INFLUENCE OF RESEARCH & DEVELOPMENT ON BUSINESS MODEL INNOVATION CAPABILITY

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Abstract— Today's business conditions are marked by great progress in the areas of new technologies, new developments and a series of turbulent changes in all areas of operations. Under such conditions, research & development is facing new challenges, and has the task of creating new business solutions through various means of innovation. On the other hand, one of the ways an organization can create multiple business advantages during times of turbulent change is through the concept of business model innovation. This can be an insufficiently exploited source of future values. An empirical study established the existence of a significant correlation between these concepts, and confirmed the set hypotheses, showing that research & development can enable a company to possess a strong strategic tool in the sense of its for business model innovation capability.

Keywords— Business Model Innovation Capability, Business Results, Innovation, Research and Development.

I. INTRODUCTION

Research & development (R&D), which began in the industrial laboratories of the 20th century, is currently facing new challenges due to the significant changes that have occurred over time. R&D is increasingly taking on the task of creating radically new business solutions through various aspects of innovativeness. This paper considers and empirically examines the links between R&D and a strong innovative means for achieving a competitive edge in the present and future periods, in the form of business model innovation.

II. RESEARCH & DEVELOPMENT IN COMPANY OPERATIONS

It is certain that new accomplishments in the area of creating new knowledge and the accompanying techniques and processes will forge the organisation's path towards business success. R&D is a sector in which the purpose and objective are to create organisational success, in precisely this manner. Experts agree that R&D represents a key element in the competitive knowledge-based global economy [16], and in present day business conditions, marked by rapid technological advancement, R&D has proven to be an important element of economic growth [5].

By definition, R&D includes those creative activities taken at the systematic level to increase the overall knowledge fund of the company, including the knowledge of personnel, culture and society, and the use of this knowledge fund to create new applications [18]. R&D also presents a framework for the primary intent of creating new knowledge that will result in both tangible and intangible resources that can be applied to the organisation's needs, products and processes.

In the current conditions of rapid technological advancements, new development directions on the global market, and turbulent changes in all areas of operations, R&D is a very important part of the business world and forms an important part of company strategy. It is important to note that R&D is viewed differently today than in the past. Over time, the application and management of knowledge in operations has become an increasing imperative. Innovation has become one of the greatest levers for creating growth, and therefore R&D is oriented towards creating new innovative knowledge that can generate prosperity for the organisation. This knowledge often has the capacity to largely impact the economic branch it operates in, or even to change the business model, customer behaviour or to create completely new markets and business opportunities.

It can be said that the actual concept of R&D pertains to a group of activities implemented by an organisation aimed at innovative accomplishments, including multiple activities based on science and technology, including scientific and technological innovation. Though integrating the function of R&D and work towards creating significant technological innovations are the areas of innovation research with the longest tradition [7], there is often a sense of improvisation in the creation of innovation projects and departments, instead of creating successful innovative organisations [10]. The literature still lacks a model for measuring the degree of possession of innovation capability and its impacts within organisations [21].

The universally accepted framework for the study of R&D are the publications of the Organisation for Economic Co-operation and Development (OECD), issued as guidelines for EU Member States and other countries, for the analysis, validation and measurement of accompanying processes and activities. The main publications are the Canberra

Manual (1995) and the Frascati Manual (most recent edition in 2002). They cover the topics of organisational activities of R&D, and give guidelines for measuring scientific and technological activity.

R&D can be viewed through two input elements that should be measured [18], and which represent its fundamental determinants:

• expenditures for R&D

• human resources employed in this area who are assigned based on their profession, and their role pursuant to the following definitions:

- Research staff, as professionals engaged in the creation of new knowledge, products, processes, methods and systems, including management of these areas;

- Technical staff, as those participating in the processes of R&D by executing tasks of a scientific and technical nature, including the implementation of concepts and operational models usually under the supervision of research staff, and requiring technical knowledge and experience.

The important of R&D in modern day business is uncontested. The research to date has confirmed a positive association between R&D and company productivity [19], and that R&D is an important source for raising productivity [5]. Also, it is evident that it is an exceptionally important factor for achieving economic growth in the long-term [4].

III. BUSINESS MODEL INNOVATION CAPABILITY

The business model of a company articulates how the organisation creates value for its clients [3], i.e. outlines the logic and gives data that show how operations create and bring value to customers, and defines the architecture of company revenues, costs and profit [24]. The dynamics and speed that characterise customer needs should be viewed through a dynamic approach to establishing and the functioning of the company business model.

Traditional management models that prefer optimisation over innovation, and continuity over change, are not able to adequately address the present day business environment [9]. In uncertain market conditions, a company should aim to create a more agile business model that is largely directed at client needs, instead of treating growing complexity as a barrier to operations, and in so doing, to transform this complexity into a source of business opportunities [12]. In order to enable the creation of business models that meet current needs, and models that are oriented towards the future of the organisation, the use of innovation models and principles becomes an exceptionally useful approach. Business model innovation is particularly valuable in times of instability [15].

Business model innovation has specific determinants. This implies an iterative, spiral approach to innovation on the one hand [6], with rapid application of a completely new model created through radical innovation on the other. The business model innovation concept presents a radical method of re-engineering operations, which is tightly tied to company strategy [22]. A serious strategic approach towards changing the business model is particularly necessary due to the need to focus on the planned abandonment of old models, without negative impacts on the organisation. Namely, the new business model destroys the old model, and as such the creation of new values marks a threat to all traditional forms of operations [11]. Therefore, management has the demanding task of formulating new and innovative strategies, and companies need to have pronounced capabilities for business model innovation.

There is an increasing level of concurrence within the literature that the following elements define the basis of a company's business model [8]:

- which values are presented to the customer in viewing the segments of customers, subject of sales, and manner of sales,

- how company revenues are achieved, with regard to price models and means of monetisation,

- how value is transferred from the organisation, considering its internal resources and processes, and external partnerships,

- how the company has positioned itself within its economic branch.

In line with these elements, it is possible to define the fundamental principles that ultimately lay the foundation of a company's capability for business model innovation:

• Innovating the value creation model of the company, with an emphasis on individual or joint effects of offering new products or services, or the possibility of offering existing products or services to new customers;

• Innovating the company's operation model by creating new price models and policies aimed at improving sales and the company's capability for reconfiguring its asset and cost structures;

• Innovating the company's corporate model, in viewing its capability to reconfigure or create a completely new value chain, to implement organisational transformation while creating ties with those involved in operations, and the importance of developing human resources as a precondition for their innovation activities.

•Innovating the company's economic model, by examining the possibility of redefining operations within the existing economic branch, and its operations in completely new economic branches and environments, i.e. its capability to create this.

There is a consensus that business model innovation is a key element in business performance [25]. A series of studies have confirmed there is a marked positive effect of business model innovation on multiple aspects of the business result. In addition to increasing differentiation, premium gains and profit

margins, business model innovation is ultimately an exceptionally powerful tool for achieving a competitive edge. The significance of business model innovation has been recognised by the academic community and by leading global managers alike. In 2012, a global study conducted by the Economist Intelligence Unit on a sample of more than 4000 leading managers showed that 54% believed a new business model is a better source of future competitive edge than new products and services [2].
The effective consideration of business models and their roles in operations, innovations and the achievement of business performance leads to a better understanding of the elements, including market trends, competitiveness, basic company operation, and the role of the entrepreneur and manager in the economy and society [24]. Due to the importance of possessing the capability for business model innovation, identifying and effectively measuring the degree of this capability is an exceptionally important factor. The company that neglects policies that lead to business model innovation can quickly find itself in a situation in which the competition changes the business conditions in their economic branches to such an extent that it critically jeopardises their operation. Business model innovation has reformulated entire economic branches and redistributed billions of dollars of value [14]. This is a clear indicator of the strength that business model innovation obviously has, and allows for the conclusion that research on this element is both necessary and beneficial.

IV. THEORETICAL TIES BETWEEN RESEARCH & DEVELOPMENT AND A COMPANY'S CAPABILITY FOR BUSINESS MODEL INNOVATION

From the above listed characteristics of concepts of R&D and business model innovation, it becomes clear that they are oriented and strongly tied to innovation. Innovation therefore becomes the primary factor for their common consideration in theory. It can be observed that companies that invest and perform R&D functions have a higher rate of innovation than companies without these activities, and innovation based on R&D has long been the stronghold of the US economy [17]. The deep roots of innovation in the concept of R&D are particularly visible in studies in which R&D represents one of the attributes used to describe innovation itself [23]. Studies have shown that the transfer, exchange and creation of knowledge have become the fundamental determinants of the success of the innovation process [13], while the literature also includes strong arguments in support of the implementation of company innovation policy based on the mutually supporting relationship between economics and the human aspects of work activities in an organisation [1]. Investments in terms of financial resources and human resources within the R&D sector impact such an implementation of innovation policy.
The Innovation Union Scoreboard (IUS) from 2011 is an EU publication that lists the dimensions of innovation directly associated with the fundamental elements of R&D, such as expenditures for R&D in terms of availability of financing and investments, and human resources. In observing the fundamental principles of a company's capability for business model innovation, we see the direct theoretical links of these two elements on the segment of corporate model innovation of the company that considers human resources. An indirect theoretical effect of R&D can be established with other segments, such as innovating the value creation model and innovating the operating model, since the purpose and objective of R&D is to create new products and services, new means of marketing, sales and distribution of existing products and services, and to conceive innovative approaches to price models. This can ultimately result in internal reconfiguration or transformation of the organisation itself. If the R&D department is capable of conceiving highly significant business solutions, that in turn can impact the entire economic branch, and with that, can innovate the company's economic model.

V. EMPIRICAL STUDY – ANALYSIS OF THE INFLUENCE OF RESEARCH AND DEVELOPMENT ON A COMPANY'S CAPABILITY FOR BUSINESS MODEL INNOVATION

For the purpose of empirical testing, a novel research model was proposed to link R&D with a company's capability for business model innovation (Fig. 1). One side consists of separate variables that are determinants of R&D, pursuant to the OECD Frascati and Canberra Manuals, while the other side consists of the company's capability for business model innovation as defined through its fundamental principles.

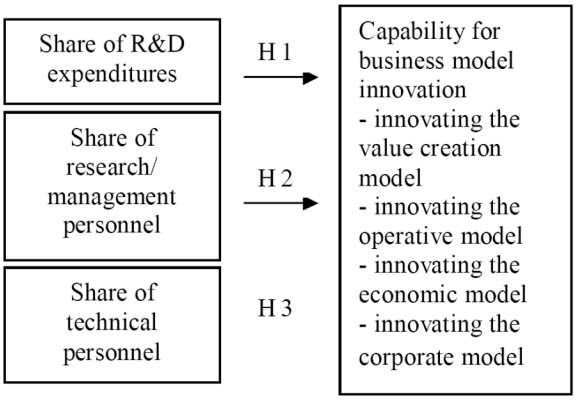


Fig.1. The research model of the influence of research and development on a company's capability for business model innovation

In relation to the research model, the following hypotheses were set:

H1 – The share of R&D expenditures of a company is associated with the existence of its capability for business model innovation;

H2 – The share of professional personnel engaged in the creation of new knowledge, products, processes, methods and systems in operations, including management of the same, in the total number of company employees, is associated with the existence of its capability for business model innovation;

H3 – The share of technical personnel serving as professional support to the implementation of applications, concepts and operational methods in R&D in the company, in the total number of company employees, is associated with the existence of its capability for business model innovation.

A. Methodological Framework of the Study

The study was conducted in late 2014 on a population of large and very large Croatian enterprises, i.e. meeting the criteria of a minimum of 250 employees. The total population consisted of 624 companies. Of these, 114 filled out and returned the questionnaire, for a return rate of 18.27%. With that, the sample is representative, particularly noting that the companies in the sample employ 10.9% of all employees in the Republic of Croatia (pursuant to employment indicators for October 2014 published by the Central Statistics Bureau). The research instrument was a questionnaire. In filling out the questionnaire, those surveyed outlined their perceptions of the measurable properties of the company. The determinants of R&D were defined in accordance with the OECD Frascati and Canberra Manuals. The possession of the capacity for business model innovation was tested through a total of ten questions determined by the factors for their identification. Company top management was surveyed. For the purpose of measuring the determinants of R&D and the capacity of the company for business model innovation, the five-point Likert scale was used to compare the company to its industry competitors. A score of one meant: significantly below the competition; score of two: below the level of the competition; score of three: at the level of the average competition; score of four: above the level of the competition, and score of five: significantly above the competition. With regard to the size of companies from the sample, statistical analysis showed that 64% were large companies (pursuant to the criteria of 250 to 1000 employees) and 36% were very large companies (pursuant to the criteria of over 1000 employees). In terms of ownership structure, 92.1% of the companies in the sample are privately owned, while 7.9% are under majority state ownership.

B. Results of the Empirical Study

The results of the descriptive statistics indicate that R&D expenditures in total company expenditures had an arithmetic mean of 3.2 on a scale of responses from 1 (significantly less than the competition) to 5 significantly higher than the competition), making this a good indicator. Companies from the sample possess the financial resources that enable them to monitor changes in science and technology, to procure the necessary new solutions, and to employ personnel with the expertise and in the numbers needed to contribute to the successful development of R&D within the organisation.

The statistical data pertaining to the employment of personnel in the areas of science and technology are important, as these show the results of measuring the input size of human resources in relation to company R&D and its innovative capabilities, as the importance of human resources for innovativeness is increasingly recognised [20]. With that, since large amounts of innovation knowledge are contained with people and their skills [18], researching the influence of the determinant of R&D in terms of human resources becomes a mandatory factor.

The arithmetic means of 3.87 for the share of professional personnel engaged in the creation of new knowledge, products, processes, methods and systems in operations, including management of the same, in the total number of employees, and of 3.85 for the share of technical personnel serving as professional support, are high. From these results, it can be seen that the companies from the sample have better than average development of resources in terms of key human resources in R&D than their competitors.

The average value of the overall score of indicators of the possession of capability for business model innovation of 3.58 presents a good result, since business model innovation still represents an insufficiently exploited source of future values [2].

The first hypothesis of the study examines the relationship between the share of R&D expenditures of a company, and the existence of its capability for business model innovation. The correlation test between these two variables from the sample gave a Spearman's coefficient of 0.641, with two-tailed significance of 0.000. This result shows that there is a real and significant correlation between the share of R&D expenditures and the company's capability for business model innovation. The concept of innovation is tied to both these constructs, which already in theory suggested their close ties. Based on this analysis, the hypothesis H1 is accepted and it is concluded that there is an association between the share of expenditures dedicated to R&D and the existence of the company's capacity for business model innovation.

The second hypothesis examines the relationship between the share of professionally personnel engaged in the creation of new knowledge, products, processes, methods and systems in operations, including management of the same, in the total number of employees, and the existence of the company's capability for business model innovation. The correlation test gave a Spearman's coefficient of

0.519, with two-tailed significance of 0.000. The results of the empirical study show there is a real and significant association between the examined variables. Following the theoretical assessment of close ties between human resources with an academic profile engaged in R&D with elements pertaining to the company's capability for business model innovation, this result provides empirical evidence of the theoretical conclusion. Therefore, the hypothesis H2 is accepted, and the conclusion is made confirming this association.

The third hypothesis examines the share of technical personnel serving as professional support for the implementation of applications, concepts and operational methods in the area of R&D in a company, in the total number of employees and the existence of the company's capability for business model innovation. The correlation test gives the Spearmen coefficient of 0.597 with two-tailed significance of 0.000. The results of the correlation test show the existence of a real and significant correlation between these variables. The previous theoretical assessment of the close ties between human resources of a technical profile engaged in R&D and the elements relating to the capability for business model innovation suggested such an association. The results of the empirical study confirmed the theoretical conclusions. After completing the analysis, the hypothesis H3 is accepted and it is concluded that there is an association between the examined variables.

The results of the correlation test conducted on the companies from the sample indicate that there is a real and significant association between the variables in each of the three hypotheses of this study. The empirical results confirmed the theoretical assumptions on the basis of linking the theory of R&D with the theory of business model innovation. Considering the nature of the variables, it can be assumed that investments in R&D also shape and influence the company's capability for business model innovation. The established associations clearly show that R&D is an important organisation segment in a company that is capable of supporting this relatively new, though highly efficient business concept. Also, the obtained results can stimulate the further development of R&D as a means to stimulate the development of innovative, new business solutions.

CONCLUSIONS

The study confirmed the existence of a significant association between the determinants of R&D with the company's capability for business model innovation. The expressed association clearly suggests that increasing financial investment in R&D, and possessing high quality and educated human resources in sufficient numbers in the area of research and development can enable the company to also possess this powerful strategic tool.

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