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The Importance of the Dimensions of the Innovation Management in Evaluating the Innovation Capability of the Firms in the Machine Building Industry in Romania

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Abstract

Among the advantages proposed by different methods of evaluating the innovation capability based on scores are the allowing of the comparison of a company's innovation capacity, materialized at the time of the analysis in a score, with the scores of other companies. It appears necessary to delimit the importance at the level of the determinants of the innovation depending on the membership of a particular industry.

Based on the literature and on our own experience, it will be identified a number of dimensions of innovation, that provides a complete image of the innovation management.

Within the research more companies in the machine building industry will be involved, and determining the importance given to the dimensions of the innovation in this industry contribute to the possibility of achieving the analyzes of benchmarking on the innovation management among various companies in other industries, in this case, the IT&C industry.

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1. The concept of the innovation capability

In the literature the term of the innovation capability is defined in different ways. Thus, starting from simple integrations, the innovation capability is seen as "a sustainable competitive advantage that underpins the firm's performance" (Alvarez & Barney, 2000), reaching more complex definitions like: "capacity to absorb, adapt and transform a given technology in the operational, managerial and transactional routines may lead a company to profit" (Zawislak et al., 2012) or "an interaction of various elements like strategy, resources, processes, methods, instruments, organization and culture that enable success in innovation and success of the entire company." (Meier, Fadel et al., 2004; cited after Buergin, 2006).

2. The current state of the research into the assessment of the innovation capability

In the process of the assessment of the innovation capability, the identification of the innovation dimensions analyzed occupy the leading role. Depending on the choice of these dimensions, an overall and fair picture of the innovation management in a company is given. Among the first steps well grounded in evaluating the innovation capability, methods based on scores, were highlighted the proposed methods by the firm Arthur D. Little (2001) in collaboration with the European Business School, method Eckelmann (2002), the method proposed by George Bala and Alexandru Gheorghiu (2007) and the improved method by the firm Arthur D. Little (2012) which was based on a study aimed at analyzing the innovation performance into a number of 650 companies.

The examples of dimensions and the analysis criteria used primarily in the process of the assessment of the innovation capability based on scores in the literature:

- Innovation strategy (Arthur D. Little, 2001 and 2012; Eckelmann, 2002);
- Process of innovation (Arthur D. Little, 2001; Eckelmann, 2002);
- Culture of innovation (Arthur D. Little, 2001; Eckelmann, 2002);
- Resources deployment (Arthur D. Little, 2001; Eckelmann, 2002);
- Organizing innovation (Arthur D. Little, 2001; Eckelmann, 2002);
- Capacity for innovation and integration in a relational system (Bala and Gheorghiu, 2007);
- Business intelligence (Arthur D. Little, 2012);
- Idea management (Arthur D. Little, 2012);
- Portfolio management of product and service (Arthur D. Little, 2012);
- Portfolio management of technologies (Arthur D. Little, 2012);
- The development process of new products and services (Arthur D. Little, 2012)
- Competences management (Arthur D. Little, 2012);
- New product development process (Arthur D. Little, 2012);
- Identifying growth opportunities (Arthur D. Little, 2012).

3. Presentation of the research

3.1. Objective and usefulness of the research

Among the advantages offered by different methods of evaluating the innovation capability based on scores is to allow the comparison of a company's innovation capacity, materialized at the time of the analysis in a score, with the scores of other companies. The problem arises when the comparison of the scores of the companies from different industries, because of a number of determinants of the innovation contributes differently to get performance in innovation.

The research aims to determine the importance of the dimensions of the innovation management in evaluating the innovation capability of the firms in machine building industry in Romania.

Based on previous researches undertaken by the authors, the results will be compared with those obtained in the IT&C industry in Romania.

The usefulness of the research comes from the possibility of achieving benchmarking analyzes on the innovation management among various companies in different industries.

3.2. *Establishing the innovation dimensions analyzed*

Based on the literature and our own experience, for the research fourteen dimensions of innovation were chosen, analyzed on the basis of 83 criteria, dimensions that provide a complete picture of the innovation management, taking into account issues relating to the conditions generating performance in innovation, resources involved, the processes undertaken and the results of innovation (see Table 1). Thus, the following dimensions and criteria were analyzed:

- Leadership in reference to: the existence of the vision and its communication, the relationship between the mission and the innovation, the top management's commitment and support in the innovative approaches, seeking the employees' help in providing ideas, awareness of the employees about the lack of the initiative in providing ideas and comments, presentation of some successful situations, openness to change and improve processes;
- Innovation strategy refers to: the existence of an innovation-oriented strategy; formulation and achieving goals of innovation; orientation towards creating competitive advantages; the existence of a development plan etc.
- Organizational culture aims to: searching and acceptance of the diversity of opinion; encouraging risk taking; accepting the mistakes in order to progress; rewarding the success; recognition of the work and of the team spirit; flexibility of the management about work time and in problem solving, encouraging the communication of the ideas etc.
- Human capital is considering: the development and updating the knowledge; the lack of the management's interest for excessive specialization of the staff; promoting the people; identifying people with creative skills; pursuit of a constant turnover of labour; the development of the communication skills for the technical personnel; the assignment of the financial and nonfinancial incentives both for the idea's initiator and for the team members which are dealing with the development and the implementation etc.
- Competencies regarding: guidance on developing key skills; identifying how the key skills and technologies within the company could be used in new ways and/or new markets/adjacent; the practice of a firm to actively seek know-how and skills outside the company by participating in profile events.
- Organizational structure referring to: the adoption of an organizational structure to pose a relatively small number of hierarchical levels; clear allocation of the responsibilities for collecting and evaluating market data, technology and competition; the existence of the temporary hierarchical relations; encouraging the delegation of the authority; collaboration outside the compartments; the existence of some persons or of a department with clear tasks to address issues related to research and development; creating spaces and equipping them to facilitate discussion and generate ideas etc.
- External relations regarding: the existence of the partnerships and the collaborative relationships with external entities; the company's involvement in organizing events in order to exchange ideas with external entities; working with partners for develop key technologies; analysing the activity of the development partners etc.
- Financing aims to: ability to identify internal and external financial sources to be involved in the process of research, development and innovation; the existence of a budget exclusively dedicated to the activity of the research and development.
- Portfolio management of technologies regarding: the company's interest for the recent technological changes in the industry; the classification of the technologies that are relevant to business; the employees' access, particularly of those from the technical compartment, to the latest knowledge in the industry; knowing the role of the various technologies in achieving the company's objectives; knowing the main strengths and weaknesses of the used technologies.
- Portfolio management of products and services covering: technical capabilities and the employees' knowledge which are regularly analyzed; comparing the performance of the products/services of the firm with the performance of the products/services similar on the market; using business intelligence tools; the existence of procedures for choosing new projects, risk analysis and resources allocation.
- The development process of new products and services is considering: the thinking of the development process of products and services as a process of "phases-gates" type; the focusing on identifying needs and providing solutions based on the segmentation and analysis of the customer based on its willingness to pay; the focusing on product configuration specifications that are described as acceptable ranges and absolute values; there is a systematic process of idea generation (for example, the campaigns of the ideas) and their prioritization; the access

of the people or groups, who want to promote a new approaching or technology, at the company's procedures, tracking the creation of the multidisciplinary teams of project; using tools for generating ideas, prioritization and selection within the company etc.

- The learning process is targeting: the triggering of the learning processes based on well-defined needs and deficiencies; the conducting of a systematic process of collecting, organizing and sharing all data and information received from the customers, suppliers, competitors; the documentation and availability of the knowledge gained from previous projects for the employees; the rotation of the employees who have valuable knowledge in a variety of project teams; the dissemination of the knowledge within the company; the interest and concern for the retention of the knowledge of the employees who leaving the company and transfer them to the successors etc.
- The evaluation and monitoring are considering: the existence of a system of indicators that measure the performance of innovation at the individual and organizational level; the retrieving of the knowledge acquired by the employees in the products and processes of the company; the comparison of the level of performance of the company in relation to those of the competitors, highlighting the role of innovation in the achievement of the results.
- The image is considering: the existence of a strategy for protecting the intellectual property; the company's concern to highlight the company's performance in innovation and in the mass-media appearances.

Table 1. Dimensions of the analyzed innovation

Conditions	1. Leadership (7 criteria)
	2. Strategy (4 criteria)
	3. Organizational culture (11 criteria)
Resources	4. Human capital (8 criteria)
	5. Competencies (3 criteria)
	6. Organizational structure (9 criteria)
	7. External relations (4 criteria)
Processes	8. Financing (2 criteria)
	9. Portfolio management of technologies (5 criteria)
	10. Portfolio management of products and services (5 criteria)
	11. The development process of new products and services (13 criteria)
	12. Learning process (8 criteria)
Results	13. Evaluation and monitoring (3 criteria)
	14. Image (2 criteria)

3.3. The choice of industry subject to research

In the choice of industry analyzed, the machine building industry was ranked in the top ten major industries with innovative activities in 2010-2012, the share of the innovative companies in that industry being 32.2% (NIS, 2014).

The products of the automotive industry, as part of the machine building industry, were ranked first among the Romanian exports in the first quarter of the year 2015, their value exceeding 6.127 billion Euros, according to the data published on the website of the Ministry of Economy, Trade and Tourism (METT).

3.4. The results of the research

At the research, 56 respondents from 17 companies in the machine building industry have participated. The period during which the analysis was held, was the first quarter of the year 2015.

All dimensions of the innovation analyzed were considered by the respondents as being very important or important because of the mean value of the dimensions, which ranges between the values 2 (important) and 3 (very

important). Of these, the most important being considered: Competencies, Strategy, Human capital, Financing (see Table 2).

Table 2. The average values for the analyzed dimensions - Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
The importance of the leadership	56	1	3	2.57	.568
The importance of the strategy	56	1	3	2.79	.530
The importance of the organizational culture	56	1	3	2.07	.568
The importance of the human capital	56	2	3	2.64	.483
The importance of the competencies	56	1	3	2.80	.444
The importance of the organizational structure	56	1	3	2.18	.716
The importance of the external relations	56	1	3	2.50	.539
The importance of the financing	56	1	3	2.63	.590
The importance of the portfolio management of technologies	56	1	3	2.46	.602
The importance of the portfolio management of products and services	56	1	3	2.34	.640
The importance of the development process of new products and services	56	1	3	2.52	.572
The importance of the learning process	56	1	3	2.34	.668
The importance of the process of evaluation and monitoring	56	1	3	2.43	.599
The importance of the image	56	1	3	2.59	.596
Valid N (listwise)	56				

Source: SPSS processing

3.5 Comparing the results with the IT&C industry

In the same research, the IT&C industry was analyzed through the participation of 80 respondents from 51 companies. The IT&C industry was ranked in the top five major industries with innovative activities in the period 2010-2012, the share of the innovative companies in this industry being 35.6% (NIS, 2014).

It is noted that in terms of the importance given to the innovation dimensions, both industries are very similar (see Table 3).

The order of the first five positions in importance is almost identical. Thus, on the first position it is seen the interest in developing key skills, on the second one is the innovation-oriented strategy, and on the third position is the human capital. The fourth position gives the first important difference, named financing, seen as very important in the machine building industry unlike the IT&C industry, where it is seen as much less important in the innovation process, occupying the eleventh position. The fifth position is occupied by the same dimension, named the image. Similarities are kept almost in all other dimensions, major differences appeared besides financing, to the learning process, to the portfolio management of the product and services and to the external relations (see Table 3).

It seems that in both industries more emphasis are putting on the dimensions related to conditions and resources involved in the innovation processes, the dimensions related to processes and results are seen as logical effects of the effort directed towards innovation.

The t test for the cumulative dispersions were calculated (as you saw in Table 4). Thus, it was calculated the difference between the averages for the two independent samples.

First, the standard error of the difference (S_{DIF}) was calculated, and then t with the formula (1).

$$t = \frac{m_1 - m_2}{S_{DIF}} = \frac{2.49 - 2.4271}{0.0154} = +4.07 \quad (1)$$

For the comparison between $t_{\text{calculated}}$ with t_{critical} was observed that $t_{\text{calculated}} = +4.07 > t_{\text{critical}} = 1.9778$ (for $df = 134$ and $p = 0.025$).

Table 3. The importance of the dimensions of innovation

	The machine building industry			The IT&C industry		
	Mean	Std. Deviation	Position	Mean	Std. Deviation	Position
The importance of the leadership	2.57	.568	6	2.45	.614	7
The importance of the strategy	2.79	.530	2	2.72	.551	2
The importance of the organizational culture	2.07	.568	14	2.20	.683	13
The importance of the human capital	2.64	.483	3	2.51	.616	3
The importance of the competencies	2.80	.444	1	2.78	.420	1
The importance of the organizational structure	2.18	.716	13	1.99	.584	14
The importance of the external relations	2.50	.539	8	2.26	.689	12
The importance of the financing	2.63	.590	4	2.39	.684	11
The importance of the portfolio management of technologies	2.46	.602	9	2.41	.706	10
The importance of the portfolio management of products and services	2.34	.640	11	2.49	.636	4
The importance of the development process of new products and services	2.52	.572	7	2.46	.635	6
The importance of the learning process	2.34	.668	12	2.44	.653	8
The importance of the process of evaluation and monitoring	2.43	.599	10	2.41	.630	9
The importance of the image	2.59	.596	5	2.47	.637	5

Table 4. The way of the calculation of the t test

	X_1	$(X_1 - m_1)^2$	X_2	$(X_2 - m_2)^2$
	2.57	0.0064	2.45	0.00052
	2.79	0.09	2.72	0.08584
	2.07	0.1764	2.2	0.05152
	2.64	0.0225	2.51	0.00688
	2.8	0.0961	2.78	0.12460
	2.18	0.0961	1.99	0.19096
	2.5	0.0001	2.26	0.02788
	2.63	0.0196	2.39	0.00136
	2.46	0.0009	2.41	0.00028
	2.34	0.0225	2.49	0.00396
	2.52	0.0009	2.46	0.00108
	2.34	0.0225	2.44	0.00016
	2.43	0.0036	2.41	0.00028
	2.59	0.01	2.47	0.00184
Σ	34.86	0.5676	33.98	0.49728
N	56		80	
m	2.49		2.4271	
s^2	0.01032		0.00629	
S_{DIF}		0.0154		

Therefore, it was found that the importance given by the respondents to the dimensions of the innovation differ in the two industries.

In conclusion, the weights of importance in determining the score of innovation at the firm's level in the benchmarking process between two companies in these industries will bear the major differences on four dimensions: financing, learning process, portfolio management of products and services and external relations.

4. Highlighting our own contributions

The research aims to improve a method developed by the authors on analyzing and improving the innovation capabilities at the firm's level. Currently, the method of analysis is offered to the market as a consulting service through the medium of the company First Step Marketing Ltd., the first company in Romania that introduced the concept of the innovation audit. More details on this initiative can be found at the address www.auditinovare.ro

Because there is very little data in the literature on how the different dimensions of the innovation contributes differently to the formation of the innovation score, which reflects the company's innovation capability at a time, the authors' approach can be considered a beginning for the practice and the experience at the country's level.

5. Conclusion

In Romania little is known on the analysis and improvement of the innovation capability (innovation audit), in this respect the proof is that ASRO published only in 2012 the first standard in this direction, SR 13547-4: 2012 Business development model through innovation. Part 4: Evaluation of the capability of innovation and the performance of the innovation management.

New European Strategy 2014-2020 focuses on encouraging the investments in research, innovation and entrepreneurship in each member state in order to exploit the Europe's potential. The companies which demonstrate that are innovative will receive significant financing and priority from the EU.

The existence of some tools that enable a thorough and objective analysis of the innovation management developed by companies, it becomes really useful. Such a tool is useful both for the company's management to improve its performance in innovation, as well as for the institutions that provide European financing for the development of the competitiveness by bringing at the same denominator of the concerns of the companies directed towards innovation in several industries.

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