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Research Paper

Presenting a Model of Product Development Process Management in Gas Refining Company

Hooman Keshavarzi [1] **Seyedjavad Iranban** [2]
Moqaddaseh Mohammadian [3]

Abstract **Every company should think about producing new goods, the production of alternative goods is necessary in order to stabilize the level of sales or new sales; Customers also want new products, and if the company neglects to do so, competitors will certainly do so. Therefore, the present article seeks to provide a model appropriate to the conditions of gas refining companies for product development. In this study, the qualitative research method has been used as a grand theory; Using theoretical sampling and theoretical saturation, 20 experts of gas refining companies (Parsian, South Pars, Fajr Jam) were interviewed. Based on the basic theory, the data were analyzed in three stages of coding (open, axial and selective) using MAXQDA software. In the open coding phase, the data were labeled conceptually and then those that were common to each other were named into a category; the obtained categories were 43 categories. In the central coding stage, logical relationships were found between the categories and the obtained categories were included in the open coding under more general categories; finally, in the selective coding stage, all categories were summarized in one main category. The main category of the research was named "Interfering factors in new product development". The final result of this research, according to the researcher's attention and reflection on the details of the process of each of the three refining companies, is to provide an existing common model for all three companies and also to provide a common desired model for all three companies.**

Keywords *Product Development, Grand Theory, Qualitative Research, Gas Refineries*

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[1.] Department of Management, Qeshm Branch, Islamic Azad University, Qeshm, Iran
[2.3.] Department of Management, Shiraz Branch, Islamic Azad University, Shiraz, Iran
[2]. Corresponding Author: airanban@yahoo.com

Introduction

Gas energy is the most important source of human energy today; As crude oil supplies 37% and natural gas 21% of the world's energy. Therefore, oil and gas are of strategic importance in the economic-political equations of the world and can play an important role in the process of international relations (Masoudipour et al., 1398). Iran, as the second largest holder of gas resources in the world and the fourth largest holder of oil resources in the world, and on the other hand being located in the Middle East and close to consumer and growing markets, has many opportunities to develop oil and gas value chain (Musazadeh et al. ، 1399). On the other hand, the present century is full of various innovations in the field of new technologies, goods and services. But in no period like today has there been such an acute need for innovation (Hosseini, 2016). Undoubtedly, the intensity of competition in global markets for the supply of products and services by different sectors of the industry is increasing day by day, and we will see more intensification in the coming decades. Given today's fierce competition, companies that do not produce new goods run high risks; Also, considering the many resources that companies spend on developing new products and the short lifespan of the introduced products, the strategy of developing new products is very risky (Naimi et al., 1399). The production and supply of new goods is a risky business. Texas Instruments lost $ 660 million before it could get rid of the home PC business, RSA lost about $ 500 million on its unlucky disc players, and Ford lost its Edsel car. It suffered a loss of $ 250 million, and DuPont lost about $ 100 million due to the production of a synthetic leather called Corfam 3 (Cutler, 2015). The Association for Product Management and Development in its recent study has concluded that about 40% of new products eventually fail (Awa, 2017). Cooper and Klein-Schmidt (1991) estimate that about 75 percent of new products fail early on. Cooper and Klein-Schmidt estimate that the failure rate of new product development projects worldwide is about 33 percent, and believes that the cost of failure In

presenting new products due to lost sales goals, unearned income, delayed profits, and development resources have been wasted (Motamedifard et al., 1399). Therefore, according to the mentioned cases, the main problem of this article is the failure of a significant percentage of product development projects and also the failure of products entering the market in Iranian gas refining companies; The companies under study are trying to study this issue.

Background

A product is anything that can be offered in the market to attract attention, acquisition, use or consumption and possibly have the ability to meet a need or desire (Cutler, 1394). Bose, Allen, and Hamilton (1982) revised their old interpretation of the new product process to consider the strategy, stating that the new product development strategy should be guided by the company's strategy and goals. Many authors agree that new product development should be driven by corporate and business strategy. They emphasize that successful product development strategies are those that implement the company's specific approaches and are guided by the company's strategies and goals (Naimi et al., 1399). Over the past 30 years, countless efforts have been made to show dramatic changes in key activities in the new product development process from the idea stage to the commercialization of the new product. What follows is an overview of some of the most important types of new product development models used in large and small industries. Partial-stage models are based on linear model. As each department takes on specific tasks. The R&D department provides interesting technical ideas and refers them to the engineering department, the engineering department receives these ideas and develops the prototype as much as possible, in the construction department of all possible ways to make a sustainable product, with mass production capability can be discovered using that construction. The marketing, planning and leadership department will be responsible for the new product entering the market for the first time

(Mohammad Kazemi et al., 2015). Activity-stage model is similar to the part-stage model, the difference between these two models is that this model emphasizes on guiding activities and is closer to reality. Also, in this model, due to the use of feedback and the existence of repetitive loops, the occurrence of repetitions is prevented to some extent (same). Decision-Step Model that Cooper, Klein Schmidt, and Cutler formulate this model as a set of decisions that need to be made to advance the project. In this model, like the activity-step model, we prevent rework and waste of project time through repetition and feedback loops. In Network models model, knowledge is composed of different parts of the organization, such as: marketing, research and development, and financial collection, and so on. This knowledge increases over time in the organization, just like a project that starts with an initial idea such as a technical gap or market opportunity, etc., and then develops the concept of the product through the development of this knowledge (Naimi et al., 1399). Simultaneous Engineering**,** The term concurrent engineering and parallel engineering is still used in industry, but with the selection of the name Simultaneous Engineering by the US Department of Defense, this designation gradually dominates other designations. Given that today the global competition in presenting a new product is very intense, the time of presenting the product to the market is a very important distinction between successful and unsuccessful companies. Successful companies learn how to manage time and use of technological advances (Talebi et al., 2010). Stage-Gate Model developed by Dr. Robert J. Cooper is a very convenient and powerful tool for new product development. This model is one of the models with a sequential pattern and consists of a series of stages and gates that have turned this model into an organized and structured flow for new product development projects (Homayoun Far et al., 1397). Alireza Khorakian (1397), in a study on "Factors affecting the growth phase of the new product development process in knowledge-based companies using the Dimtel approach and dynamic system" concluded that, three factors of customer requirements, Reworking and

delays between different phases are the most important factors affecting time in the growth phase. The results also showed that the complexity of the new product has the greatest effect on the entry delays from one stage to another in the growth phase because the increase in complexity requires more coordination. Gholamreza Soltani Fasghandi (2016) in a study on "Predicting the success of new product development using a combination of factor analysis and artificial neural network" concluded that the six main constructs of new product conceptualization, market orientation, design orientation, Tendency to technical and technological factors, use of resources and new product development management have been effective factors in the success of new product development. Also, predicting the success of new product development using artificial neural network shows that the designed network was able to accurately predict the success of new product development in 81% of cases. Iman Pouyaei (2016) in a study on "Study and prioritization of key success factors of research and development projects of aviation products" after analyzing the data, concluded that the factors of "management style and leadership, organizational resources, staff, strategy, Marketing and market management capabilities, technological capabilities, organizational structure and processes, organizational culture and values, respectively, are of particular importance in the success of aviation product research and development projects. Linda Hamid Kidder et al. (2019) in a study entitled "Comparing core consumers with new consumers as sources of innovation in the early stages of new product development" concluded that core consumers compared to new consumers have the highest potential for Produce the most promising new product concepts in the early stages of new product development processes. Alexander Witt et al. (2019) conducted a study entitled "The role of departmental thought world in shaping commitment intensification in product development projects." In this study, four studies were conducted based on actual scenarios with 460 highly experienced NPD managers in marketing, research and development. It was concluded that the importance of the

managers' world of thought for the formation of the EOC differs from the characteristics of the NPD project. In addition, POST HOC tests show departmental differences in EOC behavior between marketing and R&D, which are different from the characteristics of a project. These results suggest that circumstances should carefully consider who makes the decision to continue the NPD project in different project circumstances.

Method

In the present study, due to the nature of the subject and the goals that this research pursues, one of the qualitative methods called grand theory has been used. The statistical population in this study includes all experts in the field of production of Parsian, South Pars and Fajr Jam gas refineries. Data related to the theoretical foundations of the research were prepared in a library and documentary manner and the raw data of the research were collected through in-depth interviews with the target community. In the present study, two types of sampling methods (purposive sampling and theoretical sampling) were used simultaneously; And that the sample size is 20 according to the theoretical saturation. Finally, the data collected through in-depth interviews with individuals who included the statistical sample of the research in open coding, axial coding and selective coding using quality MAXQDA micro-software, conceptualization and finally Were analyzed.

Findings

To analyze the data, Corbin and Strauss method was performed using Max QD software. In this method, the data is analyzed in several steps. Frequent and reciprocal analysis between data, comparing concepts, developing classes and finally extracting the theory directly from the data was performed (Farhangi et al., 1399). After conducting the interviews and transcribing them, the researcher analyzed the data using Max QD software. In this way, the semantic units in the text were identified by the mentioned software and a code was assigned to each

semantic unit. The codes were then placed in identical classes based on similarity, and thus classes were obtained. In the next step, the search for the connection between the classes began (axial coding) and by answering the questions "What?", "How?", "Why?", "Where?", "When?" And "With what result?" Attempts were made to identify key categories (ibid.). In the final stage of coding, a new product development process is developed by creating a reflective or selective coding matrix. The first method of coding research data for their analysis is open coding. Open coding is a part of analysis that specifically names and categorizes phenomena through careful review of data (Hosseinnejad, 1397). Using this method, the collected data were divided into separate sections and carefully examined to obtain similarities and differences, and questions were asked about the research topic that the data indicate. Considering that Max QD software was used for data analysis in the present study; Therefore, the materials and interviews were compiled in Word format and then transferred to the software for analysis. Initially, because the volume of material and interviews conducted was large and in such a case the researcher may be confused; Therefore, conceptual labels were selected through Max QDA software for interviews with experts in the field of production of Parsian, South Pars and Fajr Jam gas refineries, which can be seen in table 1.

Table 1.

Concepts Derived from Semantic Propositions in Open Coding

Concepts	**Semantic propositions**
Effective planning	All refineries have long-term or medium-term plans for product development based on feed specifications
Delays in product delivery due to monetary and economic policies and problems	The project was postponed due to government policies and currency and economic problems, and the work was handed over to the private sector, and is being carried out by a private company after ten years
Lack of refinery independence in decisions	According to the existing framework in the ministry, product development can be done for each refinery to a limited extent
Legal barriers	Therefore, according to the policy of the Ministry of Oil, it

Concepts	Semantic propositions
	is not possible to maneuver on gas condensate and develop a new product
Get advice on planning	It is possible to implement the plan by getting a consultant and examining economic issues if it is justified.
Preliminary research on product production	Necessary checks on feed supply of refineries should be made with feed suppliers.
Accelerate the product production process	Due to the existence of management layers, appropriate decision making and planning for product development is delayed
Improve quality and quantity at the same time	In product development in terms of quality and quantity, we are required to comply with the standards announced by the National Gas Company.
customer satisfaction	Because we have concluded contracts with customers based on these standards and their satisfaction is important.
Timely delivery of the product	The subject of product delivery in accordance with customer requests is the company's top priority in line with customer-oriented strategy
Survey of colleagues and customers	Ideas come from colleagues, customers, and other refining companies.
Correct targeting	All aspects should be weighed at the beginning so that there is no problem during implementation and development.
Impossibility to use modern technologies	One of the problems of product development in refineries can be related to the issue of sanctions.
Use the ideas of domestic and foreign experts	Using experts and experts outside the refinery certainly has better results when it comes to choosing a better idea, which is not the case.
Experts are discouraged from giving ideas	Unfortunately, due to the non-payment of the prize to those whose ideas have been selected, it causes discouragement.
Restrictions arising from sanctions	Due to the political situation and the oppressive sanctions and the lack of liquidity, the construction of petro-refineries has not been done in practice
Assign decisions to refineries themselves	Many decisions and tasks regarding product development should be left to the refining companies themselves
Creating a research unit	Creating a research unit, where all the ideas obtained in this research unit are reviewed and the best idea is selected.
Lack of priority for product development for the government	In my opinion, in the Ministry of Oil and the National Iranian Gas Company, from the beginning, the issue of product development and separation of other products has not been a high priority
Existence of cost-oriented views	One of the strategies adopted by the Ministry of Oil in refining companies is to reduce costs
Comprehensive feasibility study	On this side, I believe that if it is done before the implementation of the research and marketing plan, and the successful products of our competitors, most of which are

Concepts	Semantic propositions
	the countries of the Persian Gulf.
Lack of sufficient capital	Lack of initial capital to develop the product at the time of project implementation in my opinion is one of the major problems.
Lagging behind other competitors in the market	Lack of timely supply and entry into the market also leads to the loss of customers and of course the prolongation of the issue of return on investment
One-dimensional feasibility	In the product development of refining companies, the feasibility of production may be done well, but the feasibility of the market in international markets is not done well.
Limitations on idea presentation	Restrictions on the presentation of ideas lead to reduced product development and, by its very nature, market loss
Weakness in market estimation and forecasting	Lack of estimation and forecasting of the market is weak in terms of the reaction of competitors as well as the lack of feasibility and study.
Technological weakness	Also, the impossibility of study and study is weak, which leads to the prolongation of the product development process and sometimes the failure of this issue.
Look up and down at refinery decisions	One of the problems of product design and development in my opinion, as I stated in your service requests, is the issue of product design and development by senior managers of the Ministry of Oil.
Non-participation of private companies	Due to the issues of sanctions and the non-participation of private companies in the projects, "financing" in this regard is practically difficult.
Modeling of successful companies	We also need to do the necessary research on how their companies are designed and how well the product is compatible with their facilities and technologies to develop the product
Investing in foreign companies	We have to invest in their companies (foreigners) and sign multi-year contracts with them.
Weaknesses in research and marketing of foreign consumers	For the success of a new product, marketing research and the needs of consumers and companies abroad must be examined.
Creating specialized committees to spread the idea	In the refinery, the relevant specialized committees must be selected and the most important idea selected after screening the initial ideas.
Material and spiritual encouragement of colleagues' ideas	The issue of giving ideas by colleagues has become less important due to the lack of rewards for the resulting savings.
Motivate employees and raise work conscience	Motivate your colleagues. Because the colleagues themselves see the result of their ideas and in this regard, they make a double effort to achieve the goal

Concepts	Semantic propositions
Poor publicity internationally	Perhaps one of the problems with new product development in refineries is poor publicity and reduced political influence in OPEC and other international organizations.
Weaknesses in market research and marketing	Regarding market research and marketing for new products, due to the fierce competition of other companies, more efforts should be made, which is not done well.

As mentioned above, in the present study, the researcher adjusted the material and interviews conducted in the Word file in order to use the MAXQDA software to analyze the data; After entering the Word file of the interviews into MAXQDA software and in the open coding stage, we considered labels and concepts for the interviews (semantic propositions); It was time to categorize them in the pivotal coding stage. The categorization of the data was done in such a way that, using continuous movements between the primary data, similarities and differences between the concepts were found and those concepts and data that were common to each other were named in a separate category. And arranged; So that the name of each category includes all the relevant common concepts. As shown in the open coding stage, most of the experts interviewed agreed that the ideation process in the studied oil and gas companies is incomplete and random. The present study analyzes this category of research as follows. Contrary to many companies' beliefs, the concept of correct ideation means the process of brainstorming and sifting through thousands of ideas. The importance of this category is due to the creation of a managerial attitude of ideation and innovation in the organization, because one of the best places to start a new product development project will be the idea discovery phase.

Table 2.
The Central Category of Weakness in Ideation and Iidea Screening

Concept	The central category
- Discouragement of experts from giving ideas - Limitations on the presentation of ideas - Establishment of specialized committees to screen ideas - Finding ideas from domestic and foreign partners and companies	Weakness in ideation and screening of ideas

Planning and implementation of project-oriented activities in a proper and meaningful sequence is very important and through this, rework and redesign can be minimized. This will be achieved through information and knowledge management. The design structure matrix introduced by Steward in 1981 can be considered as a useful tool in this regard. Using this method and the work transfer matrix makes the design process similar to a time-discrete fixed linear dynamic system. Be modeled. In this method, to minimize the side effects of increasing the convergence speed on the quality of the design, fuzzy logic is used to model the constraints quantitatively. Therefore, the main advantage of the method is to increase the speed of convergence of revision cycles in redesigns and at the same time to establish a balance between speed and quality of designs. The most basic work in this regard will be the formation of the core of the project management team, including the new product development project manager and senior managers of the organization or their representatives. The cornerstone of project management is based on planetary organization, and the main interface between the new product development body and the project management team will be the project manager.

Table 3.
Central Category of Compilation, Description and Planning

Concept	The central category
- Effective planning - Correct targeting - Get advice on planning	Compilation, description and planning

This category will be the last step in forming the basic concept for the product, compared to other categories, this category will be the most critical category of new product development, because many investments, costs and project resources in This stage is planned and will be used in the future, and the wrong planning and orientation in the concept of the product or business plan will incur exorbitant costs - sometimes at the cost of project failure. Therefore, the attention of organizations in this phase to the reasons for the success and failure of previous projects and the use of their experiences will be very important and fundamental.

Table 4.
Axis Category of Complete Feasibility Study

Concept	The central category
- Comprehensive feasibility study - View one-dimensional feasibility in the organization	Complete feasibility

The culmination of product development is the entry of the product into the market. This action, which is also known as product launching process, is the point at which, according to the current strategies and stated in the business plan, the organization will decide to bring the final product to the target market. Based on the plan envisaged in the business plan, the organization will produce and be present in the target market and will introduce the final product to its consumers. Determining sales

strategies, up-to-date pricing, production volume, etc. are items that will be frequently used and referenced as input in this phase.

Table 5.
The Central Category of Complete Marketing

Concept	The central category
-Weaknesses in market research and marketing -Poor advertising at the international level - Weakness in market estimation and forecasting -Lack of knowledge of global markets	Complete marketing

In order to develop a new product, it is very important to pay attention to the human resources working in the organization. The interviewees often believed that employee satisfaction and job commitment and conscience were essential to them.

Table 6.
The Central Category of Effective Human Resource Efficiency

Concept	The central category
- Motivate employees opinions - Raising the work conscience of employees - Material and spiritual - Asking colleagues for encouragement of employees	Effective efficiency of manpower

If we want to look at this category as one of the initial stages of a new product development project, perhaps one of the ways to reach new ideas is to use group meetings such as brainstorming, Delphi method, etc. Of course, these methods are organized and systematic. The most important achievement of this category will be finding an idea, need, opportunity, etc. for development. At this stage, the project management team may not have been formed yet.

Table 7.
The Central Category of Field Research

Concept	The central category
- Carrying out preliminary research - Creating a research unit	Research and field research

Among the factors that have a significant impact on slowing down the production process are the economic barriers that the organizations under study face. The semantic statements made by the experts in the open coding stage confirm our claim.

Table 8.
The Central Category of Economic Barriers

Concept	The central category
- Lack of sufficient capital - Existence of cost-oriented views	Economic barriers

The interviewees mostly agreed that political decisions, both domestically and internationally, affect the success and failure of the product development process.

Table 9.
The Central Category of Political Barriers

Concept	The central category
-Restrictions arising from sanctions - Lack of priority for product development for the government	Political barriers

Experts from oil and gas companies stressed that there are some rules that are imposed on the organization from above and the organization does not have much independence in decisions; According to them, this top-down view has a great impact on slowing down the production process of a new product.

Table 10.
The Central Category of Legal Barriers

Concept	The central category
- Look up and down on refinery decisions - The need to give decisions to refineries	Legal barriers

The product development process is a set of interrelated actions used to turn a new idea, concept or market opportunity into a viable product. Such processes are generally very complex and dynamic. The complexity of these processes is due to the fact that they always deal with multiple specialties and sometimes require multiple specialties such as mechatronics. The goal is to wrestle. The dynamics of these processes is due to the fact that the evolution of the product over time is constantly accompanied by changes in the market, customer tastes, changes in technology and even changes within the organization and changes in the external environment governing organizations. In addition to these issues, the relative evolution of knowledge in society and the environment inside and outside the organization should not be simply overlooked.

Table 11.
The Central Category of Productivity of Modern Technology in the World

Concept	The central category
-The need to comply with international standards -Need to use the latest market technology -Weak technology in the organization	Productivity of the latest technology in the world

Remember that any product or service that is provided in the form of current and current needs of its customers, will inevitably become obsolete after its life cycle, and these newer technologies There are more appropriate and appropriate answers to the changing and different

preferences and needs of different types of users and customers. But today, speeding up product development processes and faster presentation of products and services in the market is an issue that companies and organizations pay special attention to. If the product development process into a contest involves three times:

- Production time: the stage of developing the initial idea for a new product to the stage before the product is released to the market
- Market entry time: the stage of supply and presentation of the product in the market (product marketing)
- Time to make a profit: The transition from head to toe and making a profit Consider.

the company and organization will be the real winner in this competition to win all three categories [57]. Striving for such success will lead to calling the product development process a process from idea to profit. It is interesting that when offering products to the market, we will see three different types of approaches to product presentation to the market between competitors. These approaches include: - The first approach in the market: The organization is interested in being the first organization to launch a new product in the market. - The fastest follow-up approach: In this approach, the organization does not want to be called the first supplier of a new product in the market as before, but wants to be the fastest company that offers the same product to the market. - Normal sequence approach: The organization is not the first sequence, but will be among the sequences of the manufacturer and supplier of the new product.

Table 12.
The Central Category of Non-timely Presence of the Product in the Market

Concept	The central category
- Timely delivery of the product to the customer - Falling behind other competitors - Delay in the product production process	Lack of timely presence of the product in the market

Today, investment and partnership with other domestic and foreign companies are recognized as the basis for most new product development models. In this regard, participation is about different parts of the organization, such as: marketing, research and development, collection finance, and so on. Strictly like a network model that emphasizes the chain link between external relationships and internal activities that contribute to the success of new product development. There is considerable evidence to suggest that the external communications chain can facilitate the entry of surplus currents into the organization. In fact, it promotes a new product development process.

Table 13.
The Central Category of Non-investment and Participation

Concept	The central category
- Lack of modeling of successful companies -Non-participation of private companies -Lack of investment in foreign companies	Lack of investment and participation

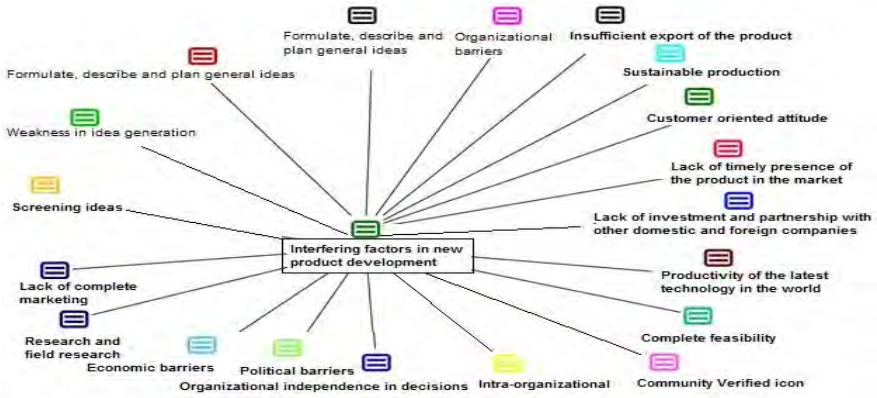
Customer orientation in relation to product development concepts is more in line with the concept of simultaneous engineering. The concept of simultaneous engineering initially means reducing product development time. Simultaneous engineering today expresses an integrated systematic approach, which simultaneously designs products and related processes, including manufacturing and after-sales service. Simultaneous engineering is a systematic approach to integrated product development that emphasizes responding to customer needs and expectations.

Table 14.
The Central Category of Customer-oriented Attitude

Concept	The central category
- customer satisfaction - Improving quality and quantity at the same time	Customer oriented attitude

Selective coding indicates the last step in the analysis of this research. At this stage, the researcher's first step was to identify the main line of research. That is, the main purpose of this study was also evident in the data obtained. Then, in order to be able to give this main line a name as the main category (the name we give to the main category must include all the words related to the paradigm), to conceptualize and analyze the categories obtained in the coding Previous, paid. After naming the main category, the main category, like the other categories obtained in the previous steps, was expanded in terms of its characteristics and dimensions. In this stage of coding, which is the final stage of coding using MAXQDA software, the categories obtained in the previous stages, in a main category called "interfering factors in the development of a new product" which included all categories Merged; Figure 1 shows this step of coding.

Figure 1.
Selection of the Main Category of Research in the Selective Coding Stage



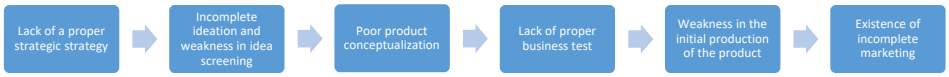
After naming the main category of research as "interfering factors in new product development", we will continue to review and analyze the main category of research. When reviewing the research conducted on these interfering factors and based on their time course, it is clear that in the beginning, researchers sought to find the causes of failure of product development projects. But most of these projects, because they had dark and painful records for their organizations after the failure in the past, are either forgotten or not expressed in scientific circles, because most of them easily express the weaknesses of their project owners. And few organizations are willing to express their problems publicly in international forums. Therefore, researchers' research, like the projects studied, failed or could not be cited extensively scientifically. So, in a 180-degree rotation, the researchers' behavior is focused on research into the success factors of product development projects. There are many reasons that have justified the failure of about 40% of new product development projects over the past years, but as mentioned above, due to existing issues These factors are not sufficient coverage for all factors of product development project failure. New products open new ways and new opportunities for organizations to make a profit and hope for survival, but at a significant risk associated with new product development projects Should not be neglected. Experimental studies show a high failure rate of new products in consumer markets. But expressing successes and conquests is not only sweet for everyone, but will also provide credibility for successful organizations. Therefore, it is obvious that the managers of successful organizations, as long as their strategic interests are not jeopardized, and other managers of organizations are interested in talking about these factors in order to gain experience of successful organizations.

Conclusion

Given that the title of this article is a product development process model; The model of this research is presented as a process model. The

current process of developing new products in the studied refineries is as follows: Due to the lack of a clear strategy and the lack of a clear relationship between new product development decisions and the company's strategy, the idea is first presented by marketing, research and development experts; These ideas have weaknesses such as: lack of important ideas about the new product and the rapid growth of legal and social constraints, failure to use customer feedback in ideation and screening of ideas and other stages of product development are the most important problems of ideation and screening Are ideas. Then in the next step, the product is conceptualized and tested without considering the quality characteristics of the product in this process. The next stage of new product development in the studied refineries is the commercialization of the product, which is also costly due to the high cost of the new product production process (finding and developing a new product is usually costly when the product reaches the mass production stage of advertising and distribution. Will increase again) and capital shortages (many companies cannot afford the huge sums that must be invested to create a new product, so they focus on modifying and copying products rather than inventing and innovating) with problems. Abundance is encountered in these refineries. After the product commercial testing phase, it is time to produce a product prototype for product marketing; Product defects, unforeseen costs, and poor timing, high prices, and technical problems of the product are among the problems and weaknesses of the refineries studied at this stage. Finally, the last stage of new product development, namely the stage of launching and introducing the product to the market, is discussed. This stage is also due to the imbalance between the additional cost due to the acceleration of product introduction and the additional revenue due to the speed in introducing the product to the market, insufficient attention to market leaders, lack of effective marketing efforts, and ultimately weakness in product distribution Refineries are not successful.

Figure 2.
Model of the Current Situation of the New Product Development Process in the Studied Refineries



According to the experts in the present study, the strategies to improve the new product development process in each of the stages of the six-stage product development process in the refineries under study (Figure 2) are as follows: Strategies for improving the new product strategy phase are long-term strategic thinking, appropriate market orientation, choosing customer-centric strategies instead of profit-oriented strategies, quickly identifying new market opportunities, clearly defining market goals Senior management support the product development team, organize and form multi-purpose teams to decide and solve problems, work closely with customers and suppliers to develop optimal new product development strategies, review and revise product development strategies Develop dynamic, interactive, and adaptive strategies, accurate knowledge of customer needs and relationship with the customer in the product development process, having a strategic insight in the business to gain a competitive advantage in the long run. This finding from the present study is consistent with the following research findings: The Hopkins (1981) study of 91 medium and large companies in the United States identified improved market research as the best way to reduce product failure rates. Comparing the successful and unsuccessful products of the company and modeling the competitors and their successful products, evaluating the development of the company's past products formally, and reviewing the conditions and process of product development before practical action for product development are the main strategies to improve product development.

According to Roswell et al. (1972), successful innovation projects had the following characteristics: 1) they had a better understanding of consumer needs, 2) they paid more attention to marketing and reputation. Strategies to improve the stage of creating new product ideas and screening them are selecting customer-centric ideas based on studying the background and previous theories of customers, selecting new product ideas using modeling techniques, selecting New ideas and concepts based on and in line with existing standards at the global level, partnership and close cooperation of research and development teams with innovation networks in order to obtain new ideas, joint cooperation with customers in idea generation and screening. Strategies for improving the new product concept development stage and evaluating it are employing and performing the customer value determination process in order to test the new product concept from the customers' point of view, interacting with the best stakeholders in the market, both personally and Through market research and focus on the real needs of customers. Strategies for improving the business test stage are applying quality improvement techniques, paying attention to customer needs in building a new product model, using information technology to inform all members of the new product development operations team, using flexible production techniques In the process of making a new product, the application of engineering technique at the same time in the manufacturing process, the application of timely production technique in the process of making a new product. Strategies to improve the prototype production stage and new product marketing test are Emphasis on meeting the goals of stakeholders in the market, reviewing the acceptance and satisfaction of stakeholders from making a new product prototype in the market, introducing a superior and unique product , Having production, technical and expert synergy, easy product use, safety with more reliability, and time saving.

Figure 3.

Proposed (Optimal) Model of New Product Development Process in the Refineries Studied According to the Answers of the Interviewees

Strategies to improve the stage of introducing a new product to the market are providing information to determine the strategies to start introducing a new product, accurate forecast of market changes to determine the appropriate time to start mass production , Extensive product advertising.

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