

دوازدهمین کنگره ملی سراسری
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Application of information technology in new product development

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Abstract — This research was conducted with the aim of investigating the impact of information technology application on the new product development (NPD) process. Data collection has been done using a Likert scale questionnaire. In this research, 18 hypotheses have been proposed, which have been examined and statistically analyzed by non-parametric hypothesis testing and chi-square test. The results of this research and hypothesis testing show the positive impact of information technology on the new product development process.

Keywords- information technology; new product development (NPD)

1. Introduction

Recent years have been proof of this claim that the significant change in people's expectations as well as the reduction of the product life cycle have caused the increasing impact of the product development process on the success of organizations. Increasing research has been done in relation to new product development in various organizations, which includes sales, technology, organizational theories, and engineering [1,2]. Successful development of a new product is one of the competitive advantages for companies. For the successful development of a new product, a company must be able to develop an innovative product that is attractive to customers, and by mass-producing it, obtain its profit through huge sales [3]. The speed of technology and market changes has accelerated tremendously in the last decade. Focusing on competitive success in today's very chaotic conditions is one of the capabilities of companies in the field of new product development. New products are increasingly becoming the key to companies' success. There is a very strong relation between the development of a new product and production lines, in order to restore the production system to a state of high production and deal with waste and low efficiency in the shortest possible time [3,4]. Considering that information technology can provide valuable opportunities to industrial companies in relation to NPD, therefore, paying attention to information technology as a new and accessible technology and knowledge in the new product development process seems very necessary. Therefore, examining various aspects of information technology and analyzing the results of using this technology in the development of a new product is a subject that has been examined and studied in this research.

2. New product development process

In fact, the development of a new product is a process that requires obtaining a large amount of information about technical, sales, financial, etc. issues and integrates a set of activities. New product development is basically a high-risk activity, where high costs and commercial and technical risk are inherent parts of it [5]. The process of developing a new product is one of the most complex and time-consuming processes that involves several plannings and operations. The new product development process can be divided into separate phases;

- a) Idea creation and conceptual design
- b) Definition of characteristics
- c) Prototype and development
- d) Commercialization

By examining various studies, this result is clearly obtained that the new product development process is different from one industry to another [6,7].

2.1. All kinds of new products

The products that are defined in the category of new products include completely new products, improvements and revisions of existing products, repositioning, cost reduction, and new product lines [8].

2.1.1. completely new products

There are products that are mostly based on innovation and inventions [9]. These types of products are transforming the market to some extent. It means that they have never been exposed to the public in any market, and may have been presented only as an idea or a prediction by a manufacturer for a production opportunity. These types of products usually create a new market that has never existed before [8].

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2.1.2. new product lines

Contrary to the classification of other resources, entering the new class is the products that enter the company into a class of production of products that are new for the company and of course these products are not new to the world [9]. This class of products opens the doors to enter markets in which the manufacturer has not participated or intervened. With the addition of classes, the manufacturer should be careful about fixing the position of the current products because they have been the generator of the current business [8].

2.1.3. Improvement and review of existing products

Making improvements to existing products does not create appreciable added value. In fact, this method is a tool to maintain the markets in hand or slightly improve it. In market conditions, improvement is considered as a defense tool that can be a temporary solution until a new product is released [5].

2.1.4. Repositioning the product

Product repositioning means re-creation to increase efficiency and new applications [9]. Changing the position is one of the ways to increase or stabilize the market share. This method includes actions to change the mentality of customers. Product repositioning is actually a marketing move rather than a development move and is mostly done on products that customers don't spend much time looking at [8].

2.1.5. Costs Reduction

These programs are exactly a tool to reduce the costs of products to provide the same and efficiency. In fact, this method is the result of an innovative competition and also, inwardly, the result of external forces. In many cases, this method is a simple tool to create more capacity in order to create less upside profits and of course more overall profits. Cost reduction is a useful help to the organization by earning more gross profit from the existing product. This gross profit can absorb the development and production start-up costs [8].

3. Information Technology

The answer to the question of what is information technology seems simple. Because it consists of hardware, software, communication and serving the users of this technology. Of course, in the various researches that have been conducted in this field, in most cases, not all of these cases are addressed, and only one of them is considered, which is the category of hardware [2]. Now we may have a good attitude about the term IT, but a more precise expression of the term is more appropriate. In fact, the term information technology includes a wide range of elements and capabilities that include creation and production, storage and expansion of data and information, as well as knowledge production. Data consists of basic information, charts and details, while information represents a practical, organized and meaningful interpretation of data. And knowledge is awareness and understanding of a set of information and how to place information for better information efficiency [10-13].

3.1. Main components of information technology

Computers and all related components are called hardware. The hardware itself has no functionality. The software expresses the necessary instructions for managing and using the hardware in line with the intended goals. Finally, a system includes a set of components including humans, computers, and other business activities that pursue a specific goal with internal communications. Every business is considered a system whose main components are production, marketing, sales, research and research, transportation, accounting and human resources, all of which work to produce a product or provide a service or each other. Modern businesses are significantly dependent on information systems. In general, the three main components of information

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technology are computers, communication networks, and the know-how or specialized knowledge that data and information are the product of these components of this information technology [13].

4. information systems

In fact, studying various sources, there is a distinction between information systems and information technology, and this distinction and difference also exists in the strategy of information technology and information systems [10]. Information systems have brought significant feedback for some organizations and in many other organizations information systems have supported their activities. The cost of the systems may be very high. There are few organizations that can function without proper information systems. As long as information systems can be vital and necessary for the activities of organizations to guide and develop business, working with information systems is still recommended as a secondary activity. Today, in the global competitive market, strategic planning of information systems is considered vital for organizations to achieve success. Strategic planning is a process by which an organization determines computer-based practical measures to help achieve its goals and objectives [11-16].

5. Research hypotheses: Application of information technology in the new product development process

Considering that in this research, the relationship and impact of information technology on all phases of new product development has been considered, therefore, the hypotheses that are raised in this research include 14 main hypotheses that examine the impact of using information technology in the new product development process. In the sub-hypotheses of this research, which includes hypotheses 15 to 18, the statistical relationship between age, education level, organizational position and experience of experts with the level of familiarity and literacy of information technology is investigated (table 1).

Table 1. Main hypotheses and sub-hypotheses of this research

H1	There is a statistically significant relationship between the use of information technology and facilitating the identification of new product opportunities.
H2	There is a significant relationship between the use of information technology and the improvement of the new product ideation process.
H3	There is a significant relationship between the use of information technology and the improvement of the new product evaluation process.
H4	There is a significant relationship between the use of information technology and the improvement of the new product development process.
H5	There is a significant relationship between the use of information technology and the improvement of the new product market entry process.
H6	There is a significant relationship between the use of information technology and the reduction of new product development process costs.
H7	There is a significant relationship between the use of information technology and increasing the speed of the new product development process.
H8	There is a significant relationship between the use of information technology and the improvement of new product development process management.
H9	There is a significant relationship between the use of information technology and the improvement of intra-organizational cooperation in the new product development process.

- H10 There is a significant relationship between the use of information technology and the improvement of extra-organizational cooperation in the new product development process.
- H11 There is a significant relationship between the use of information technology and increasing the competitive power of the company developing a new product.
- H12 There is a significant relationship between the use of information technology and increasing the profitability of the new product development company.
- H13 There is a significant relationship between the use of information technology and the quality improvement of the new product.
- H14 There is a significant relationship between the use of information technology and the reduction of the final price of a new product.
- H15 There is a significant relationship between the age of experts and the level of familiarity with information technology.
- H16 There is a significant relationship between the level of education of experts and the level of familiarity with information technology.
- H17 There is a significant relationship between the organizational position of experts and the level of familiarity with information technology.
- H18 There is a significant relationship between the experience of experts and the level of familiarity with information technology.
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6. Research methodology

The implementation of this research was based on a Likert-scale questionnaire, which consists of 38 propositions with the content of investigating the impact of the use of information technology on the phases and indicators of new product development. At the beginning of the questionnaire, in order to study the characteristics of the respondents, selected questions such as age, level of education, work experience, organizational position and the level of information technology literacy of people were included in 4 levels: weak, average, good and excellent. In order to calculate the validity of the questionnaire, the method of checking the content validity and calculating the validity index (correlation coefficient) was used. which is calculated from equation 1, and in order to calculate the validity of the questionnaire separately, the two bisecting methods of Apsierman-Brown (equation 2) and Kornbach's alpha (equation 3) have been used. Hypothesis testing in this research is based on non-parametric hypothesis testing and the use of chi-square (X^2) test. X^2 test is a non-parametric test and is used when the data is abundant and can be divided into two or more classes. The greater the difference between the observed and expected frequencies, the greater the statistical value of X^2 , and by referring to the standard table of X^2 , it is determined whether the calculated value of chi-square is significant at a certain level.

$$r_{xy} = \frac{N \sum xy - \sum x \sum y}{\sqrt{[N \sum x^2 - (\sum x)^2][N \sum y^2 - (\sum y)^2]}} \quad (1)$$

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$$r_{xy} = \frac{N \sum xy - \sum x \sum y}{\sqrt{[N \sum x^2 - (\sum x)^2][N \sum y^2 - (\sum y)^2]}} \quad (1)$$

$$r_{11} = \frac{2r_{11}}{1 + r_{11}} \quad (2)$$

The results of calculating validity and reliability of the questionnaire were as follows:

$$r_{xy} = 0.71 \quad r_{11} = 0.83 \quad \alpha = 0.85$$

7. Results

The results of the non-parametric statistical analysis, that is, the hypothesis test, which was performed using the chi-square test, are listed in Table 2. There is a statistically significant relationship between the application of information technology and facilitating the identification of new product opportunities with hypotheses 1 to 14 (table 2). Also, there is a significant relationship between the level of education of specialists and the level of familiarity with information technology. However, there is no significant relationship between the age of experts, organizational position and their work experience with the level of familiarity with information technology.

Table 2. The results of hypothesis testing using chi-square test

Hype	Pearson Chi-Square (Value)	df	Asymp. Sig. (2-sided)	X ² _{0.05, df}
H1	35.404	1	0.000	3.841
H2	43.162	1	0.000	3.841
H3	28.020	1	0.000	3.841
H4	16.370	1	0.000	3.841
H5	8.991	1	0.003	3.841

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H6	13.663	1	0.000	3.841
H7	16.001	1	0.000	3.841
H8	38.984	1	0.000	3.841
H9	12.348	1	0.000	3.841
H10	4.424	1	0.035	3.841
H11	23.182	1	.000	3.841
H12	32.304	1	0.000	3.841
H13	4.455	1	0.035	3.841
H14	14.709	1	0.000	3.841
H15	9.716	6	0.137	12.592
H16	16.095	6	0.013	12.592
H17	6.312	6	0.389	12.592
H18	6.018	6	0.421	12.592

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