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# Metrics for innovation of product – the basis for continuous improvement of an organization

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**Abstract:** Innovation is becoming more and more important in modern society. There are a lot of researches on different kinds of innovation, product innovation is one of the most studied types of innovation and it refers to the development of goods or service characteristics or with intent to use which differs significantly from previous products made by the company. Innovative product includes significant changes in the technical specifications in components and materials, incorporated software, user friendliness or other functional characteristics. The study shows some key elements of product innovation that are worth paying attention when implementing product innovation projects. Examples of such key elements are the characteristics of new products or strategic options for launching a new product. Beside the key elements of product innovation, we also present some risks that may occur, such as cost, market uncertainty, information leakage, imitation and over depending on experience. By proposing a set of indicators to measure product innovation, the article offers solutions for product innovation implementation so that any organization can have a base for continuous achievement of optimal results.

**Keywords:** Innovation, Product Innovation, New Products, Performance in an Organization, Management Systems

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## 1. Introduction

It is impossible to imagine the world today without steady progress. Innovation is an everyday phenomenon that changes progressively the economy and society [1], [2], [3], [4], [5].

The notion of “innovation”, from an economic point of view, was analyzed for the first time by Austrian scientist J. Schumpeter [2] in the first decade of the twentieth century in his work, „The Theory of Economic Development”[3] where innovation is defined as „all changes in order to implement and use new types of products, means of production and transportation, markets and forms of organization of the production process” [6], [7].

Within the innovation, as it is defined by Schumpeter, five types of activities are accepted: the creation of a new product or substantial improvement of an existing one, the introduction of new production methods, opening new markets, developing new sources of raw materials and creating or changing an industrial company. Lately, it may allow the emergence of the sixth activities: creating a new image of

the organization [8], [9].

According to the theory developed by Schumpeter competition to launch new products is far more important than price strategies for products existing in the market. According to the Schumpeterian approach organizations are separate entities, each organization can manage its resources over time in a certain way and develop capabilities throughout time that will influence the performance of the organization in terms of innovation [10].

### 1.1. The concept of Product

A product is any thing offered on the market in order to capture interest, to purchase, to use, or consumption and that can satisfy a need or a desire, it includes physical objects (tangible), services, people, places, organizations and ideas [9].

The product is seen as a multidimensional offer, as a mixture of tangible and intangible attributes [11], [12], [13], which can be divided into three levels (Figure 1):

- *Basic product* which represents services or the primary benefits that the buyers are seeking when purchasing the

product (if the customer does not perceive its usefulness practically does not exist for this product).

- *Total product* (or improved one) add to the based product a number of intangible features that enhance the attractiveness and usefulness of the product (warranty, change defective products, free service, credit, home delivery, brand image, etc.).

- *The real product* placed around the basic product combines traits such as: quality, features, brand, packaging style so as to provide a basic advantage into a form appropriate to the consumer requirements.

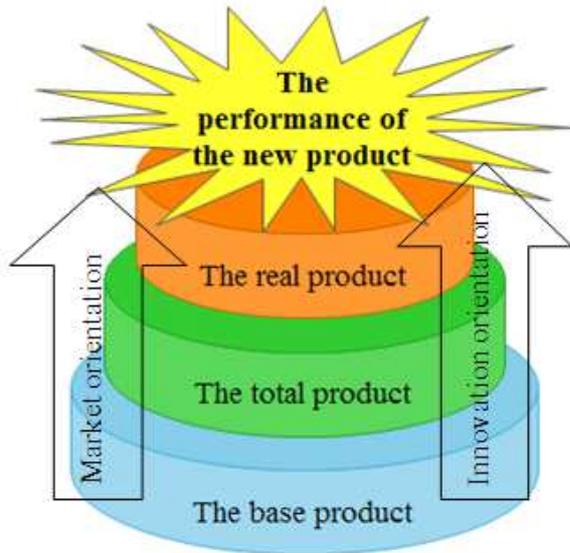


Figure 1. Levels and guidance products [authors proposal]

Market orientation is a critical determinant of the performance of new products and its role in product innovation is even greater than the orientation towards innovation.

Orientation towards innovation is a strategy to improve the performance of the new product. It involves a firm to be proactive by exploring new opportunities and the ability to exceed customer expectations. A business oriented towards innovation changes the values and encourage risk-taking and creativity, making employees feel less threatened when are working and risks in new areas.

Therefore, managers should build a market orientation along with organizational culture. Market orientation has the same significant impact on the new product performance, regardless of market turbulence and competitive intensity [13], [14].

1.2. Classification of Products by the Degree of Novelty

The novelty recognition and recording, as well as the length of time that, the concerned product, may have attached the new attribute, are elements that must be established for each product in order to analyze and determine the corresponding effects on the company, but also enterprise sectors in which they operate [11], [12], [13].

A classification of products according to their degree of novelty is presented by grouping them into eight categories

[11], [12], [13]:

1. products creating a need that previously doesn't exist;
2. new products for existing needs;
3. improved products that better satisfy the existing needs;
4. new variants of products specific to new segments of consumers;
5. new uses for existing products;
6. new packaging for the product;
7. a new form of distribution for existing products;
8. a new price for existing products.

Considering as new products both the original ones and those improved, changed or even copied, the company must find the best solutions to minimize the risks of failure, considering that new products have a low success rate (about 20%), are expensive and time consuming [11], [12], [13].

1.3. The Characteristic of the New Products

The most successful new products are those that bring bigger benefices and improved solutions on client needs [13]. The criteria that a product must fulfill are presented in Figure 2.

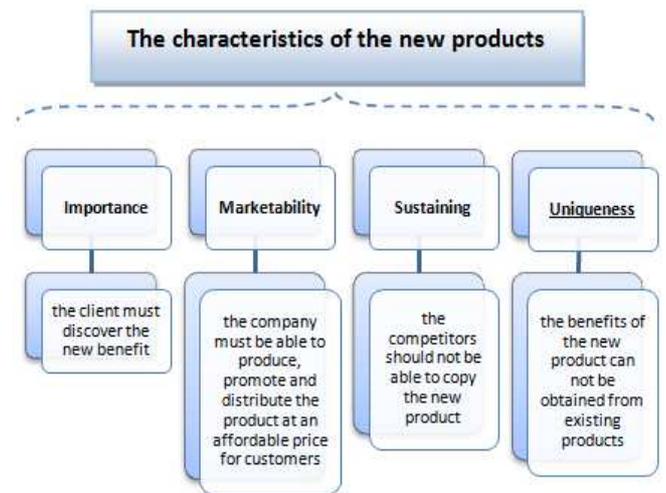


Figure 2. The characteristics of the new products [authors proposal]

Product innovation can identify six categories of new products [11], [12], [13]:

1. Absolute news, with potential to create new markets and even new industries, but such innovations are rare and having a major risk of developing and marketing.
2. New lines of products, which are not new on markets, but are new for the producer.
3. Expansion of existing product lines, which is realized within existing production lines at the company level.
4. Improvements and revisions of existing products by repackaging, conditioning, changes in the composition of the products, design etc.
5. Repositioning, which consist of new uses for existing products or switching to the new market segments.
6. Cost reduction, which takes place by designing products such that they maintain their performance in terms of

lower cost, and this is also possible due to the process of innovation.

## 2. Product Innovation

The innovation process is a complex one which cannot be regarded as a linear model but as a sequence of predetermined steps, because of the many connections and interdependencies between them and reiterating that occur.

The process of new product development has been the subject of numerous studies and models designed to determine its stages, sequence and content, decisional criteria as well as the efficiency and shortens methods of duration and reducing the risks involved [14], [15], [16], [17], [18].

### 2.1. The Steps of the Product Innovation

A model often used in European companies is the one known as "Stage-Gate Process," a conceptual and operational model presents a road map for a new product project from the idea emergence up to its market launch.

The system is widely used today in many large companies, knowing several ways to implement, that essentially starts from the same approach of the innovation process, as a sequence of steps among which are interspersed "decision gate", allowing management decisions that allow or not the continuing of the process [19] (Figure 3).

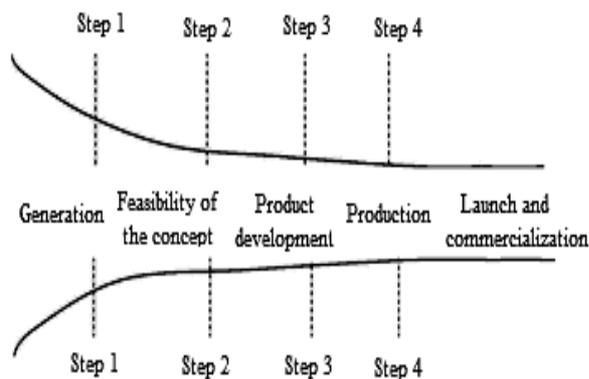


Figure 3. „Stage- Gate Process” [after [19]]

Thus, the innovation consists of a set of predetermined steps, each step in turn comprising a number of parallel activities and interrelated preset at the beginning of each stage being a decision point (which serves as a quality gate control) of continuing or stopping the innovation process.

### Product Innovation Indicators

Research on the literature shows that although it is known the importance of innovation, the measurement of innovation so far has been largely fragmentary, incomplete, and accidental. Profit increasing for company need for monitoring and benchmarking their innovation performance is the main reason for this change [20].

Both public and academic researcher are studying the identification of metrics for measuring innovation. In this article we identified a number of product innovation indicators, shown in table 1.

Table 1. Set of indicators for product innovation [authors proposal]

Set of product innovation indicators
The amount of revenue from the new product
Return on investment in new product development
Time to develop new ideas
The percentage of the ideas embodied in a new product
The number of products with functional design changes and / or technological
The number of products with changes in raw materials and components used
The number of products with changes in the shape, appearance, size (new design)
The number of products with the latest technological innovations
Speed of new product development
The number of marketed products
Sales of new products
The number of patents / trademarks / designs
The change in innovation during product realization
Product efficiency (ratio between output and effort)
The number of prototypes that have reached mass production
The number of inventions completed by an innovation
The number of technology transfer processes
The number of national and international patents registered
The number of products and technology products and techniques demonstrable (or application in economics)
The percentage of innovative projects from year to year (the evolution of innovation projects)

To measure product innovation, we identify the major requirements for the performance of innovation that are presented in Table 2.

Table 2. Requirements for innovation performance[authors proposal]

Requirements for innovation performance
Recovery rate of capital / innovation
Economic rate of return
Rate of return
Payback period
Growth rate of turnover
The rate of increase of the market
The growth rate of new products
Operating profit rate
Asset Recovery Rates
Operating profit margin
Productivity rate
Business solvency
Financial Internal Rate of Return

If you study carefully the set of indicators proposed for product innovation and performance requirements specified, systematized in Table 1 and Table 2, you will find that there are strong relationships between their different aspects. In order to highlight this more clearly in Figure 4 an analysis based on QFD method is presented.

Cerințe	Indicatori pentru inovativitate de produs																						Importance to Customer	Relative Importance	
	1 Valoarea veniturilor obținute din no...	2 Rentabilitatea investiției în dezvolt...	3 Timpul de elaborare a ideii noi 3 ani	4 Procentul din ideile materializate i...	5 Numarul produselor cu schimbări i...	6 Numarul produselor cu schimbări i...	7 Numarul produselor cu schimbări p...	8 Numarul produselor cu cele mai re...	9 Viteza de dezvoltare a produselor...	10 Numarul de produse noi introduse...	11 Vanzarile de produse noi 3 ani	12 Numarul de brevete de invenții p...	13 Gradul de modificare a invenției p...	14 Eficiența produsului (raport între r...	15 Numarul de prototipuri care au aj...	16 Numarul de invenții finalizate prin...	17 Numarul proceselor de transfer te...	18 Numarul de cereri de brevete nati...	19 Numarul de produse și tehnologii...	20 Procentul proiectelor de inovare d...	21 Metode noi de trunchiatăre a cali...	22 Creșterea numărului de inovati d...			
1 Rata de recuperare a capitalului/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0,2	23,7%
2 Rata de rentabilitate economica/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0,0	4,3%
3 Rata de recuperare a investiției/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0,2	15,5%
4 Perioada de recuperare a investiții	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0,1	12,9%
5 Rata de creștere a cifrei de afaceri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0,1	7,7%
6 Rata de creștere a pieței	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0,0	4,8%
7 Rata de creștere a produselor noi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0,1	8,3%
8 Rata profitului din exploatare	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0,0	2,8%
9 Rata de recuperare a activelor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0,0	2,7%
10 Marja profitului din exploatare	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0,0	3,1%
11 Rata productivității	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0,0	3,9%
12 Solvabilitatea afacerii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0,1	5,0%
13 Rata internă de rentabilitate fina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0,1	5,3%
Number of significant relationships	11	10	7	7	5	5	12	12	7	10	13	5	7	11	8	10	2	4	2	10	10	10			
Importance	9,5%	7,7%	4,1%	1,3%	2,0%	3,9%	10,0%	2,2%	5,2%	11,3%	2,1%	3,4%	4,6%	3,5%	4,1%	1,7%	2,5%	1,7%	3,7%	6,8%	6,8%				

Figure 4. Analysis of the links between innovation performance requirements and product innovation indicators (using Qualica QFD)

As it can be seen, there are strong links between certain requirements and certain indicators. This is a clear sign that the proposed set of indicators corresponds to the performance for innovation.

### 3. Conclusions

Currently any organization, regardless of the specific activity must be prepared to face radical and continuous changes, that characterize knowledge society. In the XXI century in the market those organizations will be competitive that will innovate continuously. Innovation is not only the way to success in business, but also a prerequisite for survival in a globalized market.

The importance and necessity of innovation result from its contribution to productivity, competitiveness, economic performance and social objectives.

Innovation depends on a realistic strategy of the company, clearly stated objectives, funding, competent management, the existence of a well-trained teams, multidisciplinary, the existence of clear and accurate job evaluation, a harmonious climate

This paper presents a clear overview of the product concept, classification and characteristics of new products, product innovation process. By proposing a set of indicators to measure innovation of the product, the article offers solutions for implementing product innovation, so that any organization can have a continuous basis for optimal results.

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