STRATEGIC MANAGING INNOVATION IN SROs IN SERBIA: SHOULD IT BE RESISTIBLE?

Marija Mosurović Ružičić[1], Vladimir Obradović[2], Marina Ignjatović[3]

[1]Institute of Economic Sciences, Serbia; [2,3]Faculty of Organisational Sciences, University of Belgrade, Serbia

Abstract: Today's complex and unpredictable environment demands from scientific-research organisations (SROs) efficient managing changes in the turbulent environment, as well as to easily recover from inflictions causes by unforeseeable circumstances- to be resilient. Research demonstrated in this paper shows that resilience of strategic management in SROs entails management capacity to manage innovation. However, not all variables of strategic management framework have an equal influence on the innovation management capacity. The following variables have made the most powerful impact: efficiency evaluation, internal environment and organisational design. At the same time, these variables define, in the narrowest sense, SROs capabilities and capacity, which altogether present a standing point for a sustainable and flexible strategic management SROs.

Key words: resilience, strategic management, sustainable innovation

1. INTRODUCTION

Strategic management of scientific-research organisations (SROs) has certain particularities determined by the very nature of scientific-research work which is usually project-organised (OECD 2015). Furthermore, SROs management need to follow and keep their ears on the ground regarding public and private interests, which additionally makes the process of strategic management complex (Güldenberg and Leitner 2008). These are merely some of the characteristics that influence managing patterns in scientific research organisations to be formed. The fact that SROs are solely one segment of a wider system, national innovation system, clearly indicates that strategic management in SROs is closely tied to understanding of the concept of *knowledge and innovation management*.

Knowledge management which occurs in scientific-research organisations should involve a motivation system for researchers, with the aim of improving knowledge transfer, while at the same time maintaining the traditional SROs goal to create and develop knowledge. Not only should an SROs manager have a thorough knowledge of the processes of research and development and innovation, but he should also have developed business abilities, in a nutshell, to have the capacity to manage innovation.

A widely acknowledge stand in literature is that innovation present the result of scientific-research work that is sought after on the market. Sustainable innovation implies the ability to overcome unforeseeable events from the environment, society and the economy (Lv et al. 2018). Contemporary literature suggests that the concept of resilience and sustainability

should be observed in a common context. It is an advanced way of managing uncertainties which follow sustainable innovation. Both concepts help organisations face uncertainties and are closely connected to innovation, since innovative projects need resilience (Lv et al. 2018; Söderholm 2008).

Complex and wavering business environment imposes a need for additional skills when it comes to strategic management (Edgar et al. 2013; Pérez et al. 2017). Resilience is actually an organisation's ability to deal with changeable and turbulent environment, along with the ability to speedily recover from setbacks (Richtnér & Södergren, 2008; Edgar et al., 2013; Xiao & Cao, 2017). From the point of view of strategic management, resilience means effective and efficient organisation management based on the abilities and capacities of organisations to successfully overcome unpredictable environment (Lv et al. 2018). In theory, a consensus has been reached which states that organisational abilities and capacities are basic components of internal environment and that they determine a strategic direction of an organisation (Jugdev, Mathur, and Fung 2007; Wheelen and David Hunger 2012). On an internal level, innovation are guided by manager's attitudes, marketing, information technologies, organisation design elements, knowledge base, internal resources etc. (Hidalgo and Albors 2008; Lau 1999). Organisation resilience is not acknowledged merely on an operative level (Xiao and Cao 2017). It is a far more complex idea that needs to be developed in a wider organisational context.

Having this in mind, it is clear that today's SROs simply must have the capacity for innovation management. Between 2018 and 2019, empirical research on strategic management of SROs has been conducted in Serbia. A part of this work's results will be illustrated in this paper in order to test the hypothesis of the paper *Strategic management in scientific-research organisations implies management capacity to successfully manage innovation* (Mosurović Ružičić 2018).

2. METHODOLOGY

Empirical research illustrated in this paper is based on the assumption that strategic management need to be understandable to all employees within an organization. Having this in mind, a questionnaire was distributed to the employees of all accredited scientific-research organisations in Serbia (institutes and faculties). 189 participants have submitted their responses. The responses have mostly been ranked on the five-point Likert scale (1- I strongly disagree; 5 – I strongly agree). The questionnaire was created online which allowed the anonymity of the respondents and increased the level or responses.

2.1. PUTTING THE HYPOTHESIS TO THE TEST

This paper put to the test the starting point of the hypothesis: *Strategic management in scientific-research organisations implies the management capacity to successfully manage innovation.*

With the aim of corroborating aforementioned hypothesis, a model was initially formed for strategic management of SROs whose components are illustrated in Table 1 and depict three

phases of strategic management: planning, implementation and evaluation (Mosurović Ružičić 2018). The data shown were average, standard deviation, minimum, maximum, Friedman's test results (which indicates that all sub-elements of the main variables are different among themselves), along with Cronbach's Alpha, validity measure scale which helped to create variables (Table 1). For the three variables, *Internal Environment, Cooperation* and *Management capacity to manage innovation* it can be seen that the values of Cronbach's Alpha are over 0.7 which is an acceptable scale. Seven variables, *External Environment, Strategic Documents, Resources, Organisational Design, Monitoring, Results* and *Methods and Techniques*, have the values of Cronbach's Alpha over 0.9, which is estimated as an excellent scale.

Table 1. Descriptive overview of the basic elements of SROs strategic management model (Mosurović Ružičić, 2018; Mosurović Ružičić, Obradović, & Dobrota, 2019)

Variable	**Br. podel.**	**Average**	**SD**	**Min**	**Max**	**Friedman**	**Friedman sig.**	**Cronbach's alpha**
External environment	10	29.24	8.826	10	49	217.908***	<0.001	0.891
Internal environment	11	30.77	6.786	15	51	699.881***	<0.001	0.782
Strategic documents	4	11.62	5.008	4	20	109.032***	<0.001	0.888
Project portfolio	7	19.86	7.577	7	35	179.239***	<0.001	0.901
Resources	5	14.14	4.958	5	25	95.548***	<0.001	0.803
Organisational design	6	20.12	6.312	6	30	138.799***	<0.001	0.885
Cooperation	5	15.25	4.691	5	25	193.875***	<0.001	0.795
Monitoring	4	10.69	4.588	4	20	138.271***	<0.001	0.878
Result	7	23.40	7.050	10	35	253.243***	<0.001	0.836
Accomplishment assessment	6	16.28	6.651	6	30	245.375***	<0.001	0.902
System of lessons learnt	4	9.65	4.726	4	20	68.104***	<0.001	0.933
Efficiency assessment	13	41.68	14.543	13	65	229.952***	<0.001	0.963
Methods and techniques	3	6.56	3.432	3	15	40.632**	<0.001	0.869
Management capacity to manage innovation	7	20.762	5.707	7	35	250.44***	<0.001	0.773

2.2. DEFINING MANAGEMENT CAPACITY FOR MANAGING INNOVATION VARIABLE

The management capacity to manage innovation is focused on innovation processes that are ongoing in SROs. Four components typical for managing innovation process within an organisation are distinguished in literature (Bessant and Tidd, Joe, Paviitt 2011): strategy, efficiency of internal and external connections, mechanisms that incite changes and organisational context. This point of view was the starting point during the creating of the *management capacity to manage innovation* variable (Table 2).

On the basis of the results of non-parametric Friedman's test for matched samples, it can be concluded that all model elements are statistically different among themselves (Table 2) and that they do not contribute equally to the creation of the variable. The reason this test was used is because the responses were measured on five-point Likert scale, thus, Friedman's test was suitable for comparison of such a scale.

For the *Management capacity to manage innovation* variable, the most important sub-elements are E*conomic sector purchasers– finance, Economic/specific industry needs* and then *Projects executed through co-operation with companies from the economy* (as illustrated in Table 2 on the basis of average and particular ranks).

	Average	SD	Friedman average rank
Key competencies within a field	2.19	1.145	2.75
Economic sectors purchasers	3.68	1.197	5.24
An adequate level of knowledge in the field of project management facilitates project tasks execution	2.48	1.227	3.25
Co-operation with the economy to execute a project	3.22	1.294	4.39
An increased number of new or significantly improved products/services/process	2.90	1.422	3.79
New market conquest	2.73	1.319	3.63
Economic/specific industry needs	3.57	1.140	4.96

Table 2. Capacity to manage innovation (Mosurović Ružičić 2018)

**p<0.05 **p<0.01 ***p<0.001*

2.3. TESTING OF THE HYPOTHESIS

In order to test the hypothesis, Pirson's coefficients of correlation between *Management capacity to manage innovation* variable and other system variables, illustrated in Table 3. *Pirson's coefficients correlation for the Management capacity to manage innovation variable, compared to other variables*.

Table 3. Correlation between strategic management elements in SROs and management capacity to manage innovation (Mosurović Ružičić 2018)

	Management capacity to manage innovation
External environment	0.615***
Internal environment	0.708***
Strategic documents	0.492***
Project portfolio	0.581***
Resource allocation	0.544***
Organisational design	0.584***
Co-operation	0.651***
Monitoring	0.573***
Results	0.453***
Achievement grade	0.554***
Learnt lessons system	0.465***
Efficiency assessment	0.679***
Methods and techniques	0.469***

**p<0.05 **p<0.01 ***p<0.001*

The *Management capacity to manage innovation* variable is significantly correlated with all other variables on the significance level of 1%.

Management capacity to manage innovation is in a medium-strength correlation (with values between 03. and 0.6), with the majority of the following variables: *Strategic documents, Project portfolio, Organisational design, Monitoring, Results, Achievement grade, Learnt lessons system, Methods and Techniques,* while it is in a strong correlations (with values of over 0.6) with the following variables: *External environment, Internal environment, Co-operation, Efficiency assessment*. The strongest connect is between *management capacity to manage innovation* and *Internal environment (r=0.708),* shown in Picture 1 and *Efficiency assessment (r=0.679)*, as illustrated in Picture 2.

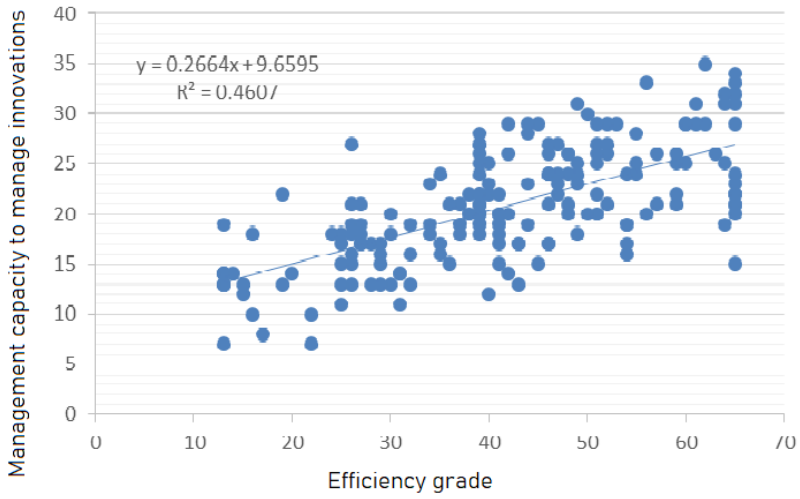

Figure 1. The influence of the Efficiency assessment on the Management capacity to manage innovation (Mosurović Ružičić 2018)

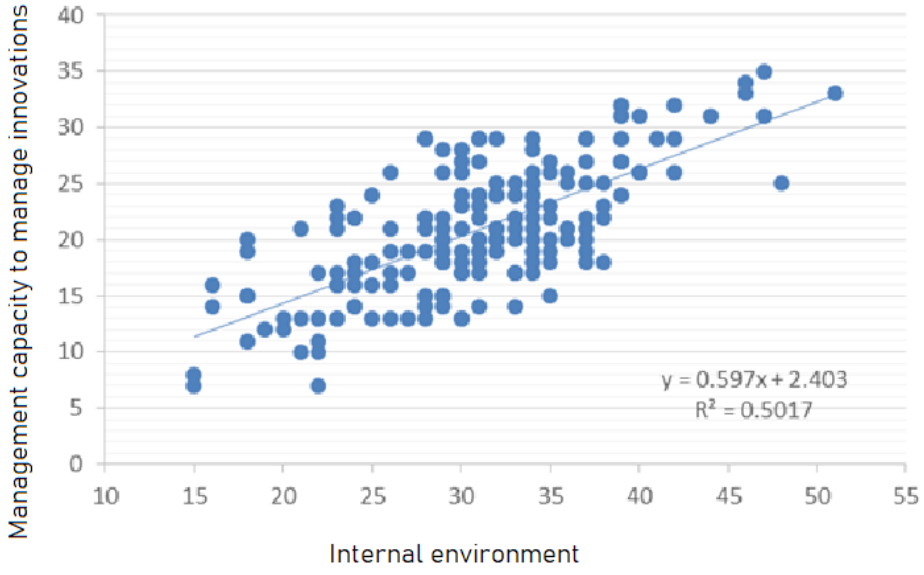

Figure 2. The influence of the Interne on the Management capacity to manage innovation (Mosurović Ružičić 2018)

For a more in-depth analysis of the connections in this model, a regression model where the *Management capacity to manage innovation* is a dependent variable is created. The model probes the influence of all model elements on organizational design. A backward regression model was used for analysis, where all statistically unimportant variables are eliminated.

Table 4. Regression model of variable influence on the Management capacity to manage innovation (Mosurović Ružičić, 2018)

Variables	**Regression coefficient (B)**	**t**	**95% of trust interval for B**	
A constant	-3.389	-3.069**	-	-
External environment	0.081	2.135*	0.006	0.157
Internal environment	0.291	5.741***	0.191	0.391
Strategic documents	0.087	1.162	-0.061	0.236
Project portfolio	-0.140	-2.021*	-0.276	-0.003
Resources	-0.140	-1.526	-0.321	0.041
Organisational design	0.194	3.369***	0.080	0.307
Co-operation	0.169	2.573*	0.039	0.299
Monitoring	0.190	2.043*	0.006	0.373
Results	0.091	2.784**	0.026	0.156
Achievement grade	0.057	0.761	-0.091	0.205
Learnt lessons system	-0.210	-2.677**	-0.365	-0.055
Efficiency assessment	0.170	10.056***	0.137	0.204
Methods and techniques	-0.011	-0.096	-0.247	0.224
F	46.895***			
R^2	0.792			

*p<0.05 **p<0.01 ***p<0.001

Table 4 illustrates the original model of variable influence on the *Management capacity to manage innovation*. The influence model is statistically significant on the level of importance of 1% (F=30.031, p<0.001). The determination coefficient is 0.792, which means that this model explains 79.2% of the variability of *Management capacity to manage innovation* variable. However, not all model variables have a statistically significant impact on the *management capacity to manage innovation*. In Table 5, a backwards regression model is shown.

Table 5. Backwards regression model on the Management capacity to manage innovation (Mosurović Ružičić 2018)

Variables	**Regression coefficient (B)**	**t**	**95% of trust interval for B**	
A constant	-3.530	-3.227**	-	-
External environment	0.091	2.423*	0.017	0.164
Internal environment	0.294	5.875***	0.195	0.392
Strategic documents	-0.134	-2.222*	-0.253	-0.015
Organisational design	0.172	3.191**	0.066	0.279
Co-operation	0.157	2.420*	0.029	0.285
Monitoring	0.198	2.271*	0.026	0.371
Results	0.087	2.707**	0.024	0.151
Learnt lessons system	-0.192	-2.595**	-0.338	-0.046
Efficiency assessment	0.170	10.263***	0.137	0.203
F	67.746***			
R^2	0.788			

*p<0.05 **p<0.01 ***p<0.001

In the model illustrated in Table 5, the influence of *External environment, Internal environment, Project portfolio, Organisational design, Co-operation, Monitoring, Results* and *Learnt lessons system* have shown a significant influence on the *Management capacity to manage innovation*. The influence model is statistically important on the level of importance of 1% ($F=67.746$, $p<0.001$). The most significant influence had *Efficiency assessment* on the importance level of 1% ($t=10.263$, $p<0/001$); the stronger the efficiency is, the better management capacity to manage innovation is. Next in line is the influence of *Internal environment* on the level of significance of 1% ($t=5.875$, $p<0.001$); the stronger the management capacity to manage innovation are, the stronger are the internal environment components. The following is the influence of Organisational design on the same level of 1% ($t=3.191$, $p<0.001$); the better organisational design is, the better capacity to manage innovation is. The determination coefficient is 0.788, which means that this model provides an explanation for 78.8% of variability of *Organisational design* variable.

3. RESULTS

Previously performed statistical analysis has confirmed the starting hypothesis of this paper *Strategic management in scientific-research organisations implies management capacity to successfully manage innovation*.

On the basis of the conducted research as a significant influence on the *Management capacity to manage innovation* have been the following: *External environment, Internal environment, Project portfolio, Organisational design, Co-operation, Monitoring, Results* and *Learnt lessons system.* The most significant was the influence of *Efficiency assessment* on the level of importance of 1% ($t=10.263$, $p<0.001$); the stronger the efficiency is, the better management capacity to manage innovation is. The next in line is the influence of *Internal environment* on the level of significance of 1% ($t=5.875$, $p<0.001$); the better organizational design is, the better the capacity to manage innovation is. The determination coefficient is 0.788, which means that this model explains 78.8% of the variability of *Organisational design* variable.

4. CONCLUSION

The activities performed in scientific-research organisations, especially when it comes to research and development activities, are in a direct link to innovation creation. Innovation projects are knowledge based and include a large number of participants that incite the need to exploit resources which will enable resilience (Richtnér and Södergren 2008; Yan et al. 1998). The research illustrated in this paper illustrates that SROs management should be based on innovation management and need to develop patterns of strategic management so as to create an environment that boosts resilience.

The testing of aforementioned hypothesis in the paper has shown that the resilience of management in SROs entails the management capacity to manage innovation. However, not all variables have the same influence on a framework for SROs strategic management nor an

equal influence on the innovation management capacity. The strongest influence has been attributed to the following variables: *efficiency assessment, internal environment* and *organisational design.* At the same time, these variables, in the narrowest sense, define SROs capacities and capabilities, which altogether present a standing point for a sustainable and flexible strategic management SROs. On the European Union level, research and development have been recognised as the instruments of importance for attaining a sustainable development, which is in accordance to the national strategy of sustainable development.

If the management of scientific-research organisations in Serbia wishes to become enabled for a strategic management in a contemporary business environment, a special attention needs to be paid to innovation and strategic innovation management requires resilience. This is the way that management will be able to accept necessary challenges and changes which will inevitably be brought by the transformation of the research system of a country in transition, such as Serbia.

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