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# Theory of New Product Development and Its Applications

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## Abstract

A product which can be a physical object or a service should be functional and emotional to satisfy the customer's need, and to offer value, be delivered as the way customer demanded. Also, it has to include other specific elements like providing customer services. New product is the result of a creative and unique idea that is able to make consumers satisfied. In the process of new product development, it should not be thought that the change will only be on product physically but also on every aspect of the product. The difference between ideas increases production of different goods. The different kind of goods can positively affect the customers' opinion about a business. When a new business starts to produce a product which satisfies customer's need, then the demand of competitor's product which was already in the market may be decreased. Establishment of new product development (NPD) departments and their direct influence in the production process is crucial for businesses. They can determine demand and needs of consumers by applying different theories. These theories can be classified as (i) product-service systems, (ii) the Kano model, (iii) conjoint analysis, (iv) the product value matrix and (v) quality function deployment.

**Keywords:** product, new product development (NPD), product mix (portfolio), product life cycle (PLC), customer requirements (CRs)

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## 1. Introduction

Marketing can be defined as an exchange which consumers expect to benefit from the firm and firms expect more market share, customer share and more pay. As a result of the fact that the market is dynamic, expectation of more customer share from customers in this exchange requires marketing to be managed with new techniques and strategies. The 7P mix, which classifies marketing's

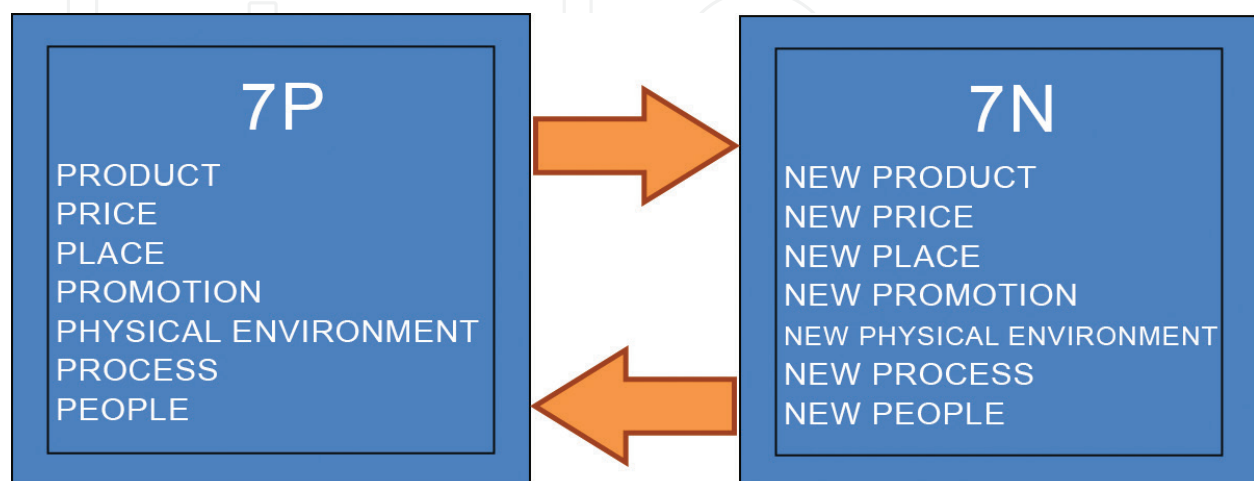
basic strategies and tactics in seven main categories, can be described as 7 N to emphasize the importance of managing the innovation process in marketing. **Figure 1** explains the transition process from 7P to 7 N and the marketing success because of mutual interactive interaction of 7P and 7 N. **Figure 1** illustrates the need to not only reactively implement but also proactively implement marketing mix elements. Mutually and integrally, management and implementation of the marketing mix elements are also important for handling new products, new prices, new places, new promotions, new physical environment, new processes and new people.

According to Fojt [1], the general view about new product development (NPD) is that it brings considerable profits to the businesses if new product is introduced to the market at the right time, is priced at the suitable amount and targets suitable customer group. Accuracy of this view was questioned by Fojt [1], and it was stated that NPD can result in new profit or loss. It is advised that various questions should be answered by the managers before new product decisions to determine whether NPD will bring profit or loss to the business. These questions are:

- What markets are they looking at?
- What types of products or services should they offer?
- Is the product new to the business or its customers?

There are several descriptions made for product term in the literature. Few descriptions will be given here to make clear what it is meant by product.

Product is defined as an entity that is brought to a market for attention, acquisition, use or consumption which meets a need of consumers. Product does not mean only tangible items such as houses, foods and computers but also intangible items such as services including thoughts, events, organizations, persons, places, etc. or a mixture of these. Services are the form of product that consists of activities, benefits or satisfactions offered for sale. Therefore, product is a broad term which defines all those things [2]. **Figure 2** summarizes the elements of a product.



**Figure 1.** Components of marketing mix.



**Figure 2.** Components of a product. Source: Adapted from Chunawalla [3], p. 2.

Definition of product term does not stay stable and changes constantly during the time. Before, product was defined as what is produced by businesses, but today it is defined as a want of a customer provided or satisfaction of a customer met in an exchange. Satisfaction can be physical or psychological. Therefore, product includes more elements [3].

## 2. New product development (NPD)

Various definitions and explanations of its boundaries about 'new product' have been made in the literature. New product is defined by Crawford as 'a product for which the company needs a new marketing, and in which the substantial changes are conveyed but excludes any changes that may require simple promotions' [4].

To make NPD effective, there should be a coordination between the manufacturing, engineering, research and development (R&D), marketing, finance and purchasing departments. Marketing department first has to make an assessment about new product, and then a cross-functional team created for the new product has to come into the scene for development of new product [5].

There are several types of classifications for 'new product'. One of these categorized new product into four groups. These are [6]:

1. **Major innovations.** Major innovations are absolutely new in the market. They are created by new technological developments and provide new experiences to the customers. For example, phones, smart phones, computers and tablets were not present before they were released for the first time. They created new markets instead of old ones as a result of attracting potential customers by claiming to ease their lives with if they use these products. However, there is a risk about attracting potential customers to major innovation product as potential customers may doubt about its worth. They can hesitate to spend money on something which did not yet prove its reliability and usefulness. Therefore, the business that created new product has to find ways to convince them that they need this product. Even though it is risky to produce a major innovation product, it can bring to the business several benefits in addition to the profit such as increased reputation of business among customers, employees, shareholders and potential investors.
2. **Product improvements.** Contrary to the 'major innovation' group, products in 'product improvement' group are not produced with the aim of creating new market. Instead, they target customers of competitors in the market. This kind of new products is popular in cosmetics, chemistry (especially detergent products) and food (diet, fat-free, allergen-free products) industries. Businesses in these industries try to attract customers to their products by differentiating their products from competitors' products in the market.
3. **Product additions.** These are imitation products which use the market created by the producers of original products. Even though these products may claim new features, benefits (which are what customers experience differently to the original product) will be limited. This kind of new product is usually chosen by small businesses which have limited resources to create an original product. Therefore, they use original product's existing market and sell with lower prices because of less costs for production of these products without product development costs. In this situation, business that produced original product will face with imitation products with lower prices which will attract customers and will endure product development costs. Because of this, businesses producing original products try to prevent imitation products by using marketing countermeasures. Therefore, it is difficult to find a distribution line in this market for imitation product businesses.
4. **Repositioned products.** Repositioned products are promoted in a new way to attract different kinds of customers. These are not new products, are not new formulations or are not new features, but they are positioned in a different way in the market for attracting different groups of customers. For example, Lucozade energy drink business changed the product's image from a drink for recovering people from an illness to a drink for people interested in sports.

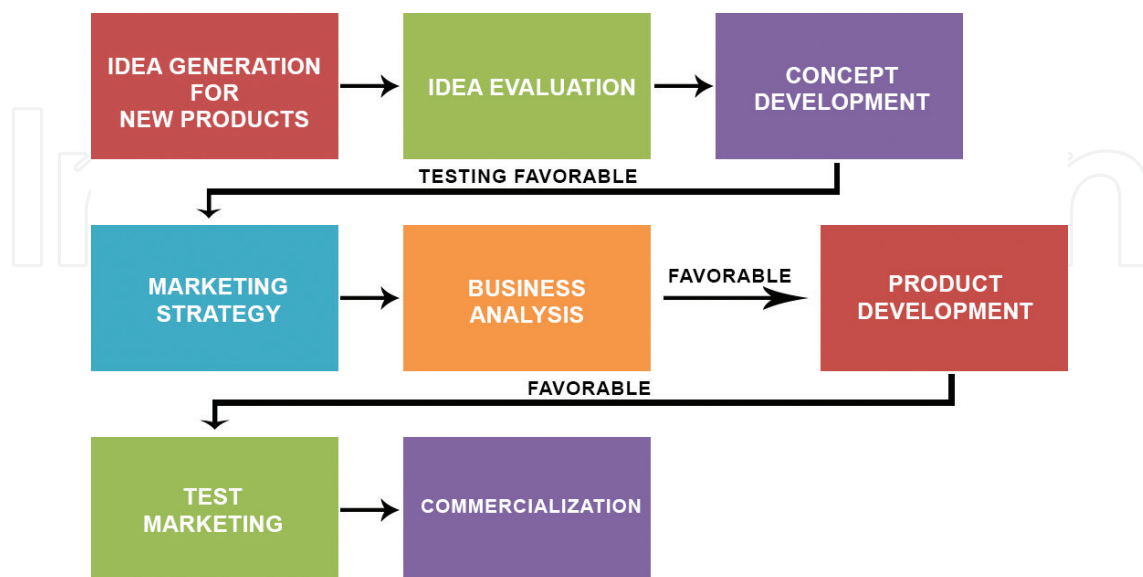
New product is categorized under the six groups by Booz, Allen and Hamilton. The 'new' feature of product is considered relevant to the business and the market [3]:

1. **Technological breakthroughs:** This group of new products is one-of-a-kind product such as anticancer or AIDS vaccines or new technologic products such as flying cars. These products are new experiences for customers at the time of their release to the market. They

offer quite different or marginal benefits to the customers. Technological breakthrough products are the result of continuous product and marketing researches. These products bring considerable benefits to the businesses produced.

2. **Significant improvements:** These products are made by considerable improvement of existing products in the market. This improvement increases the value of product and benefits both businesses and customers. For example, instant coffee replaces the usual brewed coffee. While customers enjoy making coffee easier and faster for breakfast, businesses increase the sales.
3. **Modified products:** These products are created by making insignificant improvements in the existing products such as adding new smell to the detergent or increasing/decreasing (fries, smart phones) sizes of products. The 'new' here is made to enhance the product experience.
4. **Products new to the business:** These are imitated products which are already sold in the market, but business produces them for the first time. Business uses an existing market to sell these products and tries to attract competitors' customers.
5. **Repositioning:** These products are produced currently by the business in a given market, and this business starts to produce it for new markets.
6. **Cost reductions:** Business releases the same products but with less prices to the market.

NPD completes in eight stages. At the end of each stage, business should make a decision, continue to the next stage, leave to develop products or look for extra information. **Figure 3** illustrates the process. The eight stages shown in **Figure 3** are (1) generation of new product ideas, (2) screening and evaluation of ideas, (3) concept development and testing, (4) marketing strategy, (5) business analysis, (6) product development, (7) test marketing and (8) commercialization [3].



**Figure 3.** New product development process.



Suppose that there is a business which produces doors and has an idea of producing a door that opens with a face recognition system. The stages of the marketing process for this door should be planned and implemented following the new product development process categorized below.



New product development processes under eight stages are explained below [3]:

### **Stage 1: Generation of new product ideas**

To initiate a new product development, first, there has to be an idea beforehand to create it. A lot of ideas are generated till the business finds the most suitable ones. Businesses use internal sources like R&D department, external sources like customers and competitors and other sources like seminars, universities, investors, etc. to generate ideas for new product development. It was shown in a survey including 750 interviews of CEOs in global businesses that 41% of new product ideas were generated by employees, 36% of ideas were generated by customers and only 14% of ideas were generated by R&D department.

### **Stage 2: Screening and evaluation of ideas**

At this stage, all generated ideas in Stage 1 are screened and evaluated to limit ideas to a manageable number including most useful ideas in order to ease new product development process in later stages and reduce costs and time spent for not useful ideas. Firstly, all ideas are screened to distinguish more useful ideas from less useful ones. Secondly, three questions that are involved in new product screening framework created by a marketing expert are applied to selected ideas. These questions are defined in a sum as R-W-W ('real, win, worth doing'), and business must give all these questions 'yes' answers:

- Is it real? Is there a need that will force customers to buy it?
- Can we win? Does it provide a considerable benefit for the business? Are there enough resources to make new product successful?
- Is it worth doing? Is this product compatible with the business's growth strategy?

### **Stage 3: Concept development and testing**

After the most useful product ideas that are selected at Stage 2, product concepts will be developed. The selected product ideas will be presented in a detailed and meaningful way as product concepts.

Then, concept testing will be applied to the developed product concepts. At this test, the thoughts of selected customer groups about new product concepts will be taken, and the product concept that received the best score will be selected as a new product to be developed.

#### **Stage 4: Marketing strategy**

At this stage, a marketing strategy will be created for the selected concept. Marketing strategy is created in three steps. These steps are:

- Identify which market will new product concept be sold, how much profit is targeted from new product concept and what are its planned value proposition, sales and market share for the first few years.
- Identify the price new product concept will be sold, how it will be distributed in the market and what will marketing budget be for the first year.
- Identify how much new product concept will be sold in the long term, how much profit is targeted from long-term sale and what will be long-term marketing mix strategy.

#### **Stage 5: Business strategy**

Business strategy is created in two steps:

- The first step is projection of new product concept sales. Sales can be projected by market research and review of similar products' sale numbers in the past. Then, business calculates risk by estimating minimum and maximum sales.
- The second one is projection of cost and profit. All costs involved in new product development such as investment, operation, marketing, R&D costs and profits from sales of new product are estimated at this stage. Calculated numbers will indicate financial attractiveness of new product.

If these projections are compatible with the business's objectives, it will be moved to the next stage.

#### **Stage 6: Product development**

A sample or samples of new product will be created by the R&D department of the business. Then, samples will be tested to assess new product concept whether it is attractive for customers; it can be produced at expected cost and time. Several tests are made to samples to ensure the safety, attractiveness and effectiveness of new product concept; therefore, test process may take a while to choose the most suitable sample. Businesses either do tests themselves or get a service from another business.

#### **Stage 7: Test marketing**

At this stage, tests will be made to identify how marketing of new product concept must be conducted for the best results before enduring costs for unsuitable marketing strategies. All



marketing elements such as new product concept's target market, position in the market, advertisement, distribution, packaging, costs, etc.

Marketing test provides businesses a suitable marketing strategy for new product concept to be commercialized at the next stage. Passing marketing test and going to commercialization directly may make business face with more than expected costs till the level of exceeding profit. Therefore, it is crucial for the businesses to conduct marketing test before going for commercialization at the next stage.

### **Stage 8: Commercialization**

The first thing to be done at this stage is determining the time when new product concept will be commercialized or introduced to the market. Then, at in which scale new product concept will be introduced to the market, at a small scale such as a city, medium scale such as a region, or at a big scale such as the national market, or the international market. Usually, most businesses prefer to introduce new products into the market at small or medium scales and expand the market in the process as introduction of new product at a big scale requires more capital, confidence and capacity which only few businesses have.

## **3. New product development in portfolio management**

New product development is usually done by the businesses in the kind of significant improvement or modified products which are explained in the previous section. For example, Sony's over 80% of new products are improvements of existing products. Similar to Sony, Nike started with running shoes in the beginning and then enlarged its product range to a whole range of sports apparel with constant improvements [7]. Therefore, the place of new product developments among existing products, product line or portfolio has to be carefully assessed during the initial stages of new product development.

Product line can be defined as a product group which consists of several products related to each other because of being sold by same type of marketing tools to the same customers, functioning in a similar way or priced similarly. For example, Apple produces different kinds of computers, and Nike produces several types of sports shoes. Both businesses aim to address the needs of different kinds of customers.

Assessment of how many related products will be produced or in other words what the length of product line will be and how each product in line will contribute to the profit periodically is an important subject for businesses to observe profit variations. If product line is too short, there is a potential to increase profit by adding new product into the line, or if the line is too long, a poor performing product can be excluded from the line to increase profit.

Business objectives and resources are what determine the length of product line. For example, business may have an objective to attract high-income customers; therefore, new products are developed by adding luxury features to the existing product to attract high-income customers such as automobile series starting from average model and going up to a luxury model. Or,

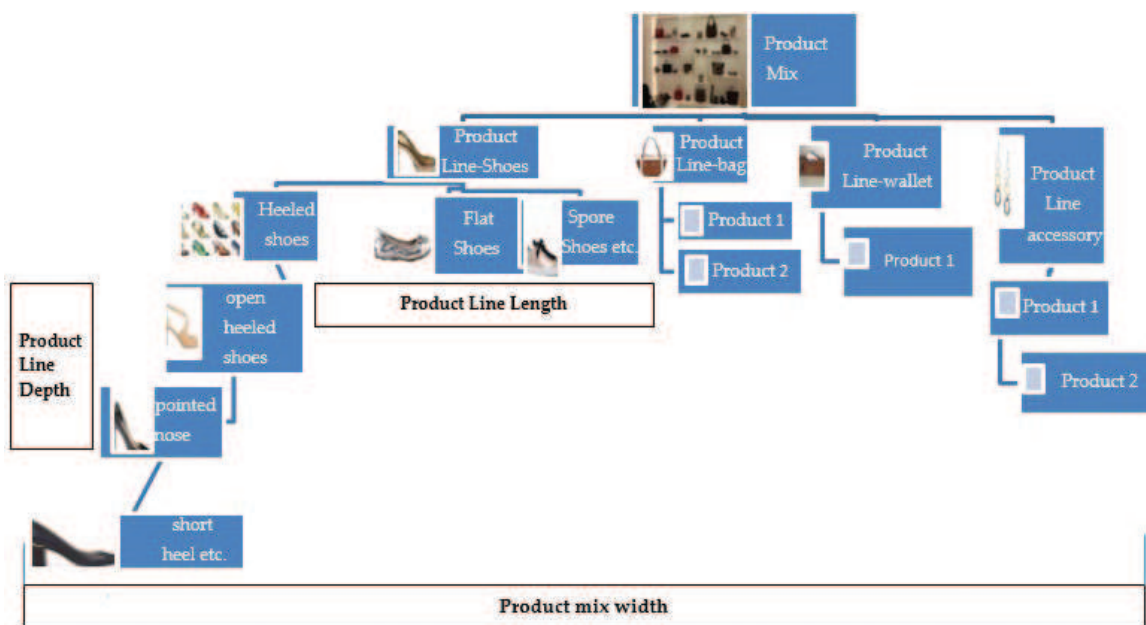
business may object to do cross-selling such as selling HP printers and cartridges. In addition, business may object to avoid profit losses in case of economic problems by creating different brands with different prices such as Gap which has several brands (Gap, Old Navy and Banana Republic) addressing customers with different income levels. If a business has several product lines, it has a product portfolio. A product portfolio has four major dimensions which are width, length, depth and consistency [2]. For example, the portfolio of Nine West business includes hundreds of products. It has four major product lines which are shoes, bags, wallet and accessory and several sublines such as shoes line consisting of heeled shoes, flat shoes, stilettos, etc. They are shown in **Figure 4**.

Product mix width refers to the number of different product lines the company carries. Nine West's product mix width is four as shoes, bags, wallet and accessory.

Product mix length refers to the total number of items a company carries within its product lines. Nine West's product mix length is eight as heeled shoes, flat shoes, spore shoes, buskin, stiletto, boot, sandals and slippers within its shoe product lines.

Product mix depth refers to the number of versions offered for each product in the line. Nine West's product mix depth is eight within its heeled shoes as open-toed heeled shoes, padded high heels, rear high heels, pointed nose, abiye shoes, platform shoes, short-heeled shoes and filler heel slippers.

The consistency of the product mix refers to how closely related the various product lines are in end use, production requirements, distribution channels or some other way. Nine West as a company has many product lines which are completely dependent on each other. Thus, the product mix consistency is high.



**Figure 4.** Product mix (portfolio) of a shoe business.

This means that a business can expand its product portfolio in four ways: expand the width of portfolio by adding new lines to the portfolio; increase the length by adding new products/product types (existing product improvements) into the product lines; increase the depth by adding more products to product types, therefore enhancing or deepening the portfolio; and change the consistency by increasing or decreasing product types according to whether business aims to be strong in a single field or operates in several fields [2].

Portfolio management is an ongoing process that new products and existing products are assessed continuously, high-profit expected new products are selected and poorly performing existing products are stopped to share business resources to products in the portfolio effectively. If portfolio management is not done accurately, businesses face with several issues. For example, resources may not be adequate if there are quite a number of new product ideas, new product ideas may not be compatible with business's strategies, poorly performing products may not be caught at the right time or the quality of portfolio can deteriorate with wrong new product decisions [8, 9].

Portfolio matrix is useful for deciding which products will be added to portfolio or which ones will be removed from portfolio. It assesses products with two criteria which are relative market share and market growth. Relative market share which is especially important for businesses in the commercial sector as holding larger market shares than its competitors is an advantage for these businesses. High-growth markets provide more benefits to businesses than low-growth ones such as more customers, increasing market shares. **Figure 5** shows that the matrix has four groups merging into one. These groups have very different names to highlight their importance [10].

1. **Stars.** Products in stars group have high relative market shares and operate in a high-growth market. While these products require high amount of investment, they also provide high profit. If market growth rate decreases, investment needed will be less; therefore, these products will be classed as cash cows.
2. **Cash cows.** Cash cows are defined as products that have high shares and low market growth rate. Because of saturated market, these products will not need high investments.
3. **Problem children.** Problem children products have low market shares but operate in a high-growth market. It means that these products will require high amount of investment because of high market share, but they will not earn significant profit as much as stars and cash cows. It is not very clear which direction (cash cows or dogs) problem children products will go on in later time.
4. **Dogs.** Products in dogs group have low market shares and operate in a low-growth market. It is a challenging task to move dogs group products to other groups because of their low market share positions.

It is often advised to use profit from 'cash cows' for the investment of stars group of products in portfolio management. It is known that there has to be some stars group of products in a portfolio to maintain a well-balanced portfolio. There is a need for cash cows group of

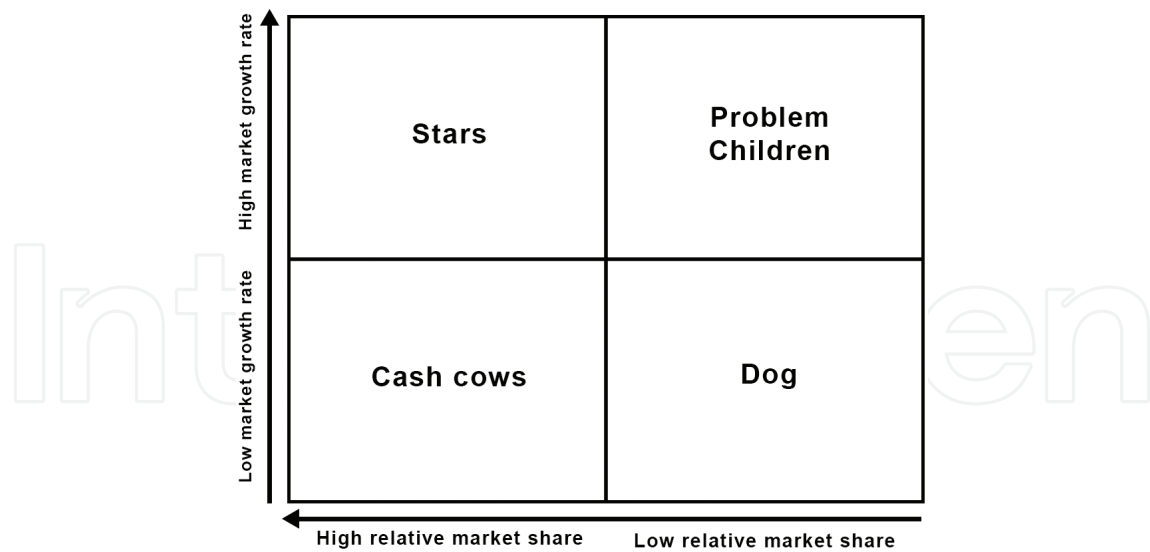


Figure 5. Portfolio matrix. Source: Walton [10].

products to earn profit. Major advantages of portfolio matrix are that it helps to find a product which will provide high profit and is useful for developing production strategies and long-term growth plans of portfolio. Also, showing portfolio in a graphic image like in portfolio matrix makes understanding how portfolio shapes and what it would bring to the business easier. Despite of advantages, portfolio matrix has been criticized from few points. One point is that portfolio matrix is very broad and developing successful strategies requires more than market analysis. Another point is that it has too many objective indicators, while subjective indicators take more places in real environment. Also, using pejorative terms like 'cash cow' and 'dog' can lead to self-fulfilling prophecies [10].

#### 4. New product development and meeting customer needs or requirements (CRs)

Competition in global market is quite high which makes businesses to give more concern to meeting customer needs. It is really difficult for businesses to be successful in global market by depending only on high-volume production and low cost. Having a desirable position in highly competitive markets requires making effort to produce products (NPD) which will meet the customer needs and satisfy them. There are several models created to be useful for businesses to understand customer requirements (CRs) [11]. Some models categorized below promote innovation during NPD's first stage (generating idea) and therefore are useful at making cost-effective decisions:

1. **Product-service system (PSS):** This model is first presented by Goedkoop et al. to make more benefits from integration of new product development with related services. It is defined as an integrated system of products, services, networks of players and supporting

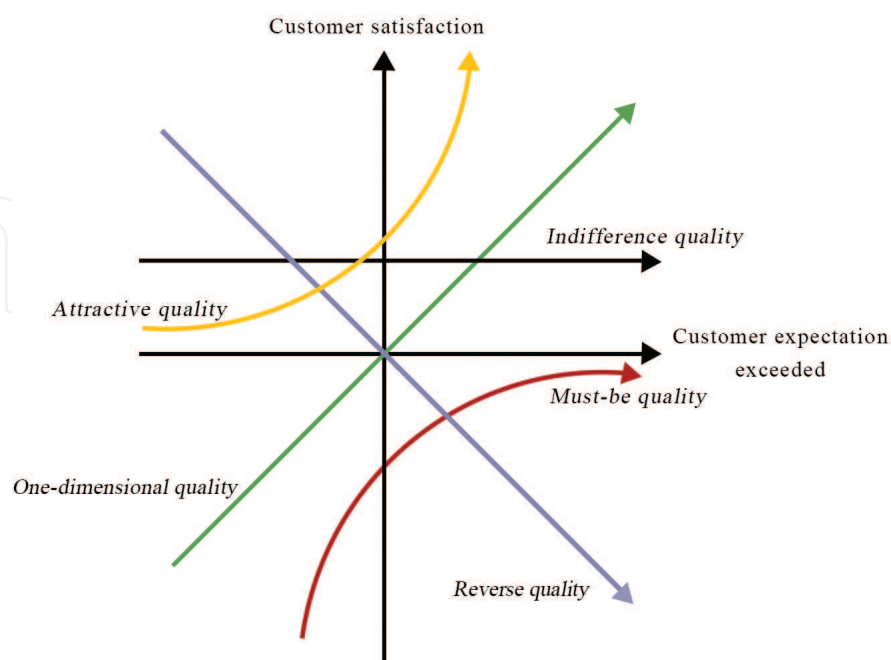
infrastructure which come together to satisfy customer needs, to be competitive and to have less environmental impacts than traditional business models. Some specialized versions of PSS were also created such as technical PSS and industrial PSS. How PSS is designed is given below [12]:

- **Customer analysis:** First, PSS designers find out the CRs and then identify the functional requirements (FRs) and engineering characteristics (ECs) of the product and service by assessing the CRs. Modeling of interrelations of CRs, FRs and ECs can be done with mapping.
- **PSS conceptual design:** Conceptual ideas are developed by using CRs, FRs and ECs such as case-based reasoning and knowledge reasoning. The most semantically similar conceptual ideas will be referenced for the specific CRs.
- **PSS detailed design:** PSS designers distribute selected ideas within a detailed structure after defining the referenced ideas. Then, specifications of PSS details are explained to understand PSS better.

2. **The Kano model:** The Kano model categorizes attributes of new product into various groups according to effects of attributes on customer satisfaction. Model assumptions are shown in **Figure 6** [13].

Attributes are categorized into five different groups by the Kano model. These groups are [13, 14]:

- **(M) Must-be:** This kind of attributes meets the basic needs which are not to be noticed by customers when met, but it will have a quite strong effect if not met.



**Figure 6.** The Kano model assumptions. Source: Szymczak and Kowal [13].



- **(O) One-dimensional:** If these attributes are included in the product, customers will notice satisfaction. If not met, customers will be dissatisfied. These attributes have to be included in products at the level that their absence will not have a negative effect on customer satisfaction (neutral point). From this point, more attributes may be added for meeting customer satisfaction.
  - **(A) Attractive:** These attributes are defined as 'bonus' which increase satisfaction if they are included in the product, but there is no significant effect when it is not included.
  - **(I) Indifferent:** These attributes have no effect on customer satisfaction. There will be no difference in the customer's purchase decision whether they are included or not.
  - **(R) Reverse:** These attributes affect customer satisfaction negatively; therefore, they need to be avoided.
3. **Conjoint analysis:** This model is used to examine the relative importance of customer needs vis-à-vis product features and attributes with a multiattribute preference analysis. It is useful to understand what will the position of new product be against products currently sold in the market by competitors. For this purpose, first, all feature and price combinations for a given product are listed. Second, a sample group of potential customers are asked to rank these combinations. Third, a statistical analysis is done to rank and weigh the combinations according to the responses to find the best combination and decide to produce it. This model is used generally in market research and preferred usually for high-consuming products [14].
  4. **The product value matrix:** This model is used to create a market requirement specification (MRS) for new product and put product development tasks in order according to their priority. It assures that the needs of all parts involved in supply chain of new product consisting of customers, suppliers, retailers and so on are met. In this model, it is assumed that the sales and marketing team know all the participants and their needs in the supply chain of the given product [14].
  5. **Quality function deployment (QFD):** This model aims to represent customer requirements in new product design and specifications and therefore make new product attractive to the customers. QFD increases quality, while it decreases production cost and development time. QFD suggests to use resources for producing new product according to customer requirements rather than business management. There are three groups of customer requirements which need to be understood well by product development team. These groups are [15]:
    - **First group:** The basic customer requirements are found out using market research methods such as interviews, focus groups and surveying. These requirements are usually unclear or undefined such as 'a fast car'; therefore, they must be defined more to include measurable characteristics. Usually, some attributes such as 'safety specifications of car' about the product are neglected or not expressed by assuming they are already included in the product by the customers during market research. To have a high customer satisfaction, the product must include all expressed and not expressed basic requirements along with high performance.



- **Second group:** These are fundamental customer requirements which are found out by assessing the use of products by customers and customer behaviors. For instance, customers may require banks to work outside 9–5 shift. This request may be provided by working longer hours or by Internet and telephone banking.
- **Third group:** These requirements are called ‘new features’ and defined as ‘delight’ because they are unexpressed and most of the time unknown by customers and excite customers when they are found in the product unexpectedly. They are not known by the customers because customers may be unaware of technical abilities of these products or used to standard products. Even though some new features become available by technological developments, some of them can be provided by understanding customer behaviors and product uses with conducting market research and new product development.

## 5. Life cycle perspective in new product development

Each product has a life cycle similar to the living creatures: it is born, grows and dies. Eventually, all products will complete the cycle at a time and will die. However, the time the new product will come to the end of the cycle is important for businesses because the main reason behind developing any product is making profit. If the cycle is not sufficiently long to cover any costs endured and make decent profit to the businesses, all the efforts to develop new product will be worthless. Therefore, businesses make an expectation for a desirable life cycle for their new products [2].

The product life cycle has stages similar to the life forms. These stages are: (1) *Introduction stage*: maintenance cost is high at this stage, and profit is limited. Product needs to be sold immediately to earn profit. (2) *Growth*: maintenance cost is lower than the introduction stage, and sales are increased. Competitors are appearing in the market, too. (3) *Maturity*: this stage brings the most profit to the business, sales increase and maintenance cost gets much lower. (4) *Decline and withdrawal*: at this stage, products of competitors are preferred; therefore, profit decreases significantly. At the end, products are withdrawn from the market [10].

There are three major facts agreed on by most about the PLC concept [16]:

1. the speed of products at each stage of life cycle is different;
2. profit per unit increases rapidly in the growth stage and decreases gradually in the maturity phase because competitors enter to the market at this stage; and
3. ‘the functional emphasis required for successful product exploitation—engineering and research, manufacturing, marketing and financial control—changes from phase to phase in the cycle as shifts occur in the economics of profitability’.

There are a few studies about launch of new products, but there are several studies about introduction of new products to the market which will be useful to understand the notion of ‘launch’ within the context of new product development. There are several important key decisions at the tactical level of new product launch which are called ‘4Ps’ and explained below [17]:

- 1. Product launch decisions:** Product launch decisions are about brand choice and product line length (also called product assortment) which are used to decide, the new product's position in the market for determining which customer needs are better satisfied to have high profit and the relative quality of product determining which new product solves customer problems better.
- 2. Price launch decisions:** Price of new product determines product's position among competitors, and it may be a measure for customers to assess the product's quality. Price decision is not made only for launch price including discounts and promotions, but it also involves a choice between skimming and penetrating in long term. Skimming is preferred often for high technological products because of high profit gain. Penetrating price is advised to benefit from increasing economies of scale and hindering competitive products when new product has a typical diffusion curve as sales increase along with diffusion.
- 3. Promotion launch decisions:** There are several activities done while introducing new product to the market such as public relation, advertising, sales promotion and personal selling. It has been suggested that if there is low awareness about a new product, a pull strategy in advertising and promotion is better to be followed rather than push strategy.
- 4. Place launch decisions:** Distribution indicates the acceptance and sales of a new product in the market because it shows how new product is available to the customers. The distribution channels must have the highest availability in the target market and reflect the target market's buying behaviour.

NPDs were more often introduced to the markets that have an early stage in the product-market life cycle. There are several advantages of early entry, but they are not given automatically as there are technological and market uncertainties inherent in the development of new products. Original new products if they are an early follower may be more profitable than being the first in the market:

'The apparent lack of consensus regarding whether new products will be more successful if launched early into markets which are more likely to grow (and not later, into markets with established competition and less growth potential) may be at least partly due to the failure to recognize that different tactics can be successfully deployed for a new product launch in both the growth and maturity phases of product-market development' [17].

## 6. Success and failure in new product development

The interrelation of the market environment, new product strategy and development process that influences the success of a new product. When new product concept is developed, the introduction of it to the market has to be made in an effective and efficient way. For this purpose, organizational factors such as inter-functional coordination, structure and leadership must be involved in the process heavily [18].

Literature has shown that there are various elements affecting success of a new product. These elements are categorized under three groups below [19]:

1. *The need for interdisciplinary inputs.* It was shown in the literature that an interdisciplinary teamwork is necessary for the success of a new product. Because, new product development process involves several works and issues which need to be undertaken by different kinds of professions. The lack of a profession in the team of new product development process may lead to overlooking of important issues which will affect the success of a new product significantly.
2. *The need for quality inputs to the process.* In addition to having both technical and marketing information accurately and timely, updating of this information is also crucial for the success of a new product to be coherent to the changes in conditions.
3. *The need for speed in the process.* The new product needs to be released to the market and produced quickly to collect a significant share of profit from a new product before competitors enter to the market because history has shown that a good chunk of profits is gained by the first business operated in the market at the early stages of new product life cycle while others share the rest (of profit) left by the first business in the market. However, businesses should be cautious about making a speed introduction and production of new product to avoid making mistakes.

Kotler and Armstrong bring several reasons explaining why do so many new products fail, while there are clear instructions about how a new product development can be successful. The first reason is overestimating market size which will cause to overproduction resulting in profit loss. The second reason is poor design of a new product that will not be attractive as much as for potential customers. The third reason is producing it for the wrong segment of market such as selling a luxury product in an economically struggling region. The fourth reason is releasing new product to the market at a wrong time, for example, producing a high-tech product for the use of people at the time of an economic bottleneck when people hesitate spending money for products not necessary for daily needs. The fifth reason is pricing it wrongly, too expensive or too cheap which both will lead to loss in profit. The sixth reason is poor advertisement which will prevent a new product being known by the right customers [2].

## 7. Conclusion and suggestions

Products released to the market to meet customers' needs are changing almost instantaneously, while consumer needs are not changing. NPD which is the changing process of these products is not only a responsibility of research and development departments of businesses but also requires the cooperation of design, engineering, production and marketing departments. The NPD ideas coming from the channels like the universities, consumers, employees, rival company examples, etc. are first assessed by research and development department, then an NPD idea is created by the department, the idea is designed by the design department, its prototype definition and technical details are arranged by the engineering department and it is launched by the marketing department. NPD is required for the marketing of products which will meet

customer needs or requirements to satisfy the customers beyond their expectations. The success of the newly developed product would begin with the success of planning and implementation of the new product launch and maintenance of the sustainability of this success by the marketing department. The duty of marketing to make the new product successful requires the transition from 7P to 7 N that summarizes the marketing mix elements as new product, new price, new place, new promotion, new physical environment, new process and new people. Thus, with the new product, the price, the place, the promotion, the physical environment, the process and the people elements should be replanned and re-implemented. 7 N product life cycle (PLC) should be adapted at each stage of the marketing strategy. As a matter of fact, incorrect marketing practices such as incorrect price, insufficient promotion, distribution to the wrong market segment, presentation of product to the consumer in an unattractive design and environment, not using the interdisciplinary team work in the process and not being able to enter to the market before competitors are known as reasons for failure of the new product.

New product development for a company is the development of product mix or portfolio. While the product portfolio is developed as important innovations, it can also be developed as product advancement, repositioning of product or product additions. For example, how does the production of a door that includes a face recognition algorithm allowing to recognize faces even from distant locations affect door manufacturer's product portfolio? And, how does production of this kind of door before by competitors affect the sales and market share of the manufacturer? The production of a face recognition door by this manufacturer will enlarge the product portfolio. The production of different varieties of the door such as lock opening, automatic opening, etc. contributes to the length of the product line. The development of locking features such as door opening by a card reading or a device from inside of the lock contributes to the depth of the product line. Not adding this kind of door to the product mix by the door manufacturer although there is a demand by consumers in the target market will lead to a decrease in the market share, or producing it after competitors will lead to loss of taking the best part of the market and increase in the cost of winning the customers lost to the competitors.

#### FACIAL RECOGNITION SYSTEMS

MAGIC FACE is a facial recognition terminal which is useful in recognition of faces from even a distance by using a facial recognition algorithm. It is used successfully in systems need tracking, controlling or counting such as member or student tracking systems, cafeteria control systems, safety gate systems, prison counting / inspection systems and secure car parking systems.



Employees should be encouraged to develop new product ideas, consumer needs and wants in addition to new product ideas should be researched and complaints and information collected from consumers should be recorded and then converted to new product ideas. The marketing strategy should be evaluated, business analyses should be carried out for ideas which passed transformation from ideas to production test and found suitable for production and the developed products should be commercialized after the market test phase. Different business departments should work in cooperation in order to achieve the success of the new product. For this purpose, creative and innovative personnel should be employed in R&D, engineering, product design and marketing departments as much as in production department. Inadequate coordination between these departments will result in failure of new product development, and failure of new product development will lead to a financial crisis.

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