

## **Developing a New Product Development Model Emphasizing on Environmental Considerations and Consumer Participation**

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### **Abstract**

This research aims to provide a new product development model with an emphasis on environmental considerations and consumer participation. The model design was based on the grounded theory approach. The statistical population of this study includes all new product development experts in the food industry (including executives and academics) and thirteen experts selected by the snowball method. Results showed that the primary phenomenon involves activities and actions taken to develop a product based on environmental considerations and with the participation of consumers. The effective causes of new product development are divided into three categories: market, customer, and technical factors. The underlying conditions for product development are classified into two categories of infrastructure and capabilities. Also, penetrating interventionists were divided into three categories of cultural factors, risk management, and supportive factors. In addition, new product development includes three mechanisms: marketing, commercialization, and green design. The results of the product development model design emphasize on consequences of economic benefits and non-economic benefits.

**Keywords:** New Product Development (NPD), Environmental Considerations, Consumer Participation, Grounded Theory.

### **1- Introduction**

Marketing researchers define the process of innovation covering all stages from idea to commercialization and consumer acceptance; New product

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development (NPD) happens at the innovation process, and it should be considered before the implementation of the process. [1]

The NPD relates to all the new products and services that a company develops. The vital force of companies that are struggling to gain a competitive advantage is to meet the changing demands of consumers and adapt to changing technological uncertainty.

New and successful products allow for competitive differentiation, barriers to entry, the development of new markets, and increased income and profits.[2]

Research has shown that the impact of NPD on sales and profitability is increasing over time and is more critical for the competitive position of the company.[3]

While the NPD is in favor of a company's competitive position, it should be noted that the failure rate of new products is between 40% and 75%. In this way, companies need to minimize their failure rates and failures and increase the efficiency of new products to increase competitive positions.

The NPD consists of idea generation, product development, and product testing before distribution and commercialization.

On the other hand, environmental issues and approaches focused on the sustainable development of companies and products have become increasingly important in recent years, and are gradually gaining ground in determining the company's strategy. Environmental degradation has become an important issue for governments and communities around the world [4]. The trend towards international treaties for environmental protection, such as the Kyoto Protocol, which took place in 2005 and the World Summit on Sustainable Development in 2002, led to changes in the patterns of competition in the world. When societies and governments became aware of the necessity of this issue, they began to exert pressure on companies. Law enforcement agencies and institutions have also legislated considerably, and activists and social groups are protesting against companies that take action against the rules of business sustainability. Also, they call for consumers who are interested in Eco-friendly products. In response to these changes, a large number of companies have taken environmental policies into account and adopted sustainable business behaviors [5]. Several research studies have also been conducted in line with this changing business world to examine different aspects of sustainability-related issues such as Corporate Social Responsibility. [6]

Environmental Entrepreneurship Marketing [7] and Corporate Environment [8] were considered important issues as well as significant advances in understanding the importance of sustained business practices in



the field of marketing, and many other areas have taken place. Environmental considerations have led customers to demand new requirements for how to make goods, used, and how to dispose of [9]. Therefore, environmental considerations should be considered in the design and development of new products that minimize damage to the environment by making, consuming, and disposing of the product.

On the other hand, one of the problems in designing new products is that on many occasions, it does not meet the customer's needs and demands, hence require more consumer involvement in product designing. The product without the presence of consumers, newly designed products cannot be tailor-made to the needs of customers.

Hence, the information related to the product is increasingly important in terms of quality, application, and cost. Therefore, according to this matter, major changes in the level of product development will be necessary. Accordingly, the main issue behind this research is how to develop a new product that addresses environmental issues and has the least environmental impact and has the highest environmental compatibility, as well as how Can the use of consumer participation be used in the development of a new product?

## **2-Theoretical Foundations**

### **2-1- New Product Development Based on Environmental Considerations**

Different products and services have different environmental outcomes and effects and usually occur in a part of the life cycle of a product. Some of these effects are minor, and others are significant and affect the vast range and geographic range of the globe-including effects on global warming. At the same time, the level of attention and interest of customers and consumers is sharp; and this has led companies to consider environmental considerations in their product development strategies, which lead to more and greener product innovation [10]. Green strategies are those activities of the organization that emphasize the survival of the environment and the business opportunities that emerge from those activities [11]. Increasing attention to the development and launch of green products is because green products create a potentially important market and can even increase people's awareness of the development of green products, which ultimately creates many benefits for the organization. More insight into the development of a new green product may be the starting point for improving this trend and reducing the failure rate of green product innovation.[12]

Growing attention to environmental issues has increased scientific attention in the development of new green products, especially in environmental management literature.



Recent studies have focused on most of the organizational aspects of green product development, including the history of green product innovation activities [13] the effects of different strategies on green product innovation, a specific design strategy, such as recycling and rebuilding [14] and market records and environmental performance of green product innovation .

Today, the development of new green products is one of the key strategies for many companies [13], which could reduce costs by optimizing the consumption of materials and energy in products; increasing innovation and creativity in the organizations; meeting the needs and expectations of customers; improving the brand quality of the organization and its positive image in the public mind; improving the level of customer loyalty to an organization and its products; attracting capital and funds from the capital Responsible and interested stakeholders in environmental issues; Reducing environmental degradation effects and consequences, and improving regulatory relationships of environmental concerns. So that; companies can make green product development in order to standardize product reform and management of raw materials with environmental concerns and thereby help reduce negative impacts on human and environmental health [10].

## 2-2- Literature Review

Siegel [15] says that companies can take on the benefits of differentiation and market share in terms of sustainable product innovation. These innovations include redesigning, packaging, developing more sustainable products, and promoting the sustainable benefits of these products. Also, some sustainability management actions can enhance cost benefits. Redesigning, replacing raw materials with less polluting and recycling of peripheral processes are among these actions. Therefore, the use of sustainable management strategies in the conventional process of developing new products can help companies achieve long-term competitiveness and sustainability goals. These conditions make the company and society both reach a win-win situation.[16]

Huang & Wu [17] believe that the stable development of a new product in the direction of the nature of "cradle to grave" involves a range of factors that require the integration of various tasks in an organization, including production, marketing, research, and development .

According to Peng and Lin, sustainable management is to produce sustainable products and minimize their overall environmental impact through sustainable product design, sustainable R & D, and sustainable marketing. Faludi [18] also believed that sustainable management is a process of applying enterprise-wide innovation to achieve sustainability,



reduce waste, and social responsibility. Huang and Wu [17] also believe that sustainable management is a comprehensive organizational process for the development and production of environmentally friendly products and reducing pollution sources in order to minimize the risks to human health and the natural environment.

Pujari et al. [9] concluded in a study that products focusing on the environment should have effective performance in the market and reduce their impact on the environment to be successful.

Sustainable management should go beyond compliance with the law and move through the use of innovative new approaches to efficient use of resources, waste minimization, pollution prevention and recycling, and reuse of manufactured goods [19].

### 3- Research Purposes

This research aims to "provide a new product development model that takes into account consumer participation and environmental considerations," along with the main purpose, sub-objectives are presented as follow:

- Determine how and how much the impact and importance of consumer participation are in the new product development process
- Determine how and how important environmental considerations are in the process of developing new products.

### 4- Research Methodology

This research has sought to develop a new product with an emphasis on environmental considerations and consumer participation, while it is exploratory and developmental. The approach of this research is qualitative, which is based on the grounded theory. Grounded theory is a qualitative research method that develops a theory using a data set [20]. In this study, a systematic approach, attributed to Strauss and Corbin, was used to analyze the data. The systematic method itself has three steps to open coding, axial coding, and selective coding. The statistical population of this study includes all experts in the field of new product development in the food industry (including executive and academic experts) selected by the snowball method. The data collection method is the study of theoretical literature and in-depth and open interviews. Thirteen people were interviewed in this study, which the received information was repeated from the ninth interview.

#### 4-1- Open Coding and Analysis

From the interview transcripts, the researchers analyze the data line-by-line and allocate codes to the text. The analytical process involves coding strategies is the process of breaking down interviews and observations into



distinct units of meaning which are labeled to generate concepts. The codes represent concepts that will later become part of the theory and also provide meaning to the text and may be created by the researchers or may be taken from the text itself. A code allocated in this way is known as an in vivo code. In vivo codes are especially important in that they come directly from the interviewees, do not require interpretation by the researcher, and provide additional context-description. From the initial interviews, a list of codes emerges and be used to code subsequent interviews. At the end of the sampling process, a large number of codes should have emerged.[21]

#### **4-2- Axial Coding**

Axial coding is the process of relating categories to their subcategories. It termed axial because coding occurs around the axis of a category linking categories to subcategories at the level of properties and dimensions. This involves documenting category properties and dimensions from the open coding phase; identifying the conditions, actions, and interactions associated with a phenomenon and relating categories to subcategories.[21]

#### **4-3- Selective Coding**

Selective coding is the process of integrating and refining the theory. Because categories are merely descriptions of the data, they must be further developed to form the theory. Therefore, the first step is to identify the central, or 'core' category around which the theory will be built. As the core category acts as the hub for all other identified categories, it must be central in all other categories, and they must relate to it while it must appear frequently in the data.[21]

#### **4-4- Data Collection and Analysis**

Data collection and analysis in the research process conducted simultaneously and the emerging theory was proposed based on the data. Data analysis continued simultaneously after the first interview until it was saturated. Researchers encrypted the copied text and discussed coding refinement for each emerging theme. Classified codes were categorized, compared, and interpreted within the context of the general transcripts.[21]

For reporting of the qualitative study findings, the trustworthiness of methods is widely considered applicable in place of the validity and reliability associated with quantitative research. In this research, four supporting processes of trustworthiness were applied, which are conformability, dependability, credibility, and transferability. Credibility was confirmed by selecting the appropriate data collection method for the interviews. The researchers interviewed participants for their views and



experiences in their practice environment. Furthermore, member check was used to prolong the involvement of the researcher to increase the credibility of the data, and, after encoding, the interview transcripts were returned to the participants to ensure the accuracy of the codes and the relevant interpretations. Dependability was established by detailed and descriptive data analysis and direct references to the professional experiences of the individual. The conformability and consistency of the analysis were maintained through research team meetings to discuss and dissect the preliminary findings. Thematic analysis and the coding process occurred through consensus. To increase the transferability of the findings, a description of the context, selection and demographic data of the participants, data collection and the analysis process was presented so that the reader would be able to determine whether the results are transferable to other environments.

## 5- Result

Data presented using the framework proposed by Corbin and Strauss for the development of categories and subcategories. Categories include causal conditions, Phenomena (how developing a new product), the context in which it happened, the interventional terms that affected the coping strategies of the participants, action/reaction (coping strategies), and the consequences of choosing their coping strategies. Finally, the categories were connected together and the meaning of "Providing a new product development" was theorized.

### 5-1- Background Conditions for New Product Development

Basically, the development of new products cannot be analyzed in the vacuum. Instead, it should be looked at in a broader context that includes a set of ground elements by Corbin & Strauss [19]. In essence, the elements of product development by creating sustainable conditions lead to the facilitation, strengthening, or limitation of the process of developing new products. Accordingly, the background conditions for product development are classified into two categories of infrastructure and capabilities (Table 1).

**Table 1. Background Conditions for New Product Development**

Characteristic	Sub Category	Main Category
Application of technology in product design	Infrastructure	Background conditions
Research and Development Unit		
Environmental regulations		
Project Management		
knowledge management		
Own resources for development		



Characteristic	Sub Category	Main Category
Applying efficient and effective human resources	Capabilities	
Use of new methods and tools in design		
Having valued factors		
Having strong teams		
Appropriate corporate communication		

### 5-2- New Product Development Process Interventions

From a theoretical point of view, interventions, or contingent effective elements of product development contributes to the product development process contingently. The contingency nature of the conditions created by these elements makes the response to these elements contingent upon the situation.

In this research, based on the ideas extracted from the text of the interviews, and the study of the literature on penetrating contingent elements, the process of product development was divided into three categories of risk management factors, cultural factors, and supportive factors. (Table 2).

### 5-3- New Product Development Mechanisms

As another component of the product development process, the adoption of product development mechanisms refers to a set of actions and interactions (actions/reactions) that are used to develop a product. Based on the interviews conducted and the study of the subject literature, the codes were extracted and then provided to the experts, and based on them, product development mechanisms were finalized. Accordingly, they were divided into three mechanisms of marketing, commercialization, and green design (Table 3).

**Table 2. Intervention Conditions for the New Product Development**

Characteristic	Sub Category	Main Category
Identification and management the risk of customer loss	Risk management	Intervention conditions
Identification and management of financial risk		
Identification and management the risk of credit loss		
Identification and management of technical failure risk		
The culture of innovation encouragement	Cultural	
Culture of Collectivism		
Culture of co-operation		
The commitment of senior management to environmental principles	Supportive	
Leadership and direction of managers and leaders		
Management Attitude		



**Table 3. New Product Development Mechanisms**

Characteristic	Sub Category	Main Category
Marketing strategy	Marketing	Mechanisms
Market Planning		
Marketing research		
Marketing Intelligence		
Product Pricing	Commercialization	
Product Scheduling		
The share of sales of new products from all products		
The head point of the product		
Sustainable use of resources in design	Green design	
Replacing Inputs with Less Pollution		
Importing recyclable materials in the production and design of the product		
Environmentally friendly packaging design		
Efficient use of raw materials in design		

**5-4- Creators (Causes) of New Product Development**

Product development creators are a set of circumstances and events that trigger the onset of the product development process. These conditions are known as factors contributing to product development. To identify these factors, after reviewing the literature and interviewing the experts, the codes were given to the experts, and the final factors were selected. Accordingly, the effective factors of product development are divided into three categories of market factors, customer-related factors, and technical factors (Table 4).

**Table 4. Causes of Product Development**

Characteristic	Sub Category	Main Category
Market trend analysis	Market factors	Causal conditions
Market research		
Market targeting and division		
Market potential		
Determine the position of the product and participate in the market		
Modeling of competitors		
Feedback from customer	Customer related factor	
Provide accurate information from customers		
Taking into account the fashion of the customers		
Taking into account the voice of customers		
The demands of engineering	Technical factors	
R & D demands		
Knowledge about new products		
Process characteristics		
Product Characteristics		



### 5-5- The Main Phenomenon of New Product Development

The main phenomenon is the activities and actions taken to develop a product based on environmental considerations and with the participation of consumers. According to the interviews, the study of the subject literature, the main phenomenon was divided into two categories of concept development and product development. The development of the concept requires the ideas of consumers in product development, initial prototyping, pilot production, and initial market testing. After the development of the concept, product development begins (Table 5).

### 5-6 - The Consequences of New Product Development

The consequences of product development reflect the efforts of interviewees to define the things they want in certain circumstances. In this research, interviewees, using words such as "wanting", "seeking ...", and "should ... get/get", indicate the cases that if they occur, they can realize their goals and objectives (which are provided here). Based on the ideas extracted from the text of the interviews and the literature review, one can state that the interviewees' description of their experiences emphasizes two characteristics of economic benefits interest and non-economic benefits (Table 6).

**Table 5. The Main Phenomenon of New Product Development**

Characteristic	Sub Category	Main Category
Primary prototype	Develop the concept based on the consumer participation	Main phenomenon
Market Initial Test		
Experimental production		
Ideas and creative thoughts of consumers in product development		
The speed of innovation of new products	Develop the product based on the consumer participation	
Cooperation of the marketing and research team		
Product Position in Total Product Portfolio		
Collaboration between environmentalists, engineers and manufacturing staff		
Consumer participation in design and product evaluation		
Running the sample tests		
Calibration		
Environmental marketing		



Table 6. the consequences of product development

Characteristic	Sub category	Main category
Reduce the costs	Economic benefits	Consequences
Increase the productivity		
Reduce errors in design and construction		
Enhance reliability		
Increase profitability		
Sales growth		
Innovation development	Non-economic benefits	
Environmental performance (less damage to the environment)		
Increase the learning		
Customer satisfaction		

After the open coding, which separates the data into different categories, the axial coding links the categories and subcategories to each other according to their characteristics and dimensions. The researchers use the paradigm to discover the relationship between the categories. Paradigm shows the relationship between different dimensions. Then the selective coding process took place. It is s a process in which the main category is selected and systematically linked to other categories, the connections are validated, and the categories that need to be developed are improved. Selective coding started based on the identified communication pattern between categories and subcategories in open and axial coding by turning the storyline and ended in the return process to the final model as follows.

## 6- Conclusion

The results of this research in identifying the background factors showed that environmental laws and regulations are one of the factors influencing the design of the product that these laws should be approved and implemented by the government and other regulatory bodies to design a product that cannot harm the environment. This factor is consistent with the results of Porter and Vander [22]. In this category, we also refer to the use of appropriate technologies and technologies in design, which is consistent with the results of the research by Cooper [3]. In this research, the availability of human and financial resources as one of the new product development infrastructures has been consistent with the results of Greenbiz. [14]

Besides, in this research, tools, and systems are also referred to as other background factors in product development, which is consistent with the results of Kolk.[5]

The causative factors affecting the product design and development process are the recognition of the market and the receipt of information from customers. The design and development of a new product are not meaningful without knowing the market and competitors and having information from



customers and knowing their demands and expectations. Therefore, the results of this study are consistent with the results of the research by Siegel. [15]

The new product design mechanisms based on environmental considerations and with the participation of consumers, presented in this study, can be used to replace inputs with less pollutant, to import recycled materials in the production and design of products, design Packaging of environmentally friendly products and the efficient use of raw materials. These processes are also mentioned in Siegel [15] and Huang and Wu.[17]

One of the underlying criteria of the main phenomenon is environmental marketing referred to in Peng & Lin [23]. Besides, in this research, the ideas of consumers are mentioned, which was also mentioned in Brown & Dacin [6] research.

In the end must say, Companies first need to identify the target market and then reach out to market segments and customers. Companies then seek to develop products that may lead to refining or manufacturing a product. Offers to buy a product are increasing every year as consumers look for more types of products. Companies that are not able to produce new products are out of competition and suffer the consequences.

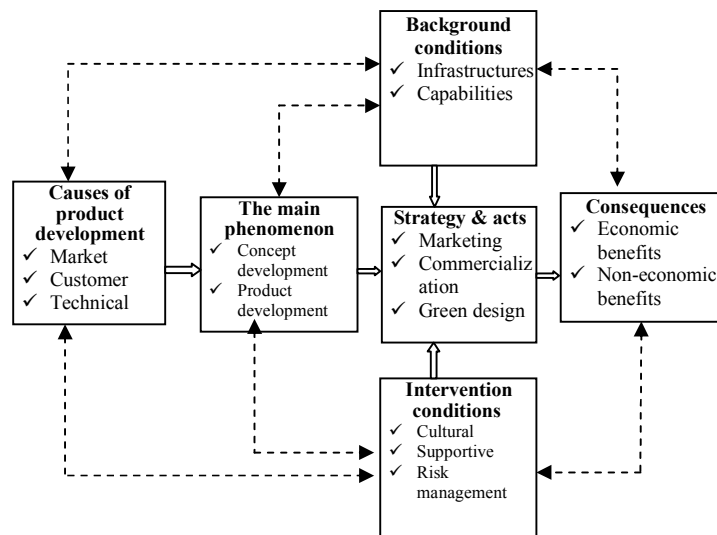
## 7- Suggestions

Considering the effective components mentioned, the following strategies for using managers to succeed in new product development are as follows:

- The role of technology management is casual. The role of technology management is one of the important issues in new product development, and it is suggested to carefully analyze the organizational requirements to analyze the relationship between the new product development process and technology management.
- Depending on the type of market (competitive or monopoly, etc.), you should think about new product development. In some markets, there is no need to develop a new product, and other strategies will be more efficient. It is also not cost-effective in some markets in terms of cost, infrastructure, and profitability.
- It is useful to use an enterprise strategy to support new product development. Leading companies must devote some of their financial resources to research and development. Others allow their employees to devote a certain amount of time to new product development. Then, companies need to organize the development process. This can be done by executives with experience in product development or by a team from different parts of the company with product development capability.



- Introducing a new product is a must for any company. Companies that fail at a shallow rate should use a scientific process to generate new market offers.
- Paying attention to the issue of environmental pollution and reducing the resources consumed for the production and design of green products with the lowest consumption of electric and fossil energy.
- Creating the credibility and credibility of green product promotions and environmental claims by paying attention to the quality and standard of the product line and complying with world-class standards.
- Increasing consumer intent to buy, attract, and loyalty through stimulation to create a positive attitude to green products.
- Identifying risks is essential. Given the industry and the competitive situation, the types of risks they face when developing a new product should be considered. Technology risks, financial risks, and laws and regulations, and cultural risks are among the risks that must be taken into account.



**Figure 1: The Model of Providing A New Product Development Model with Emphasis on Environmental Considerations and Consumer Participation**



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