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DEVELOPMENT OF A MODEL FOR MONITORING THE NEEDS FOR INNOVATION IN FURNITURE ENTERPRISES IN BULGARIA

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ABSTRACT

There is a variety of methods for assessing and modelling the innovation factors that are presented in the specialized literature. However, out of the scope of those analyses is the use of the "First Alert" or the "signal line" approach. Through it the enterprises can analyze their need for innovation activities and the extent to which those innovations are needed. The main goal of the present study is to develop and analyze to use of a to make a decision whenever Bulgarian furniture enterprises have to implement innovation. The applied research methods are based on the logical, deductive, and comparative methods, as well as the "signal line" approach. This study proposes for the first time the use of a pan-European revenue regression curve and the number of innovative enterprises. The results show that the innovation activities must be, first of all, focused on the staff and then on the assets that the entity possesses and use. The results of the study support the development of the literature by presenting a more in-depth analysis of the possible ways to use the national statistical institute data for planning the innovation activities by furniture enterprises.

Keywords: innovation, furniture enterprises, modelling for monitoring.

INTRODUCTION

Innovation is considered a major factor for achieving economic growth at micro and macro levels. According to Weiss (2011, p. 3) forestry sector is considered to be "low-tech", mature and declining and in this respect, it can be seen as less innovative. However, it plays a major role in economic growth even though the sector invest less in innovation and R&D. The sector's innovation are primarily focused on improving and developing forest products (Skog et al., 1995). Innovation is associated with big investments and a high level of uncertainty. This in hand is a factor negatively affecting Bulgarian forest enterprises, which in general are investing less in research and development (R&D). Representative studies on the problems of innovation in the forest industry in Bulgaria are mainly focused on innovativeness and evaluation of the innovation activity in furniture enterprises (Popova, 2013), digitalization and innovation cooperation in the forest sector (Popova-Terziyska 2018, 2021), studies of certain types of innovations and innovation problems (Neykov, Popova-Terziyska, 2020). The conducted researches however reflect the need for innovative development and digitalization in the sector but do not offer a tool for supporting the

management activity at the company level (Popova, Georgieva 2019). Rametsteiner et al. (2005) argue that that to strengthen innovation in the forestry sector it is essential to develop and implement appropriate innovation policy, strategy or program. Such micro policy and strategies are related to the influence of many factors affecting managerial decisions. The literature provides many models for monitoring the innovation factors but in Bulgaria, there is no in-deep research regarding the need for innovation in forestry and the factors affecting it. Those questions are essential in terms of the decision-making process and strategic planning activities. In the literature, there are widely used variety of methods for assessment and modeling the innovation factors, internal and external firm's relationships and economic efficiency. Svagzdiene and Kuklyte (2016) used a regression equation and comparison of three EU countries to outline the main factors that influence the Innovation Index on a macro level. They considered factors like GDP, education, R&D costs, internet availability, etc. Shanin et. al. (2018) distinguished factors for innovative development of timber processing complex by the use of parametric and deterministic approaches with ratios. They compared financial independence, customer satisfaction criteria, and financial availability ratios to reference values. Hans Lööf and Almas Heshmati (2006) investigated the relationship between innovation and performance through sensitivity analysis. Park et. al. (2018) and Gherghina et. al. (2020) reveals the relationship between the particular feature of the enterprise and the incomes from the companies' innovative activities. However, those analyzes are primarily focused on already commonly used factors like deteriorated infrastructure and higher costs that determine the need for innovations. Out of the scope of those analyses is the use of the "First Alert" or the "signal line" approach. It is based on the international sectoral characteristics of the innovations. The model regress the enterprises implemented product or process innovations and subsequent outcome of the innovations. Of all forestry industries in Bulgaria, the most developed are the companies operating in the field of manufacturing, design, and sales of furniture (Popova, 2019; Georgieva, 2020). Based on that the main object of analysis in the manuscript are the factors affecting the need for innovation in furniture enterprises in Bulgaria. The main goal of the paper is to analyze the essential factors affecting the need for innovation and to what extent. Without neglecting the importance of all external and internal innovation factors main focus of research is the expenditures for: innovation activities except R&D; R&D costs; personnel; external services and materials; tangible and intangible assets. To achieve the stated goal, the following research tasks are set: (1) to outline a model for determining the needs for innovation in furniture companies in Bulgaria; (2) to implement the selected model, by the use of specific economic indicators for the period 2010-2018. The applied research methods are based on the logical, deductive, and comparative methods, as well as the "signal line" approach. The results of the study support the development of the literature by presenting a more in-depth analysis of the possible ways to use the national statistical institute data for planning the innovation activities by furniture enterprises.

MODEL SPECIFICATION AND DATA COLLECTION

This study employs the following model:

$$\mathrm{n}(Y) = b.ln(X) + a \quad (1)$$

where X is the vector of innovative firms number in the observed countries, Y is a vector of a particular indicator like Turnover or Value added per Factor Costs.

A double logarithmic form has been chosen to estimate the constant elasticity of the turnover against some innovative companies.

The first alert has been derived by solving the equation (1) for x:

$$x = \sqrt[b]{\frac{Y}{e^a}} \tag{2}$$

The model in equation (2) describes the potential capabilities of the particular enterprise to search for new alternatives and to implement any kind of innovation. Dependent variable X is the share of the innovativeness that should occur independently of the annual revenues. This equation is applicable in cases when the management or the shareholders of the enterprises do not see the need for innovation or they are not sure about the extend of the innovation activities. The model describes the positive relationships between the revenues and the potential innovation expenses. The revenues or the turnover can indicate the need for innovation when they are reduced, i.e. when the capabilities revealed by the model (2) do not exist. In this case, we recommend being carried out the monitoring of the enterprise's turnover trend line and the sectoral one. If something is going not correctly, the turnover will indicate it. The innovation expenditure equation is as follows:

$$IC_{PE} = x.\overline{IC}_{C31,Bulgaria} \tag{3}$$

Where IC_{PE} is the vector of the Innovation Costs for Particular Enterprise, $\overline{IC}_{C31,Bulgaria}$ is the average of the innovation expenses per enterprise for sector C31 (Manufacture of Furniture) in Bulgaria.

For the purposes of the model data from the Eurostat Community Innovation Surveys for the period 2010-2018 and Community Innovation Surveys of Bulgarian Statistical Institute for specific data for Bulgaria is used. The sample countries are the 19 EU countries in sector C31 "Manufacture of furniture". All the calculations have been made in Stata v. 16 and Mathematica v. 8. Data for the resulted variable have been extracted from the Structural business statistic of Eurostat. Model (1) has experimented with different values for annual revenues.

RESULTS AND DISCUSSIONS

The model was executed through the following procedure: first, panel data estimates have been made. It was done to be outlined the type of effects and the consistency of the analysis between countries and periods. The independent variable is the Number of Innovative Enterprises or "number". The dependent variable is Turnover or gross premiums in million euros or named "turnover". Those variables are the only two that have statistical significance or relation. Second, a test of the existence of serial autocorrelation throughout Wooldridge (2002) recommendations and Wald test is made. The results show that there is a serial correlation and consequently random effects which are not applicable (P=0.000) Furthermore, the p-value of the "number" variable is P=0.071 for GLS random-effects. Because of that, we can conclude that there is an effect between countries, but not between years. The results for intercountry comparison are displayed by the estimation throughout

equation (1) year-to-year. Following this approach, it is possible to be outlined the changes in the elasticities over the years. The results for the equation are presented in table 1.

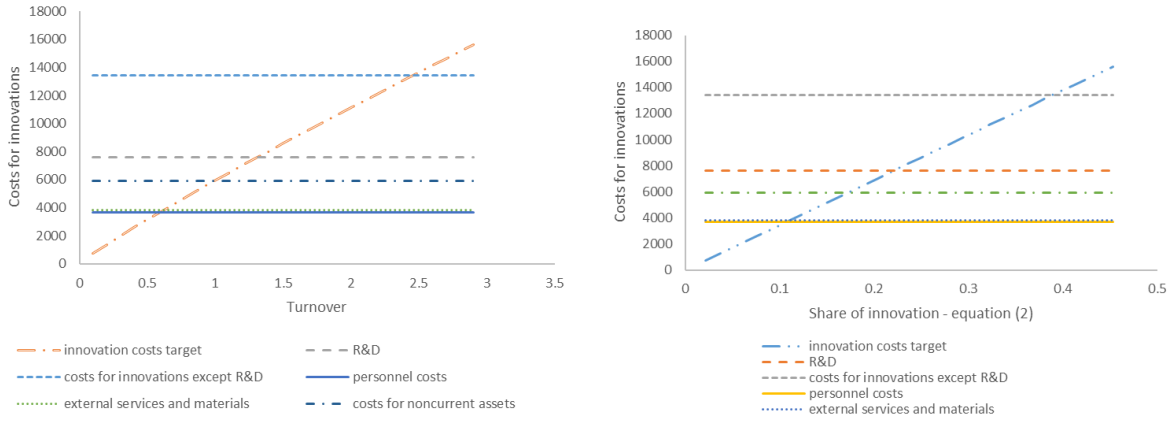
Table 1. Results for equation (1)

	Coefficient	Coefficients	Standard Error	t Stat	P-value
2010	Intercept	4.713	1.107	4.255	0.001
	b	0.531	0.214	2.487	0.024
2012	Intercept	1.800	0.798	2.256	0.038
	b	1.081	0.152	7.105	0.000
2014	Intercept	2.653	0.643	4.127	0.001
	b	0.955	0.126	7.558	0.000
2016	Intercept	2.033	0.625	3.252	0.005
	b	1.092	0.123	8.889	0.000
2018	Intercept	1.938	0.682	2.841	0.011
	b	1.102	0.131	8.403	0.000

Source: own calculations

The presented data shows that the elasticity of turnover generated by the innovative enterprises varies between 0.53 and 1.102. This means that for 1% of the innovative enterprises, created in 2010, the revenues (turnover) increased by 0.53% per country. It is so until 2018 when the revenues increased about 1.1%. The improvement over the years covered by the survey is toward increasing the elasticity. This means that the turnover is becoming a stronger factor, which motivates the enterprise to become more innovative. For Bulgaria, the curve of the need to implement any innovation experiments with values in an interval of revenues which are typical for medium enterprises in C31. The results for equation (3) are presented in figure 1.

Figure 1. Line of innovation requirements and the thresholds in BGN



Source: own calculations

The innovation needs' curve[1] passes through the individual innovation cost thresholds. The lowest threshold is staff costs. When the signal curve reaches this threshold, it passes through the next, namely for external services and materials. After this threshold, the enterprise should implement staff organizational innovation. In this respect, some operations, positions, or methods used in the job activities have to be changed with new ones. The closeness of the two thresholds hints that appropriate materials or external services should supplement these new innovative operations. The managers have a wide variety of alternatives to implement innovation, but mostly at the personnel level. The threshold does not have to be accepted like an exact point or upper limit. It is the lower limit of the innovation activity of the firm

The next threshold costs for noncurrent assets. The innovation activity should include all the previous thresholds. The new operations should be improved with new software, licenses, machinery, etc. After this threshold, the enterprise should implement innovation in the entire process or in terms of new products. Here the company can show creativity and bold steps towards product development. The innovation should comprise all the elements of the production process - labor, machinery, materials, and software. When an enterprise crosses the threshold, the management should shortly complete the innovation process and access the market.

The third threshold signal that the enterprise should take into account is the R&D. This is a very broad activity, but in the context of the furniture industry, it should be related to the research of new product details or new marketing activity. This threshold reveals the capability of developing R&D within the enterprise, i.e. the time for its creation.

The fourth threshold is for all different innovation activities except for R&D. Because of that it could be considered as the luxury threshold. It means that the enterprise is free to develop and implement the innovation no matter the manager's decisions. There are no restrictions in terms of opportunities for innovation and its implementation.

Thresholds and the signal curve can cumulatively assess the enterprise's possibility and the need for innovation. Comparing the results with the Structural Business Statistics of

[1] For the purposes of the current study, this curve is called the "signal curve".

Eurostat for the Bulgarian furniture industry, the lower time for innovation signaling is two years. This concerns 83% of the enterprises' process innovation related to the staff activities. For 8% of the Bulgarian furniture enterprises annually they will receive a signal that they have to do something new for the personnel and the process. Only 3% can spend all the innovation costs from the model.

CONCLUSIONS

The model presented in the study shows the possibilities of the information available in the statistical institutes for planning the innovation activities. This study proposes for the first time the use of a pan-European revenue regression curve and the number of innovative enterprises. Thanks to it, indicative signal lines can be set as to whether there is a need for innovation and to what extent. The signal line for the Bulgarian furniture industry shows that it should start with the staff. It then goes through the provision of working capital for new activities and training and then comes to the new equipment for the overall process or product innovation. The proposed model could be used when preparing the future enterprises' strategy of the forest industry in Bulgaria.

As the main limitation of the study is that, the model presents an extensive relationship between sales turnover and the number of innovative enterprises, and does not provide an answer, if the innovative activity in a non-innovative enterprise increases, as well as how much the turnover will increase. The model sets only an indicative framework, in the context of European quantitative dependencies for increasing revenues while increasing the number of innovative enterprises. The model will scale with the number of revenues and when they are in the size typical for a given type of enterprise, the model shows the inverse relationship between them and the necessary degree of innovation of the enterprise. A suggestion for future studies is the use of the model in other sectors of the forest industry, such as the wood processing and paper and board production sectors. In this respect, comparative analyses can be made and conclusions can be drawn regarding the need for innovation in the forest industry in Bulgaria as a whole.

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