Product Innovation by Means of Smart Materials: The Case of Daxorol

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Abstract. This research aims at investigating the role and function of smart materials as a flexible approach in developing innovative products, and their impact on companies’ performance. The paper first elaborates smart materials as a new trend in technology, by further identifying types of smart materials. Supplementary, some benefits of using smart materials in companies are named, especially for a case study on using smart paint and coating for producing innovative product. The concluding part responds to the question: How will product innovation by means of smart materials improve companies’ performance?

1. Introduction

Being different is considered as an advantage in the modern millennium. Nowadays, firms perform under a greater pressure than before because of competition that they face in the market. Usually, they offer the same or similar product or service, or they are under the pressure of the customers who expect and require more and more from the product they consume or service that they use.

In order to face with the new conditions and situations, firms are forced to continuously search for new ways of acting; they should continuously bring to the market innovations, namely to offer new products and services, or enhancing the existing ones.

Considering the issue of firm performance, it has been central in strategy research for decades and encompasses issues raised in the field, such as, why firms differ, how they behave, how they choose strategies and how they are managed [1]. A central premise of the resource-based view (RBV) is that firms compete on the basis of their resources and capabilities [2].

By a resource is meant “anything which could be thought of as a strength or weakness of a given firm, for example: brand names, in-house knowledge of technology, employment of skilled personnel, trade contacts, machinery, efficient procedures, capital, etc. [3].

This paper aims at identifying the advantages of innovative product by means of smart materials, in terms of competitive advantage and firm performance. In order to do so, the paper employs case study analysis, i.e. a factory that produces colors and coating in Macedonia, named Daxorol, is under the loop of analysis.

The structure of the paper is as follows. Fist, the empirical evidence of the impact of product innovation on firm performance is treated. The link between product innovation and smart materials is explained, before introducing the characteristics of the case study. Afterwards the paper presents some concluding remarks.

2. Product Innovation by means of Smart Materials
Smart materials are known as well as the materials that respond to environmental stimulation with particular changes in some variables. Due to this, they are also called as responsive materials. In response to their environment these materials can change their mechanical properties: shape, stiffness, and viscosity (or electromagnetic properties) in a foreseeable or controllable manner. The term “Smart materials” is applicable to materials and systems that can responsively react to change interior environments through material properties or material synthesis.

There are many groups of smart materials, each exhibiting particular properties which can be harnessed in a variety of high-tech and everyday applications. Smart materials have been around for many years and they have found a large number of applications. As such, smart material technologies are the key to 21st-century competitive advantage. Thus, various companies that work with building materials can significantly increase levels of functionality by using smart technologies and smart materials. As a result, the building methods and materials will be changed by the importance of smart materials.

Painting and coatings are ancient techniques for changing or improving the characteristics or performance of a material. The development of smart paints and coatings give these old approaches new capabilities. Smart paints and coatings can be generally classified into:

- high-performance materials,
- property-changing materials and
- energy-exchanging materials.

The pigments may be insoluble or soluble finely dispersed particles, the binder forms surface films. The liquid may be volatile or nonvolatile, but does not normally become part of the dried material. Coatings are a more generic term than paints and refer to a thicker layer. Many coatings are nonvolatile. These paints or coatings absorb energy from light, chemical or thermal sources and reemit photons to cause fluorescence, phosphorescence or afterglow lighting.

Before going to the analysis of the paints and coating factory as a case analysis, we will examine the relationship of product innovation and firm performance, with specific emphasis on the case of Macedonia.

3. Evidence on the Impact of Product Innovation on Firm Performance

Innovation is a process of transforming the new ideas, new knowledge into new products and services. Considering firms’ innovative activities, it is unclear whether it leads to improved firm performance. One should expect that if the firm is innovative than it will respond to customers needs, thus will be positively evaluated by the market as a good performing firm.

Different studies found the positive effects of innovation on firm-performance [4]. There are different driving forces that push companies towards innovation, such as R&D activities. Since R&D intensity is higher in EU member economies, they should be a leading example for other non-EU countries. Whenever there is a lack of knowledge to bring changes in the firm, we suggest that spending on the acquisition of new knowledge will have a positive effect on innovation activities and additionally on firm-performance [5].

Different studies found the positive effects of innovation on firm-performance [6,7]. It is also noted in vast literature that firms that engage in developing innovative products and services are positioned to compete more successfully through the development of new products and processes, increasing market share, return on investment (ROI), and overall firm success”. Reference [8], applying metaanalyses techniques to aggregate prior empirical research on the innovation–performance relationship (42 empirical studies on 21,270 firms), have found that product innovation has a positive effect on the firm-performance.

So that a company undertakes innovation activities by means of smart materials, one should consider its technological intensity. The technological intensity of the industry in which a firm is operating is another variable that might have an impact on product innovation, and at the same time on firm performance.

A questionnaire based survey was conducted in 60 companies in Macedonia, in order to measure the scale in which they undertake product and process innovation. We have followed the Eurostat definition for the classification of components of the manufacturing industry on the basis of their technological...
intensity, using NACE at 2-digit level as the basis of classification, grouping different activities into high-technology, medium high-technology, medium low-technology and low-technology industries. Labor productivity is a measure for the performance of the firm, and it is cross-tabulated with technological intensity and innovativeness for identifying the current situation in Macedonia. Fig. 1 shows the relationship between product innovation of firms in different technological classifications and their labor productivity.

![Graph showing labor productivity and innovativeness by technological intensity of firms](image)

**Figure 1.** Labour productivity and innovativeness by technological intensity of firms (in million denar per worker).

Firms in the group of high-technology manufacturing or high knowledge intensive services seem to perform better than other firms. Also, innovative firms seem to be performing better than non-innovative firms across the sample. Interestingly, there are no non-innovative firms in the high-technology and high-tech KIS industry.

4. Case Study: Daxorol

In this paper, Daxorol will be examined as a case study of company that has introduced new product to become more competitive in the market. Daxorol is a factory that produces colors and coating in Macedonia. It is characteristic for this company that it employs advanced contemporary technology for production. It uses Daxomix to produce 1500 shades of colors, that can be applied on interior and facades.

In order to satisfy customers’ requirements and difficulties in choosing colors, Daxorol employs machinery to come up with innovative product. Since, the difficulty in choosing color by customers is because they cannot imagine the effect of the change on the wall, Daxorol has found solution for them. With the Dinova color designer, they have the opportunity to try by their own on the first on-site appointment with a coherent color scheme. Furthermore, the customers can show even more competence with the new color measuring device Colorcatch Nano. With this innovation, it is possible to measure color tones from a size of 0.4 mm.
4.1. Dinova Colordesigner - the Application for Photo-Realistic Color Design Axomix

The application Dinova Colordesigner has the possibility to create color designs, that can be presented to the customers. The color designer is suitable for smartphones and tablets and is distinguished by its simple and intuitive handling. This application has many advantages that can be stated as follows: (i) Photorealistic design including background structure, light and shadow effect; (ii) Design possible in a few minutes and on site; (iii) Easy, intuitive handling; (iv) Very low cost; (v) Further strengthen your consulting competence.

4.2. Colorcatch Nano – Shade Measurement Has never Been More Accurate

With the color meter Colorcatch Nano one can save time and money. It incorporates a revolutionary technology to accurately measure the shades of smooth, textured or patterned surfaces. It reads over 50,000 pixels per measurement. The advantages of the Colorcatch Nano are as follows: (i) Pixel-accurate measurements possible with up to 5 dominant colors per measurement; (ii) Optimal illumination of all structures thanks to 9 integrated D65 LEDs (daylight); (iii) Lens with 6x magnification; (iv) Disturbances such as shadows, dust or dirt particles are calculated by algorithm; (v) Handy format, low weight and high mobility.

4.3. DaxoMix - the Professional Sound System from Daxorol

It is characteristic for this factory the precision and high quality innovative product as an output of DaxoMix. They cooperate exclusively with the best and most experienced color mixing plants manufacturers. The aim of the factory is that every DinoMix tweeter fulfills the high expectations of professional processors. The advancement in technology has brought to distinguished product that offers many advantages.

5. Conclusion

This paper has set an accent on the importance of product innovation, especially by making use of the smart materials. It investigated (i) the concept of product innovation by means of smart materials and (ii) the impact of product innovation on the firm’s performance, especially for the case of Macedonia. The statistical overview of the Macedonian sample shows that technological intensity and innovative companies, have better performance measured by labor productivity.

Finally, some important findings can be identified from the case study analysis of this paper. Firstly, Daxorol incorporates new machinery and technology to satisfy customers’ needs, and the result is improved performance. Secondly, being concerned with the advancement of the materials used, makes these company more professional, by coming up with precisely identified colors and materials. Finally,
the relation between product innovation and labor productivity in Macedonia has shown to be positively related. We come to this conclusion, as no matter the crisis that the country has faced lately, Dxorol has showed better performing results.

6. References
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