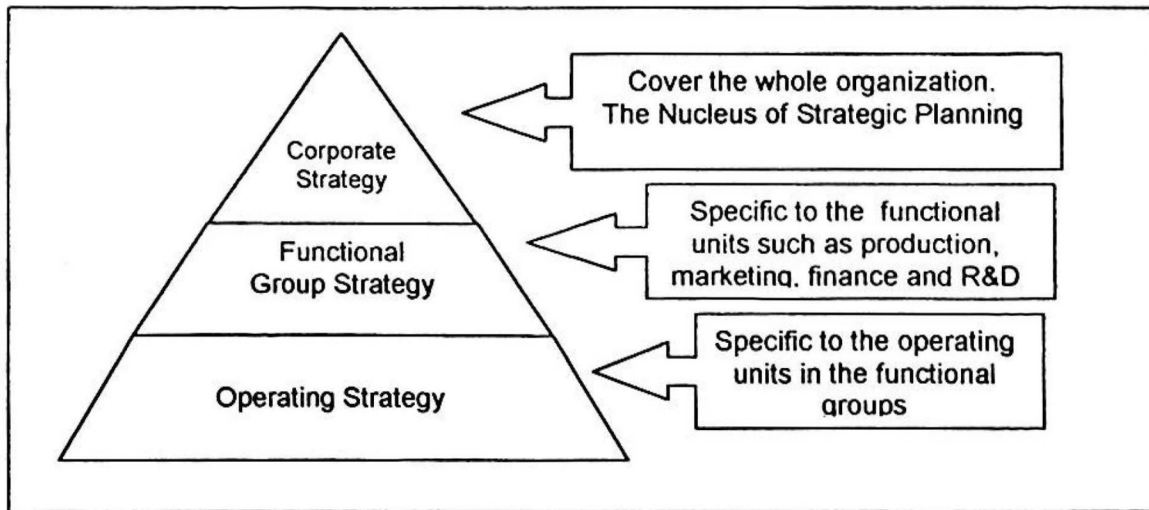


Figure 2.2: A typical three level strategy for single business company (Thompson, 1999)

2.2.2 Corporate/business-level NPD strategic plan

Hamel and Prahalad (1994) presented arguments that management must build vision of the future of the industry and then act to maximize the company's ability to respond to changes in the industry. Management must answer questions about what customers it will serve, the future competitive environment, the technologies that are likely to be winners and the company's basis for competitive advantage. All these fundamental strategies need to come from top managements and not from middle managers. These are elements that constitute a corporate /business strategic plan.

Researchers and practitioners of this field have offered many variations of what is to be considered during the creation of NPD strategic plan at corporate/business level (Crawford, 1997; Miller, 1999; Thompson, 1999). However, there exist prevalent

commonalities that can be used as guidelines in crafting this plan. The major outcomes that are expected out of corporate/business strategic planning that are of particular interest to the NPD groups are financial and timeline strategy (Sower, 1985), product strategies for segments on the operations and it can be in the form of Business Priority Matrix (Tregoe, 1989), and specific technology base strategy for every product. Financial analysis will give boundary conditions on the profit target, acceptable pay back period, and time line when the products have to be in the market. Business Priority Matrix will spell out the set of choices of what product and markets the company will be focusing on. Technology base strategy will specify the company's technical competitive advantage that can help the company to be ahead of its rival

a) Financial and timeline strategy

The bottom line objective of a company is to create profit for the benefit of its owner and shareholders. Without adequate profitability, a company's pursuit of its visions, as well as its long-term health and ultimate survival is jeopardized. In line with that, financial analysis, also called "profit gap analysis" need to be performed (Sower, 1985). This can be performed by looking at the projected profits the company is going to make based on existing products, taking into account product lifecycle, market-trend, and likely investment. This projection is compared against reasonable desired profit trend that the shareholders or owner of the company would like to see. The profit target trend tends to be a judgmental decision based on Return on Capital (ROC) and resource levels in a particular company. The gap in desired profits and profit target can now be used as a guide on how many new products should be developed and when, the minimum profit level that

is necessary to make the effort worthwhile, and the maximum acceptable pay back period. This can be the basic time frame baseline for the company's product roadmap, what product to be introduced and when.

b) Product Strategy and Technology Base Strategy.

Decisions on "what product and market" and "which technology strategy will be pursued" are interrelated. The idea is to use company technological strength in pursuing new product opportunity in a new market. To reach this decision, the management has to understand the company's microenvironment and macroenvironment (Thompson, 1999).

Microenvironment analysis will analyze the company's internal resources strength and weakness. Areas of strength should be utilized and areas of major limitation should be used to mark the boundary. Recent research has shown that successful NPD projects are associated with quality performance either in technology, marketing, production, or financial resource (Miller, 1998). Thus critical evaluation of strength and weakness of resource and skill should be made in these areas to give a good picture of company's capabilities. Ideally the new product should offer an advantage that comes from technological strength of the firm where a technical accomplishment permits new product for which there was not, up to that point, any expressed desire from the market place. This technological strength is not only related to research laboratory. A technology is a system or set of people and things that permit work. A soft drink bottling plant, small-order-handling system, and engineering design capability are examples of technology. This analysis should be able to indicate the choices of a company's technical competitive

advantages and also the boundary conditions with respect to internal resource capabilities, to be utilized as part of the NPD strategy.

Macroenvironment analysis will look at external factors that might have impact on the company well being. They include industry environmental scan and the competitive condition with respect to other competitors within the same industry. After performing this analysis the team must have a clear fix on the key industry traits, the intensity of the competition, the drivers of industry change, the market position and strategies of rival companies, the key for the competitive success, and the industry's future profit outlook. This evaluation does not only guide the company to its selection of markets. Coupled with results from internal resources strength and weakness, it should become clear whether to search for new markets for existing product, or to developed new market for existing product, or to develop new product for existing market, or to diversify with new product in new market.

The product strategy can be predominantly influenced by either market situation or company's technological leadership position. This is dependent on the finding during the macro and micro economic analyses. If the market situation influences the decision, it is termed "market driven strategy" and if the company's technological leadership influences the strategy, it is termed "technology driven strategy" (Crawford, 1997). However more and more research findings indicate the balanced strategy of dual drives is clearly the winner (Cooper, 1984). This means that in forming those strategies, both market and internal technological leadership should be considered.

2.2.3 NPD Functional-level Strategic Plan

Once the corporate and business strategic plan has defined the “ playing field” in terms of profit target, acceptable pay back period, time line, future product and market focus, and technology base strategy, the NPD group can start the front-end NPD process. The first step is to define a group strategic plan.

Researchers and practitioners in this field describe this process with different names and forms, but the intentions and ideas behind them are the same. Lynn and Akgun (2001) call it project vision, Crawford(1997) refers to it as Product Innovation Charter (PIC), and Miller (1999) refers to it as NPD Intent. The purpose of this NPD team strategic plan is to translate the strategic goals into product and market specific guidelines to guide NPD process for the organization, and this guideline must be in written form because “secret strategy that exist only in the minds of few leaders will not do much good for a team of thirty” (Thompson, 1999). The following discussion will cover two aspects of this strategic plan, the first part is the source of information and the second is what it should be comprised of.

a) Source of information for NPD Strategic Plan

Miller (1999) and Crawford (1997) both agreed that NPD Intent and PIC must be derived from corporate/business strategic plan, which should be the main reference source. Alignment between NPD group strategic plan and corporate/business strategic plan is very critical in ensuring the success of the NPD efforts. Based on a study done on sixteen major

industrial products, involving more than 40 NPD professionals and executives from 22 business units and corporate development groups, linking the NPD process to overall business strategy was one of the main factors for successful NPD (Miller, 1998). Nine of the sixteen companies participating in that study concluded that steady flows of ideas has little value if the business proposition derived from these ideas is not of strategic interest. The management team must be able to articulate the business/corporate strategy so that the NPD community can support the strategy and idea generators will know where to apply their creative talents. This result is also consistent with findings from the research done by Khurana and Rosenthal (1998), who observed that companies that were more successful in their approach in the front end of NPD process were able to link business strategy to the NPD process.

Although Crawford supports the idea of corporate/business plan to be the main source of PIC formation, other sources are also suggested. These other sources can be from new opportunities arising from external changes in the industry detected by the marketing people, internal ideas from employees, or top management pet projects. Research done on 90 NPD projects not linking to corporate/business plan (formal, under-the-table, and pet projects) across many different business units in a large diversified European technology manufacturer reveals that performance difference among them are muddled because they are not used in targeted ways, and because linkages among them are missing (Loch, 2000). Aside from this study, very little, if any, research has been done to investigate performance of projects initiated through non-strategic plan compared to the positive correlation between performance and synergy between NPD strategy and corporate/business strategy. However there are few success stories documented on the

success of such project such as Sony Walkman and Calvin Kline unisex scent (Crawford, 1997).

As mentioned earlier, the strategic planning process does allow top-down and bottom-up information flow. This flexibility can be utilized to maintain synergy throughout the planning hierarchy for those projects that do not originate from corporate/business strategy.

b) End Result of NPD Functional-level Strategic Plan

The objective of this planning stage is to translate the strategic goals into product and market specific guidelines to guide the NPD process. This guidance is critical for the front end of NPD activities when information on specific opportunities is minimal. This guideline should chart group direction, where it must and must not go; it tells the group its goals and objectives, why it exist, what its role is , what its purpose is; and it tells the group how it will play the game, what are the rules, time line, cost constraints and a host of miscellaneous things (Crawford, 1997). This is aligned with the Strategy-Making Pyramid network defined by Thompson and Strickland (1999). At the functional-level, a strategic plan must consist of missions, objectives, and strategies.

Once the plan is completed, it must be presented and sanctioned by the management. This again, is to ensure synergy. The documents should be available and communicated to the team that is going to perform the next step of the NPD process, which is Idea Generation. At this stage the team should have a clear picture of the team mission: which market segmentation should be targeted, what product segmentation should be focused on, what internal technology strategy to be utilized, and other specific deliverables

such as timeline and cost target. By having these guidelines spelled out before concept generation, screening, and development stages start, improvement in efficiencies and speed of the NPD projects could be expected. The guidelines should have explicitly defined areas where “not to look” thus reducing the likelihood that the team will wander and wastefully burn limited NPD resources.

2.2.4 Summary of NPD Strategic Planning Process

Based on the literature review discussed previously, the framework for the NPD strategic planning process can be illustrated by a process flow diagram shown in Figure 2.3. The boxes use the conventional nomenclature of flowchart diagram construction (see Appendix A). Firstly, the senior managers have to conduct financial, macroeconomics, and microeconomics analyses as part of corporate review process. Based on the outcome of the analyses the senior managers of company will then decide on the overall strategy driver to pursue new products. These strategies can be “technology driven”, “market driven”, or a combination of the two. The next step is for the senior managers to formulate the outcomes of corporate strategy, which are target market and product segmentation, internal capability/technology strategy, and financial and timeline guidelines. The outcomes of corporate strategy will be used as guidance and boundary conditions for NPD team to define their strategy in the form of either NPD Intent, Product Innovation Charter, or Product Vision.

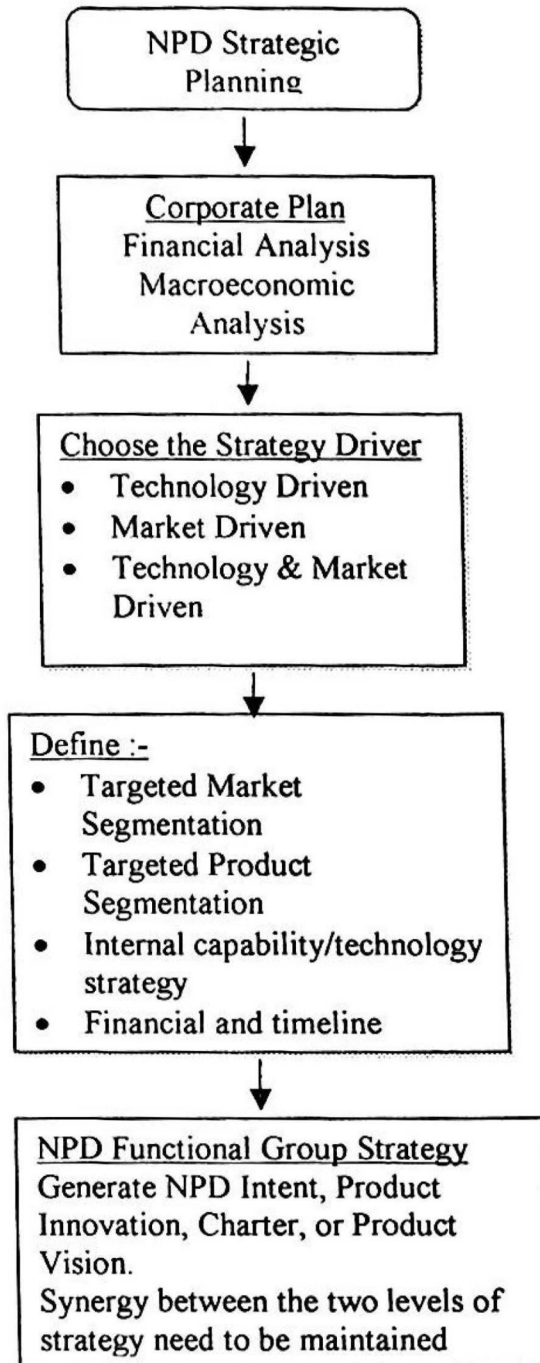


Figure 2.3: NPD strategic planning process flow diagram

2.3 Idea Generation

Idea generation process, also known as concept generation or ideation, is an act by which new product concepts or ideas are created (Crawford, 1997). In order to improve the probability for the new product to be accepted in the marketplace, this act must be balanced both in structure and in creativity (Corsi & Sacchi, 2002). While creativity has to do mainly with the doers, the structure is mostly to do with the process. This review will focus on the structure or process of the act to generate ideas.

Idea generation is perhaps the most difficult and yet an important step in the NPD process. Without it subsequent steps cannot take place smoothly. The effectiveness of the subsequent steps is obviously dependent on the quantity and the quality of product ideas discovered during this phase. Studies show that new product ideas attrition rates are very high. Study on success/failure that have been cited in all new product literature since World War II indicated that 25% of all industrial products and 30%-35% of consumer products failed in the market place (Sower, 1985). The large numbers of ideas that are required to find one successful product suggest that to become a successful developer of new products, one must first become a successful developer of new ideas.

The expected outcome of this phase is new product concept statements. A product concept statement must consist of three components namely, form, technology, and benefit. It is a verbal and/or prototype expression that tells what is going to be changed and how the customer stands to gain. The statement can be put together this way: *Technology permits us to develop a form that provides the benefits.* If any of these three is

missing, there cannot be product innovation (Crawford, 1997). Concept statement will greatly facilitate the next stage of NPD process, concept /idea screening.

In idea generation phase one pitfall that the team should look out for is the bias of preconceived solutions. They are engineers' ideas of what the product should do, not the customer's. Another pitfall is the creation of ideas within a vacuum of the team experience. With a number of members, a product development team can generate a large number of ideas and solutions from their experience. This number, however, does not compare favorably to the vast array of solutions that are possible from the knowledge contained in the history of humankind. The team must avoid the psychology that a much better solution is around the corner, if we have extra knowledge and insight. In order to minimize the chance of getting trapped in these pitfalls, various idea generation methodologies have been developed.

2.3.1 Idea Generation Techniques

Crawford (1997) categorizes idea generation techniques into two general approaches. One approach is through seeking ready-made ideas and the other through a process run by the NPD team. Most firms use both approaches, but in each industry it is a common knowledge which one has better batting average. Food manufacturers usually will not even read new product suggestion sent by consumers. They have more than enough concepts of their own. Yet, in some other industry such as toys and tools, inventors thrive. There are even inventors' fairs, where inventors are invited to display their innovations. Manufacturer of scientific instrument and plant processing equipment report the majority of their successful new products came originally from customers. In

contrast, manufacturers of engineering polymers and of chemical additives for plastic report no projects coming from customer. On the other hand, Sower (1985) used a different set of classification from Crawford. However there are similarities in the techniques described by both researchers. Some of the idea generation techniques available through literature search are listed as shown in Table 2.1 (Sower, 1985; Fiskel & Wapman, 1994; Crawford, 1997; and Myun, 2001).

Table 2.1: Idea generation techniques and their objectives (Compiled from Sower, 1985; Fiskel & Wapman, 1994; Crawford, 1997, and Myun, 2001).

Idea Generation Techniques	Objectives
Traveling abroad	To define Product Concept
Examine Foreign Literature	To define Product Concept
Employing freelance scouts	To define Product Concept
Information from subsidiary companies	To define Product Concept
Repertory grid techniques	To solicit market needs
St James Model	To solicit market needs
Company suggestion scheme	To define Product Concept
R&D staff working on their own initiatives	To define Product Concept
Invention Group	To define Product Concept
Think tanks	To define Product Concept
Circulation Sheets	To define Product Concept
Lead user	To solicit market needs & To define Product Concept
High Touch	To solicit market needs & To define Product Concept
Scenario analysis	To define Product Concept
Design for Environment	To define Product Concept
University Research	To define Product Concept

Crawford (1997) suggested that idea generation consists of two parts, the first one is to solicit market needs and the second part is to define product concept to address the market needs. Based on Crawford's suggestion and also observation after going through various idea generation techniques available in the literature, the idea generations techniques are developed to achieve one or both of these objectives: to solicit market needs and to define product concepts. The second column of Table 2.1 shows the objectives associated with the respective idea generation techniques. To further illustrate these associations, listed below are some examples of idea generation techniques and the expected outcome.

i. Traveling abroad

Experienced and creative company representatives travel abroad for a planned tours visiting stores or exhibitions. The purposes of these visits are: to look for established product available overseas that can be launched directly into home market and to stimulate new product ideas through looking at products in a new environment. Minnetoka executives got the idea of pump toothpaste while browsing in a West German supermarket.

ii. Information from subsidiaries

Companies with foreign subsidiaries can establish a system to report new products to each subsidiary and also competitor products in their respective countries. This information can be compiled in the form of monthly or quarterly newsletters and sent to all subsidiaries. This technique is practiced by Nestle Co. The head office in Vevey, Switzerland, distributes *Communication Marketing* to all its subsidiaries monthly. The newsletter contains details of new products developed by its companies operating in all parts of the world.

iii. Repertory grid techniques

This technique provides information concerning individual customer attitude towards a particular product segmentation under investigation. The approach used by this technique is to present three brands to an individual and ask him/her in which way two are similar and the third different. Ultimately exhaustive list of ways of looking at the product type can emerge. Usually after twenty or forty such interviews, no new information can be found for the selected product segmentation. Analysis of these data can reveal consumers attitudes towards certain product brands and the reason behind it.

iv. St James Model

The objective of this technique is to find out what customer's rate as the most important attributes and to discern how the characteristic of existing brands compare to the "ideal brand". This technique utilizes the result of the *Repertory grid techniques*, screens the desired attributes of products defined, and develops the "ideal brand" for large scale survey. The survey result helps identify the special product feature for a given market segmentation.

v. Company Suggestion Scheme

This technique invites the company employees to contribute their ideas for new product. The company can make the invitation through newsletter, staff meetings, or organize a company-wide kick-off ceremony. Special mechanism must be in place to gather those ideas coming back. This program must be handled with skill to be effective and to ensure no bad relation develops between the company and the employee. Various