FRAMEWORK FOR MEASURING PRODUCT INNOVATION TO SUPPORT SUSTAINABLE DEVELOPMENT

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Abstract
Innovation, in the current highly dynamic and competitive business environment, is the best solution for organizations to improve their performance and ensure their competitiveness and success. One of the most visible and known types of innovation is product innovation, it allows organizations to have competitive advantage by differentiating its production and increasing the quality and variety of goods. The demand for products continues to increase but in the same time, the environmental factors are more and more present in the organization policies, in these conditions, the sustainability aspects related to the product developments are becoming a competitive advantages. The purpose of this paper is to study the relation between sustainable development and product innovation and offer a framework for a better management of product innovation. To have a certain control over the innovation process we propose a measurement framework formed by a set of indicators correlated to the environmental requirements.

Keywords
Innovation, sustainable development, product innovation, measurement indicators.

JEL Classification
O32; O33

Introduction

We are living in an accelerated transition period, marked by complex and profound transformations in all areas of activity. The significance of innovation is reflected primarily in the high rate of development new products and technologies, but the changes are not just about tangible things (Pamfilie & Croitoru, 2018). Within organizations, innovation actions are increasingly oriented towards management methods, organization and business configuration, which contribute to sustainable competitive advantage. At the same time, innovation is manifested in society in general, materializing in new strategies, concepts, ideas and organizations addressing social needs - from the labor market and working conditions to education, health and community development. Organizations may increase the performance of their innovation processes by focusing on capitalization of external innovation resources and adopting innovation principles (Olaru et al., 2015).
The concept of innovation defines synthetically the introduction of the new. The finding and introducing the new represent the main factors that have determined the evolution of humanity throughout its existence. The importance and volume of these activities grew up with the evolution of society. Especially in recent decades, there has been a phenomenal

increase in interest in innovation as a way to achieve sustainable economic growth of organizations and society.
There are studies that empirically determined innovation process lifecycle, composed of key stages of managing innovation as: the creation of ideas, development of innovations, utilization, review, and improvement or abandonment (Pan, 2010). The innovation activities include, among others, research and development (R&D), capital expenditure, human resource development, design and market development. Measuring innovation in the business sector and the organization engagement in innovation activities, of which R&D is one, indicates that mostly organizations innovate than do R&D (Gault, 2018).
Innovative performance is a critical dimension in assessing competitiveness and national progress and innovation is crucial in approaching global challenges, such as climate change and sustainable development (Maier et al., 2018). Innovation is not only the path to success in business environment, but also an essential condition for maintaining in a highly competitive market (Olaru et al., 2013). Customer satisfaction is one of the main components of management systems, so companies that implement them have to be innovative in developing and launching new products or services to match the customers' needs and requirements (Simon and Yaya, 2012).
The work treats sustainable development through product innovation from the perspective of the organization. Sustainable development is the achievement of a better quality of life today without compromising the chance of future generations to the best of life. This means achieving a balance between economic, social and environmental protection. In organizational context, product innovation is about creating a new or improved product in terms of technical-functional features, components, materials, ease of use or other functional features.

Research background

Considering more and more restrictive regulations and given the increasingly importance of sanogenetic and environmental criteria in a highly dynamic and complex competition, many organizations are concerned to improve the performance results in relation to society as a whole, with certain focus on promoting sustainable development principles (Olaru et al., 2010).
According to the vision of sustainable development, progress integrates immediate and long-term goals, local and global action, economic and environmental issues, all inseparable. Sustainable development pursues and strives to find a stable theoretical framework for decision-making in any situation where a human / environmental report is found, whether it be environmental, economic or social.
Sustainable development is defined as being the way of development that, for now, does not jeopardize the chances of development for future generations. This approach includes productivity, harmony, satisfying social, economic and environmental requirements and the concept of intergenerational equity (Summers and Smith, 2014). As a structure, it includes the *energy*, the *environment* and the *human resources* components.
Energy is a component of sustainable development because the way power generation and consumption are currently managed depends the access to energy for future generations. The *environment*, viewed in multiple ways, monitoring, depollution and preventing its further degradation, is a component of sustainable development, as future generations will be forced to live in the environmental conditions they will inherit from the current generation. *Human resources*, viewed because of the education, culture and health of the current population, are an initial condition for the evolution of future populations. The inheritance of an indigenous, uneducated or unhealthy population may be a major handicap for future generations (Vasile, 2019).

Initially, sustainable development was intended to be a solution to the ecological crisis caused by the intense industrial exploitation of resources and the continued degradation of the environment, and primarily seeks to preserve the quality of the environment. The concept has now expanded on the quality of life in its complexity, both economically and socially. To better align cleaner production within business and society, organizations can enable sustainability activities as a catalyst for change (Sroufe, 2017). The subject of sustainable development is now also the concern for justice and equity between states, not only between generations (Burz, 2012; United Nation, 1992).

Sustainable development must be seen as an adaptation of society and the economy to the great challenges humanity faces today. People are at the heart of sustainable development concerns. They have the right to a healthy and productive life, in harmony with nature.

We cannot talk about development without innovation, because innovation is the basis for sustainable development in any field. An effective implementation of innovation by the organizations is essential in adding value so that those remain competitive and also developments in current economic climate (Maier et al., 2014). There is some resistance in an effective innovation management system implementation, but good communication with staff and external partners, as well a leadership focused on competence and awareness could reduce it (Maier et al., 2016).

A company should be aware that in innovation processes management may occur certain risks and cause failure of the potential innovation projects. If the company can identify, assess and address these risks, it will significantly enhance the success and effectiveness of innovation processes management in the company (Lendel, Hittmár and Latka, 2015).

In the model developed by Calik and Bardudeen (2016) to measure sustainable innovation performance in manufacturing companies there are proposed three factors that should be used to assess the economic dimension of product and process innovation: innovation expenditure, number of new sustainable products or processes, sustainable patents and citations.

Through product innovation, the company can achieve a competitive advantage by differentiating its production and increasing the quality and variety of goods that allow it to grow demand and open up new growth opportunities (Leon, Martinez and Castilo, 2005; Suzianti, 2005; Brad, 2008; Brad, 2010; Camisón and López, 2010).

Product innovation refers to the development of goods or services with characteristics or intentions of use that differ significantly from previous products made by the enterprise. Product innovation includes significant changes in technical specifications, components and materials, embedded software, friendly use, or other functional features (Maier, 2014).

The expanded product concept assumes (Brad, 2010):

- The product itself, through its intrinsic properties resulting from conception and "design".
- Product-related processes, product quality relies on the quality of the manufacturing processes and the "technologies" integrated into the product.
- Sales services.
- The associated after sales service, the quality of the product is also given by the value added at the stage of use and withdrawal from use of the respective product.

The expanded product must (Brad, 2010):

- balance and ensure the sustainability of consumption and production;
- reduce environmental impact;
- must increase customer satisfaction.

Research methodology

The majority of data used in our research are secondary data, collected from different bibliographic databases, full-text databases, numeric databases or even special purpose databases. The collection of data was made by the use of keywords and the results were filtered by using Boolean operators and syntax. We evaluate and analyze the obtained data based on several criteria like the date of data collection; we try to have bibliographic sources as current as possible; the dependability or the source credibility; the content of data. The majority of data available in the innovation field are qualitative data, thus the first challenge of the research was to transform a part of qualitative data in quantitative data. For this, we used a content analysis and a grounded analysis of the qualitative data. In order to have a sustainable development we need to have the necessary tools to evaluate the current situation regarding innovation in the organization. In order to develop these tools, we first conduct an extensive review of the existing literature in the domain and related domains focusing on other innovation management models.

There are many ways to measure the productivity of product innovation; therefore, choosing the most appropriate measurement indicators requires a degree of selectivity. For a more accurate choice of indicators to measure innovation, it is necessary to define the indicator term. An indicator can be defined as something that helps us to understand where we are, where we are going (what we are heading for), and how far we are from a certain goal / goal.

For product innovation, we propose the following set of indicators:

- Income received from new product/ service;
- Return on investment in the creation of a new product/service;
- The time to develop the new idea;
- Percentage of ideas materialized in a new product/service;
- Number of products/services with changes in functional and/or technological design;
- Number of products with changes in raw materials, materials and components used;
- Number of products with changes in shape, appearance, dimensions (a new design);
- Number of products/services with the latest technological innovations;
- Number of new products/services placed on the market;
- New methods of increasing the quality of goods;
- Speed of development of new products/services;
- New product/service sales;
- Number of patents / trademarks / models;
- Degree of change of innovation during product realization;
- Product efficiency (result/effort ratio);
- The number of prototypes that reached serial production;
- The number of inventions completed by an innovation;
- Number of technology transfer processes;
- Number of registered national and international patent applications;
- Number of products and technologies produced and techniques with demonstrable impact (or applicability in the economy);
- Percentage of innovation projects from year to year (evolution of innovation projects).

In order to expand the scope of analysis, in this paper we used the empirical research method and used a questionnaire with representative sample of firms (104) to check the degree of innovation in the existing product.

Questions for the interview were (Maier, 2014):

1. How important to your business is the innovation process?
2. Please appreciate the importance of the following types of innovation for your company (Marketing Innovation, Product Innovation, Process Innovation, Innovation in Network Development, Innovation in Human Resources, Administrative Innovation, Strategic Innovation and Policy Innovation).
3. Please appreciate the importance of product innovation indicators.

Research results and Discussions

A percentage of 58% of the 104 firms interviewed considered the innovation process (fig. no. 1) to be very important, and 17% of those interviewed considered the innovation process to be of no importance to the organization they belonged.

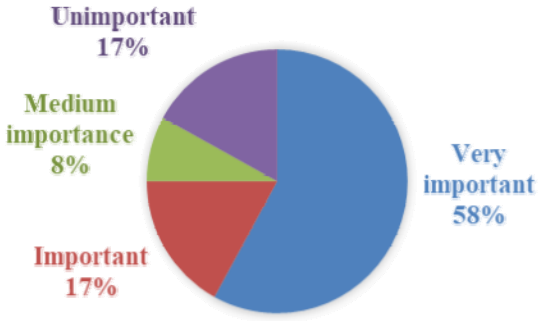

Fig. no. 1 The importance of the innovation process for organizations

Among the seven type of innovation proposed all 104 firms (fig. no. 2) appreciate the product innovation as the most important (92%) followed by marketing innovation (75%) and innovation in human resources (75%), process innovation (67%) and innovation in network development (67%); strategic innovation (50%), innovation of the vision and policy (50%) and the lowest percentage giving is administrative innovation (42%).

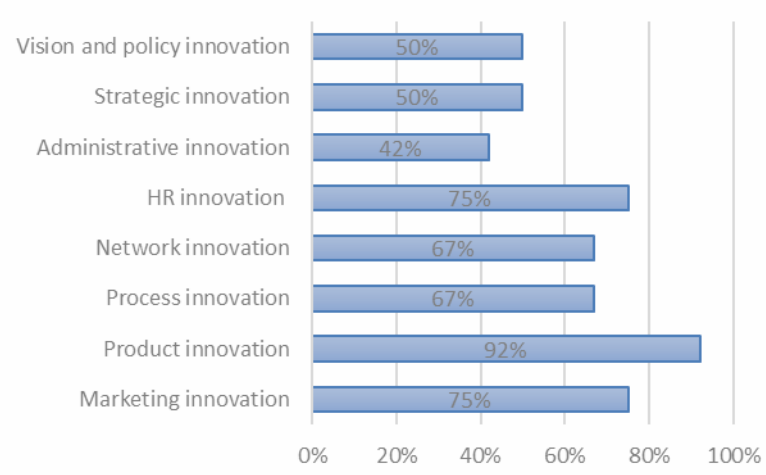

Fig. no. 2 The importance of the innovation types for organization

The measurement indicators proposed for product innovation were evaluated by the organizations (table no. 1) according to their importance. The value of revenue from the new product / service (100%), the return on investment in the creation of a new product / service (100%), the time to develop the new idea (75%), the new product / service sales (75% very

important for the firms surveyed, but also the analysis of the worrying percentages of indicators considered to be of no importance for companies, such as the percentage of innovation projects from year to year / evolution of innovation projects (33%) and the number of products and technologies produced and techniques demonstrable impact / or applicability in economy (25%).

Table no. 1 The importance of the product innovation indicators

Assessment / Indicators	Important	Medium importance	Unimportant
Income received from new product/ service;	100 %	0 %	0 %
Return on investment in the creation of a new product/service;	100 %	0 %	0 %
The time to develop the new idea;	75 %	25 %	0 %
Percentage of ideas materialized in a new product/service;	50 %	50 %	0 %
Number of products/services with changes in functional and/or technological design;	42 %	42 %	17 %
Number of products with changes in raw materials, materials and components used;	42 %	42 %	17 %
Number of products with changes in shape, appearance, dimensions (a new design);	58 %	17 %	25 %
Number of products/services with the latest technological innovations;	50 %	33 %	17 %
Number of new products/services placed on the market;	67 %	33 %	0 %
New methods of increasing the quality of goods;	67 %	33 %	0 %
Speed of development of new products/services;	75 %	25 %	0 %
New product/service sales;	25 %	67 %	8 %
Number of patents / trademarks / models;	33 %	42 %	25 %
Degree of change of innovation during product realization;	75 %	25 %	0 %
Product efficiency (result/effort ratio);	50 %	33 %	17 %
The number of prototypes that reached serial production;	42 %	33 %	25 %
The number of inventions completed by an innovation;	33 %	34 %	33 %
Number of technology transfer processes;	25 %	33 %	42 %
Number of registered national and international patent applications;	42 %	33 %	25 %
Number of products and technologies produced and techniques with demonstrable impact (or applicability in the economy);	25 %	42 %	33 %

The results included and analyzed in this study revealed a number of issues:

- Innovation management provides results irrespective of the industry or size of the company - small, large or high-tech companies do not have a special advantage because the contribution to the growth of innovation depends on the quality of the management effort.
- Innovation management is implemented in an extensive variety of ways across diverse industries, such as products, processes, services or new businesses, thus revealing a wide innovation base and strong innovation potential in the business environment.

- Good innovation management offers a plus with a significant overall impact; between 6 and 30% of additional revenue is provided by innovation projects , with an average of nearly 20%, which is considerable compared to general revenue growth rates of between 5% and 10%.
- However, growth is much lower in those areas of the public sector that do not operate in line with commercial standards.

Conclusion

Although the process of innovation is a very important factor behind the economic growth and prosperity of the global economy today, it is also little understood. Over the past century, industry leaders have learned to master the production process in a way that it no longer functions as an important competitive advantage. The new challenge is to lead the innovation process –exploiting the change, developing new competitive advantages by providing better products and services, running better processes or even delivering completely new solutions.

For individual firms and society in general, the innovation skill is vital to ensure development and competitiveness in the coming future. To be able to innovate, people are well trained and willing to get involved in this investment in innovation. In addition, that is not only because global economic progress is expected of humankind due to innovation, but also because in the situation of diminishing the material resources, no country in the world will be able to develop without creating the conditions for using the most at hand resources, still inadequately used, the human mind.

The renewal of the products and markets to which they are distributed is not sufficient; we need to change the technological processes, the working methods, the working relations, the relations of a company both public and private with its outside, especially with the shareholders, the financiers, the suppliers and, last but not least, the clients.

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