DSCIM - 2017

1st Doctoral Students Conference on Innovation Management

Proceedings

MAIN
MASTERING INNOVATION

Co-funded by the
Tempus Programme
of the European Union

October 3rd-6th 2017

Novi Sad, Serbia

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ISBN 978-86-7892-972-4 (Printed edition)
Conference Proceedings DSCIM Conference 2017.
Publisher: Faculty of Technical Sciences, Novi Sad, Serbia. Printed in 40 copies.
Printed by: Futura d.o.o. V2

*"**MAIN - Mastering innovation in Serbia through development and implementation of inter-disciplinary post-graduate curricula in innovation management**"*
Contract no 544278-TEMPUS-1-2013-1-RS-TEMPUS-JPCR.
This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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Introduction: DSCIM - 1st Doctoral Students Conference on Innovation Management

Petar Vrgović, PhD[1]; Amila Pilav-Velić, PhD[2]; Carsten Dreher, PhD[3]

[1]Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia
[2]School of Economics and Business, University of Sarajevo, Bosnia and Herzegovina
[1]Freie Universität Berlin, Germany

This book of proceedings follows the 1st Doctoral Students Conference on Innovation Management. It was editors' intention to illustrate the current research topics that are being observed at the doctoral level of studies.

1 Introduction

Innovation management is a field of research that attracts more and more doctoral students around the world. The inspiring research in innovation is constantly changing with the advances in science, technology, and economy, providing new challenges for every new generation of students who enter their PhD studies. Also, since innovation is truly an interdisciplinary phenomenon, it attracts researchers with different backgrounds and perspectives.

DSCIM - 1st Doctoral Students Conference on Innovation Management, which is to be held in October 2017 in Novi Sad, Serbia, aims to bring together students from different countries and from different perspectives who do their doctoral research in this exciting field. This event also aims to connect these students with practitioners and industry, so that a synergy effect can be made to spark further collaborations.

2 DSCIM 2017

Students who applied for participation in DSCIM 2017 were strongly focused on innovation as their area of research, which was the organizers' strong intention from the start: to gather PhD students who are interested in researching innovation. During the submission process, they were in different stages of their research, where ones already had specific results to discuss, while others were still defining their research goals and methodology. Having papers that are extracted from research in various phases was a challenge for both the editors and the reviewers, since submissions were not easily comparable.

Participants in this conference have different backgrounds: economics, industrial engineering and management, business administration, psychology, mechanical engineering and law; this fact truly depicts the interdisciplinary nature of Innovation science.

The topics of the papers submitted to this conference vary widely, from measuring innovation, through factors of innovation, and to managing sustainability of innovation.

The organizers and editors would like to thank to reviewers from the Program Committee who reviewed the papers, provided very constructive comments and helped the authors to improve their papers. We also recognize the Organizing Committee and administrative assistants, for contributing to the success of this conference. Finally, we wish to thank all the authors who submitted and published papers at the DSCIM conference.

3 Background of the project

This conference was organized in the frame of the Tempus project "MAIN - Mastering innovation in Serbia through development and implementation of interdisciplinary post-graduate curricula in innovation management" Contract no 544278-TEMPUS-1-2013-1-RS-TEMPUS-JPCR.

The general objective of this project was to foster Serbian innovative capacity by modernizing Serbian higher education system and providing sustainable source of high-quality human resources. The project achieved this by developing and realizing interdisciplinary postgraduate curricula in the field of innovation management based on best practice from existing EU study programs and according to the Bologna requirements at Serbian higher education.

Developing and implementing interdisciplinary master program in innovation management as a joint degree of 4 Serbian universities was achieved through synergetic partnership of 3 Serbian public and 1 privately owned university, 1 college of applied sciences, 6 organizations representing key Serbian stakeholders, 4 well known EU universities and 2 non-academic EU partners with extensive experience in dealing with innovation and curriculum development.

The principal outcomes included defined structures, research and teaching contents of curricula for joint degree master programs in innovation management, their accreditation and realization, developed and implemented set of LLL courses for professionals, updated teachers' and trainers' skills, introduced interdisciplinary and practical oriented teaching approach, established laboratory and virtual learning environment, published new books, realized teachers and students mobility, and established Serbian Innovation Management Council.

These results provided infrastructural resources necessary to secure project sustainability beyond its lifetime. Results and best practice are actively diffused and exploited at national, regional and European level, and DSCIM is among these activities.

For more information about the MAIN project, please visit: http://www.main.uns.ac.rs.

For more information about the DSCIM conference, please visit: http://www.iim.ftn.uns.ac.rs/dscim.

Editors
Correspondence
vrgovic@uns.ac.rs
amila.pilav-velic@efsa.unsa.ba
Carsten.Dreher@fu-berlin.de

A holistic approach for measuring the human contribution to regional innovation output

George Martinidis[1]

[1]PhD candidate and doctoral researcher, Department of Urban and Regional Planning and Development, Aristotle University of Thessaloniki, Thessaloniki, Greece

Abstract

Keywords: Human factor in innovation, Human capital, Social capital, Psychological capital, Innovation measurement, Innovation index, Regional innovation systems.

1 Introduction

The term innovation has become so popular that it is constantly being abused, treated as a filler word without meaningful intent. There is good reason for this popularity, however, as innovation is the central issue determining prosperity (Porter, 2008) and the main driver of progress and development throughout history (Godin, 2008a). Although the study of innovation tends to focus on processes and spatial systems (Milbergs & Vonortas, 2004), the human factor is the fundamental driver behind any innovation process and the main explanation for the disparity of innovation prowess between different countries, with other factors influencing innovation, such as technology and capital, essentially being subordinate to it (Cornell University, INSEAD & WIPO, 2014). In fact, human talent is expected to be more important than capital or infrastructure in the future, in the framework of the predicted fourth industrial revolution (Schwab, 2016).

It can therefore be safely assumed that improving all the human-related aspects that affect innovation -factors such as education, skill, knowledge etc.- is the best way to improve innovation output in a system or region. In order to do this, however, it is essential to understand in which ways do human factors influence the innovation process and the resulting innovation output, how these factors interact with each other and with other, non-human, factors (e.g. infrastructure or funding) and how they can be assessed and measured.

2 Current Measures and their Weaknesses

The first systematic attempt to measure innovation started in the 1950s with the pioneering work of Rupert Maclaurin. Since, at that time, innovation was measured at the level of firms, his proposed measures included indicators such as research budget, research workers, new products developed, new firms, and growth curves for products and firms (Godin, 2008b). By the 1980s, it was realized that innovation does not only take place in firms, and, even when it does, it is affected by external sources of knowledge and technology (Komninos, 2008). This led to a shift from firms to geographically defined systems of innovation (Freeman, 1987), which is reflected in the evolution of innovation metrics. In the 1980s and -mostly- 1990s measures incorporated system-related indicators, based on surveys and the integration of publicly available data (Do Carmo Costa, 2015). This emphasis on systems is even more noticeable in the fourth, post-2000, generation of metrics, which is based on a knowledge-based networked economy and pays close attention to knowledge, intangibles, networks, clusters, and systems dynamics (Milbergs & Vonortas, 2004).

Out of the various innovation metrics, it can be argued that the human factor is the aspect of inno-

vation that is most difficult to measure. GDP expenditures on R&D, the percentage of employment on knowledge-intensive services, or patent applications, despite their own methodological difficulties, are easier to measure than, say, human knowledge, skills, attitudes and behavior. The Global Innovation Index admits that "statistically capturing the human contribution to innovation is a daunting challenge" (Cornell University, INSEAD & WIPO, 2014, p.V). Firms assess their staff by examining the knowledge and skills of their individual employees, taking into account both formal education and on-the-job training (Gupta, 2009). The measurement of human contribution to innovation in a region or country is usually focused on roughly the same qualities, but their assessment for a large and diverse population is a more complicated process, which requires specially developed scales and indices.

Mclaurin, who created one of the first scales measuring innovation, focused on firms and their activities, as was the tendency in that time, and paid little attention to the human factor other than measuring the number of research workers in a company, in order to correlate it with the number of inventions and use it as a measure of efficiency (Godin, 2008b). However, as innovation metrics and indicators evolved they started to acknowledge the importance of human capital in shaping innovation output, and since the 1990s it is considered an essential component of the frameworks developed to measure innovation, and is usually assessed in the form of knowledge (Do Carmo Costa, 2015). As innovation metrics evolved and became more complex, innovation is formally assessed by a number of major international indices. In most of these frameworks, human factors are viewed as a part of the input or enablers that determine the knowledge, technology and economic output of innovation (Cornell University, INSEAD & WIPO, 2016; Hollanders, Es-Sadki & Kanerva, 2015).

The Global Innovation Index (GII) considers human capital, along with research, as one of the pillars of its innovation input sub-index. The "Human Capital & Research" pillar is further divided into three sub-pillars. The first includes a mixture of indicators capturing achievement at elementary and secondary education levels: expenditures on education, school life expectancy, government expenditure per pupil, pupil-teacher ratio and PISA scales for student performance in reading, math and science. The second assesses higher education by capturing enrolment rates, graduates in science & engineering, and the inbound mobility of tertiary students. The third measures the level and quality of R&D activities through the number of researchers in the population, gross expenditures, and the quality of each country's top three universities according to the QS university rankings of the top 700 universities worldwide (Cornell University, INSEAD & WIPO, 2016).

The European Innovation Scoreboard (EIS), measuring innovation in the European Union, follows a slightly different approach than the GII, but it still devotes what it terms as a "dimension" of innovation enablers to human resources. This dimension consists of three indicators intending to measure the availability of a highly skilled and educated workforce, so, in effect it measures human capital. Those indicators are: the number of new doctorate graduates aged 25-34, the percentage of the population aged 30-34 that has completed tertiary education, and the percentage of population aged 20-24 having completed at least upper secondary education (Hollanders, Es-Sadki & Kanerva, 2015).

The Innovation Union Scoreboard is connected to the Regional Innovation Scoreboard (RIS), which, in the 2016 edition, provides a comparative assessment of innovation performance across 214 European regions (Hollanders, Es-Sadki & Kanerva, 2016). The Regional Innovation Scoreboard follows exactly the same formula as the Innovation Union Scoreboard, so human resources are a dimension of innovation enablers consisting of the same three indicators. However, despite the crucial role that regions hold for EU policy, most of the indicators used by the EIS are not available at the regional level. This lack of data severely affects the human resources dimension as well. Only one of the three indicators used, the percentage of population between 30 and 34 having completed tertiary education, is available at regional level for the 7th edition of the RIS (Hollanders & Es-Sadki, 2016). This is an improvement over the 6th edition (Hollanders & Es-Sadki, 2014), where a proxy had to be used for this. The other two indicators, the number of new doctorate graduates aged 25-34, and the percentage of population aged 20-24 having completed at least upper secondary education are not available on a regional level (Hollanders & Es-Sadki, 2016).

3 Different Aspects of the Human Factor

The approach through which the major indices mentioned above take the human factor into ac-

count is essentially the concept of human capital. Human capital is a term invented by economist Theodore Schultz in the 1960s, to refer to the value of human capacities (Schultz, 1971). Human capital can be defined as "a measure of the economic value of an employee's skill set" (Investopedia, 2016), or, more specifically, a collection of knowledge, talents, skills, abilities and training possessed by individuals (Carbaugh, 2013). Schultz's basic idea was that, like any other kind of capital, human capital could be invested in. In this case, the investment can take place through education and training, and the resulting benefits are expected to lead to an improvement in the level and quality of production (Becker, 1962; Schultz, 1971). The role of human capital in growth, economic development and innovation is the main reason that governments are usually eager to invest in the improvement of the human capital at their disposal (Becker, 1962; Simkovic, 2013).

However, even though education and skills play such a central role in the innovation process, one cannot simply throw some educated and skilled people in a country or region and expect that innovation will automatically flourish. One significant historical example of this is the poor innovation performance of communist planned economies. In such countries the share of GDP invested in education, training and R&D actually tended to be quite large compared to capitalist countries in a similar level of development but their innovation performance lagged significantly behind "the West". The main explanation for this seems to have been the existence of an environment that was unconducive to innovation. The causes lie in the totalitarian nature of communist regimes (Schroeder, 1989).

In any case, a number of peer-reviewed studies -many examples of which are cited below- have attempted to explore the human factor beyond the limits of human capital. The concept of human capital may not be enough to capture the entire impact of the human factor on innovation and development. Human beings do not work in a vacuum, using their own skills in isolation from their surroundings. To counter this shortcoming, the concept of social capital was developed to reflect the added dimension of trust, relationships, and contact networks between people (Luthans et al., 2004). According to the social network theories of innovation, social capital functions as a moderator in the relationship between expenditure on innovation and innovation output (Barrutia & Echebarria, 2010). Like human capital, investment in social capital can be vital to the success of employers, organizations as well as entire economies (Luthans et al., 2004). Social capital is particularly relevant for innovation as it is part of the mediating mechanism that transforms innovation to economic growth (Akcomak & Ter Weel, 2009). Social capital can even shape and improve human capital, as social capital in the family or in the community can play a crucial role in the creation of human capital in new generations (Coleman, 1988), which is also why families are as important as schools, if not more, in promoting human capital (Carneiro & Heckman, 2003).

In essence, the main premise behind the concept's development is that social capital complements "traditional" resources such as physical capital and human capital with the extra resources provided by social networks, trust, norms and values to produce better outcomes (Akcomak & Ter Weel, 2009). In other words, social capital provides a value-added contribution to other types of capital, or functions as a multiplier of their own effect. With the emphasis placed on regional systems of innovation, the contribution of social capital is even more crucial. Since innovation systems are actually networks and relationships between relevant actors, social capital is an essential component of these systems. Social capital reduces wrongdoing by public officials, facilitates negotiations, encourages the sharing of tacit knowledge and reliable information, and contributes to agreements being honored (Maskell, 2001).

Indeed, social capital, along with geographical proximity, seem to be very important for determining the innovation output of regional systems (de Dominicis, Florax & de Groot, 2013). Social capital is particularly important for the support of entrepreneurship, which is one of the important factors behind social capital's role in encouraging innovation (Doh & Acs, 2010). Social capital has a strong impact on innovation in small and medium enterprises, as innovative firms make greater use of networks, collaboration and information exchange (Cooke, Clifton & Oleaga, 2005). This provides a powerful reason to foster strong social relationships within the modern networked economy (Doh & Acs, 2010).

In the same way that human beings do not work in isolation from their external surroundings, they also do not work in isolation from their interior characteristics, capacities and identities. This is taken into account by a further aspect that Luthans et al. (2004) call positive psychological capital. This concept is drawn from the approach known as positive psychology, focusing on people's strengths, and in particular those positive aspects that are more closely connected to a more effective work

performance, namely the psychological capacities of confidence, hope, optimism and resilience (Luthans et al. 2007). According to Luthans et al. (2004), these capacities are measurable, open to development, and can be invested in and managed in order to improve positive psychological capital in the same way as for human capital.

There are plenty of studies on the impact of psychological factors on innovation. Most of these take place, understandably, on the individual level, and attempt to understand the features of the innovative person. For example, Sternberg and Lubart (1999), suggest that an individual's propensity to innovate requires six distinct resources including: intellectual abilities, knowledge, thinking styles, personality, motivation and environment. Intelligence, motivation, knowledge and personality are all factors that are often cited in the relevant literature (Patterson, 2002).

Early theories (e.g. Cattell, 1971; Spearman, 1931) focused on creative thinking, which was viewed as a component of general intelligence. Yet, leaving aside the furious debate on its definition and validity (Deary, 2001; Legg & Hutter, 2006), while intelligence is a feature often found in innovative individuals, it is not essential or sufficient for innovation (Patterson, 2002). Knowledge is indeed an essential component of innovation, but too much expertise on a field can have a negative effect and block the process of creative something innovative (Sternberg, 1999). Overall, knowledge seems to have an "inverted U" relationship with innovation, with too little or too much knowledge being counter-productive (Patterson, 2002). Motivation is also an essential component of innovation, and innovators often viewed as devoted and absorbed in their work. The most prominent researcher in this field, Theresa Amabile (1996), suggests that intrinsic motivation is particularly important whereas extrinsic motivation might even prove detrimental.

Personality seems to be the most complicated of the individual factors that have an impact on innovation. Feldhusen (1995), has identified a number of personality characteristics of many creative and innovative individuals, including high energy levels and commitment to study or work, intense independence and individualism, a sense of creative power and an internal locus of control, and a heightened sensitivity to details. Overall, decades of research, at least since the 1960s, have highlighted several characteristics but there seems to be very limited assimilation of the commonality between them (Patterson, 2002). There is a need for an organizing framework to identify some conformity between findings. One of the universally accepted models of personality based on personality traits, such as the Five Factor Model of Personality (FFM, also known as "the Big Five") of Costa and McCrae (1992), or Eysenck's (1950) three-factor model can be used for this.

By examining these models and the studies in the literatures that used them as a framework, Patterson (2002) found some evidence that innovation is positively associated with the characteristics of openness, a lack of agreeableness and conscientiousness from the FFM, and with the characteristic of psychoticism -this does not necessarily imply some sort of psychopathology but merely a nonconformist, tough-minded individual that is willing to take risks (Eysenck, 1993)- from Eysenck's three-factor model. Patterson (2002) suggests that further research is required, but in any case it is hard to see how can such characteristics can be invested in and improved in order to cultivate psychological capital in the same way as human capital. Improving intelligence and knowledge might be accomplished through better education, but intrinsic motivation and, especially, innovation-conducive personality traits seem much more difficult to encourage through external intervention.

Simply put, while human capital focuses on what a person knows, social capital focuses on who he/she knows, and positive psychological capital on who he/she is (Luthans et al., 2004). In this sense, the human factor in innovation refers to all human characteristics that have an impact in innovation and development, and therefore includes the characteristics included in the definitions of human capital, social capital and positive psychological capital (see figure 1).

4 Creating a Holistic approach to measure innovation

The brief review above should be enough to illustrate the central importance of the human factor for the process of innovation and its output. As the various studies cited have shown, there are several human-related elements that have a significant impact on the innovation performance of firms, regions and countries. These can be grouped together in the categories of human capital, social capital and psychological capital, as proposed by Luthans et al. (2004). Human capital essentially refers to

Figure 1: The three components of the human factor in innovation.

people's education and skills. Psychological capital refers to people's attitudes and behaviors, and, on the scale of societies, as in the case of regions and countries, it is captured by the concept of innovation culture. Social capital refers to the networks and connections between people, and these are captured by various indicators, as well as by some aspects of culture. In practice, human capital is complemented by social capital and psychological capital All three types of capital and their influence have to be taken into account in order to measure the human factor properly.

Yet, the leading international indices focus solely on education and, sometimes, skills. It was explained that the Global Innovation Index assesses human capital through various factors related to all levels of education, as well as research and development, but assesses education only in a one-dimensional, quantitative manner, and does not take any aspect of culture into account. The same weaknesses apply to the Innovation Union Scoreboard and its regional version, the Regional Innovation Scoreboard, with the latter also suffering from a lack of data on the regional level. Culture, in the form of organizational culture, is taken into account only in scales that operate on a very different level, dealing with individual organizations or enterprises, such as the Creative Climate Questionnaire (Ekvall, 1996).

This conclusion, however, is by no means a reason to discredit the GII, EIS or RIS. Despite some criticism (e.g. Edquist & Zabala-Iturriagagoitia, 2015) and some considerable problems that some of these scales face, such as the aforementioned lack of regional data plaguing RIS, these indices still are the most important and widely-used tools for measuring and comparing innovation performance. In addition, the EIS and RIS follow a particularly strict methodological approach, only using data from official and reliable sources such as Eurostat, OECD and the UN (Hollanders & Es-Sadki, 2014) and only measuring indicators directly, without resorting to the use proxies or indirect relationships.

Still, the literature shows that human capital by itself is not enough to capture the full range of social attitudes and behaviors towards novelty, change and innovation. With man being the centre of the innovation process and the driving force behind it, people's attitude towards innovation and their capacity for innovation are crucial for determining the outcome of the process, and this attitude and capacity cannot be explained solely by education and skills. Instead, if the conclusions of the studies examined here are taken together, in the context of a model that takes human, social and psychological capital into account, it seems that culture and networks form the attitude and capacity, while education and skills provide the means and tools to increase this capacity and to realize it within the existing innovation systems. All three aspects are equally important.

As was explained above, the measurement of human and, especially, social and psychological capital is a complicated and difficult issue. Social and psychological capital have to be measured via surveys, using data that is difficult to obtain and based on self-reports rather than facts, or via the use of proxies whose connection to the target concept is sometimes rather tenuous. It should therefore be obvious that an attempt to insert elusive variables into the EIS and RIS goes against the logic of these indices and might significantly undermine their validity and reliability.

On the other hand, this should not be a reason to disregard the need to measure the impact of the human factor on innovation more efficiently than

existing indices do. Foray and Hollanders (2015), the latter being a key researcher behind the EIS and RIS, openly admit that "several crucial factors and conditions are not easily observable within this statistical framework" (p.213) and that "if the IUS [note: now the EIS] can be considered as an important tool to inform innovation policies, it should not be applied in an isolated manner or without relying on other types of indicators and information on the system considered" (p.214), including other statistical evidence as well as qualitative insights.

In the case of the human factor, a variable whose full complexity cannot be accurately captured by these major indices due to their nature, the critical qualitative assessment of a particular country's or region's human capital and its characteristics is, of course, important for specific case studies. But in order to benchmark human capital, to make meaningful comparisons between countries or regions, and to better understand the impact of the human factor on the process of innovation and innovation systems, what is needed is the development of a dedicated index capturing all three aspects of the human factor that are important for innovation: human, social and psychological capital. Again, it is important to stress that such an index cannot replace established systems such as the RIS, as it can never hope to be as comprehensive, nor does it aim to. It can instead complement systems such as the RIS in viewing the human contribution to the innovation process in much greater detail. The effort to create such an instrument is already underway by the author (Martinidis, 2017).

Yet, how can the three types of capital be effectively measured? The studies that were cited above offer some potential approaches. In terms of human capital, the number of university degrees / graduates is a solid starting point (Hollanders, Es-Sadki & Kanerva, 2015), despite its weaknesses as a valid measure of innovation (Asteriou & Agiomirgianakis, 2001). Vocational skills training can be at least as important for innovation as academic education if not even more so (OECD, 2011), so this also has to be taken into account. Involvement in research and development is also a crucial component in the innovation process (Bilbao-Osorio & Rodriguez-Pose, 2004). Finally, since universities are not simply degree-producing factories, but important important actors connected to the local economy, business and government (Vyrostova & Vyrost, 2007), their quality also has to be taken into account, ideally as measured by some accredited international university ranking scale, as in the case of the GII (Cornell University, INSEAD & WIPO, 2016).

Regarding social capital, there seem to be two general approaches, one based on political science and sociology (e.g. de Dominicis, Florax & de Groot, 2013), and the other based on economics (e.g. Barrutia & Echabarria, 2010). The former mainly uses value indicators (such as generalized trust) from various social surveys and scales, while the latter uses several demographic and economic indicators. Each approach has received criticism from the proponents of the other for not capturing the concept of human capital properly (Perez et al., 2006). Whether the indicators used are social or economic, however, the main measures explored by social capital include trust in other people, trust in the system, the strength of the connections and networks between people, life satisfaction, and social exclusion (exclusion from the networks between people) (Barrutia & Echabarria, 2010).

The main difficulty with measuring psychological capital, is that the measures used for individuals or small groups, such as the staff of firms (e.g. Hsieh, Hsieh & Wang, 2011), cannot be applied on the scale of regions or countries. Regions and countries are more than the sum of the individuals that comprise their population. They constitute cultures, which are wholes that are different than the sum of their parts and cannot simply be treated as king-size individuals (Hofstede & McCrae, 2004). These cultures, however, are measured by approaches such as Hofstede's cultural dimensions, which form the most widely-used and accepted model for measuring culture (Didero et al., 2008). These dimensions: power distance, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance, and long-term vs. short-term orientation, are significantly correlated to the Five Factor personality dimensions (Hofstede & McCrae, 2004), and they can explain a large part of the differences in personality dimensions between different countries (Hofstede, 2011), and can therefore be considered to be a valid measure of psychological capital. As for how they can be measured, studies (e.g. Kaasa, Vadi & Varblane, 2013) recommend using available data from social surveys to fit Hofstede's dimensions. A list of potential measures for the three types of capital is summarized in figure 2.

Finally, in order to assess the importance of the human factor -as expressed by these three types of capital- on innovation, one needs a valid and reliable way of measuring innovation output. Traditionally, the number of patent application has been used as a convenient indicator for this (Godin,

2008b), and is still taken into account in both peer-reviewed studies (e.g. Varsakelis, 2006) and major benchmarking scales (e.g. Hollanders, Es-Sadki & Kanerva, 2015). However, patent applications are a measure that is certainly not enough by itself and it can be highly inaccurate in the 21st century business climate (Basulto, 2015), in which patents might prove destructive rather than creative in terms of their economic impact (Nicholas, 2014). Instead, it makes a lot more sense to use the innovation output dimension from the RIS, which essentially examines the end user utility of innovations in the market via the percentage of SMEs introducing innovations, and the employment in and exports by knowledge intensive and high-tech intensive industries (Hollanders, Es-Sadki & Kanerva, 2015).

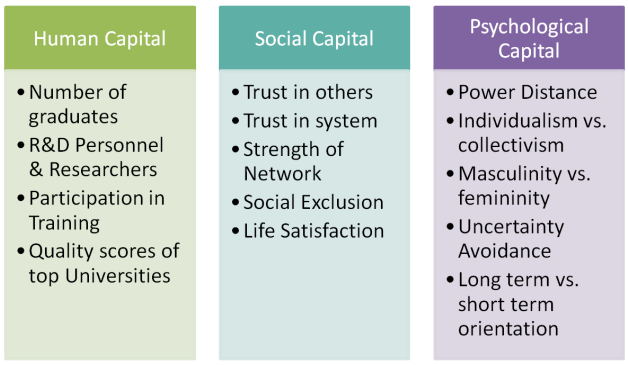

Figure 2: Potential measures for the three types of capital.

5 Conclusions: The Potential Applications of a Holistic Approach

As explained, a specialized framework for assessing the human factor and its impact on innovation output would never be a replacement for indices such as the RIS, but, it has the potential to be extremely useful in complementing the RIS, or other existing measures. As the main researcher behind the RIS, Hugo Hollanders, has stated, the index should not be applied in an isolated manner, without complementing it with other types of indicators and information regarding the system being assessed (Foray & Hollanders, 2015). In this way, the assessment of the human factor can be useful for understanding the peculiarities of the human contribution to innovation, and -ideally- optimizing it. This, of course, can be a challenge in itself.

The assessment of human, social and psychological capital across regions can first of all show whether social and psychological capital, which can often be overlooked in favor of human capital, have an equally important impact on innovation output. More importantly, it can identify which of the aspects of the three types of capital are the most important for innovation output. Identifying the key aspects can be the first step towards improving them, in order to increase innovation output.

In the case of human capital, the applications of this can be relatively straightforward. If, as expected (e.g. Asteriou & Agiomirgianakis, 2001) the number of university graduates is found to be less important for innovation output than the quality of universities, and, most of all, their connection to the industry and the market, then development policies should focus on an outcome-based education (Spady, 1994) and in encouraging closer links between universities and businesses, in accordance with the triple and quadruple helix models (Leydersdorff, 2012). If R&D staff numbers and the frequency of skills training are found to be important then the recommendation should be to encourage R&D and increase research jobs, and to increase emphasis on skills training and practical experience compared to "theoretical" academic education, respectively.

In the case of social capital, the practical applications of this research can be more complicated. While it has been established that social capital is - by definition, since it is considered a form of capital- something that can be invested in (Luthans et al., 2004), the form of this investment is not completely

straightforward. Improving social capital can have a strong impact on innovation, via a greater use of networks, collaboration and information exchange (Cooke, Clifton & Oleaga, 2005), and this provides a powerful reason to foster strong social relationships within the modern networked economy (Doh & Acs, 2010). But it is not very clear how these strong social networks, collaboration and information exchange can be fostered, and this topic requires additional research.

Psychological capital can be an even more complicated case. Whether one refers to psychological capital on the individual scale, as motivation and personality traits (Patterson, 2002) or to its form on a mass scale, as culture (Hofstede & McCrae, 2004), it is hard to see how such aspects can be encouraged, reinforced and improved in order to increase innovation output. On one hand, it has been suggested that innovations are able to shape cultures as well as the other way around (Herbig & Miller, 1992), and there are approaches, such as modernization theory, which state that cultures are open to constant change and evolution (Inglehart, 1997). How this change can be effectively fostered by regional or national policies aimed at reinforcing the innovation-conducing elements of culture, however, is another question requiring focused research.

Yet another application of this line of research, is that a closer examination of the levels of human, social and psychological capital across regions can perhaps highlight any significant differences between regions that have high and low levels of these types of capital, resulting in customized, "bespoke" approaches for increasing innovation according to the specific human factor profiles and specific needs of these regions. In general, since the human factor is the most crucial component of the innovation process in several ways, its cultivation and optimization can have a major positive effect on innovation, and, by extension, economic growth and prosperity. A lot of research is required on the topic, but its potential applications can be extremely important.

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About the author

George Martinidis has studied psychology on an undergraduate level, and applied psychology, as well as economics and politics, on a postgraduate level. He is currently a final year PhD candidate in the Department of Urban and Regional Planning and Development of the Aristotle University of Thessaloniki, Greece.

His PhD topic is “The Contribution of the Human Factor to Systems of Innovation and the Formulation of Regional Development Policies”. He has published a journal article outlining the theoretical side of his study: “The importance of Man within the System: Defining and measuring the human factor in Innovation, a review”, in the Journal of the Knowledge Economy.

Additionally, he is studying the evolution of innovations throughout human history and cultures. His research and academic interests also include history, politics, human rights, and the current European crisis.

email:martinidis@urenio.org and gmart55@yahoo.com

Measuring Social Innovation – research plan

Krisztina Varga[1]

[1]PhD candidate, University of Miskolc, Misckolc, Hungary

Abstract

Defining measuring possibilities of social innovation is required by the European Union's cohesion policy, Horizon 2020 (R & D policy of European Union for 2014-2020), and social challenges that can arise both for internal and external reasons (eg. aging, migration) and require a long-term solution. The study examines the „widened" definition of social innovation, the relationship between competitiveness and social innovation, and present the role of new bases and social innovations beside the earlier innovative fields (technical innovations). The main objectives of the European Union include increasing the global competitiveness of the continent. The Horizon 2020 program combines research and innovation, emphasizing the role of social innovation (in addition to technical innovations), which requires the definition of frameworks for measurement. Measuring social innovation is a complex task that determines the introduction of a multilevel measurement model. During my research, it became clear that the existing indicators focus primarily on economic and technological innovations, and there is the questions: can be adapted the measuring system of technical innovation in measuring social innovation? If the answer is yes, how can be adapted it? The main goal of the paper to identify those indicators which are able to help in measuring social innovation in complex way.

Keywords: Social innovation, Measuring innovation

1 Introduction

Defining the concept of social innovation, defining its levels and measuring possibilities are relevant challenges, but the literature on the topic does not or only partly address them. Social innovation is a process that promotes the well-being of the community and addresses the challenges that society faces. Its unambiguously accepted definition is not available. According to the definition of OSLO Manual, social innovation can be interpreted as a concept that will result in satisfying needs in society, along with new or novel collaborations and structures. Innovation is a new or significantly improved product, process, marketing method or organizational method for business practices, organizations, or co-operation in a "widened" interpretation (EC 2006). The definition is primarily the guideline for technical and economic innovations, however, the European Union's research, development and innovation policy (Horizon 2020) has already paid particular attention to the definition of social innovations. The main objectives of Horizon 2020 include "smart, sustainable and inclusive growth" (EC, 2014, pp. 7), which is also the basis for encouraging competitiveness examination.

Social innovation is interpreted as a process by which the quality of life and the development of life expectancy can be seen. Social innovation is a new solution (or new approach) that simultaneously satisfies the social need and enhances the capacity of society to act (Czakó, 2000).

According to the definition of the European Union (Lessa et al., 2016), the concept of innovation can be interpreted on three levels, according to the degree of represented novelty:

- Organizational / corporate level,
- Regional or national level,
- Innovation at international level.

Bulut et al. (2013) identify the micro-level goals of social innovation by meeting social needs, increasing living standards, developing individual or group capabilities that also determine the activities of organizations and companies. In their view, macro-level objectives are in line with the general change in society, emphasizing the importance of innovations aimed at eliminating inequality and the initiatives that result in sustainable development.

Pol and Ville differentiate between the micro and macro levels of quality of life. The micro level of quality of life enhancement, as the main objective of social innovation, is determined by individual conditions, while macro-level analysis requires an analysis of the conditions of a particular community (Pol-Ville 2009).

The definition of the levels of social innovation is supported by the European Commission's study of social innovation in the following cases and in the form of implementation (Nemes-Varga 2015):

- Social innovation as a bottom-up organization involving NGOs,
- Social innovation as a response to social values to community needs,
- Social innovation as a process leading to renewal and transformation of society.

The above categories demonstrate that the focus of social innovation efforts is to meet the needs of the community and to solve their problems, while the narrower idea is interpreted exclusively as a grassroot, citizen engagement process. Social innovations, which can also be found in the new approaches of society and in structural transformation, are often created from the top by the action of macro-level measures. This finding also predicts the grouping that differentiates the micro- mezzo- and macro levels of social innovations.

2 Innovation and Competitiveness

During the last two decades social innovation has emerged as a new area of innovation studies. This new development is partially explained by the fact that many empirical examples have shown that without social innovation the possibilities of technological innovations can only partially utilized. Introduction of new technologies often requires changes in organizational structures and processes. So economic and social innovations are equally important in realizing economic, social and technological development. Due to the expansion of innovative areas, innovations are complementary processes. Social and technical innovation are closely interrelated. If there is a change in the economy, it is necessary and lawful for social changes to occur. Social innovation is a necessary step to improve development and competitiveness, where innovators play a major role. Innovators are the local community or, in the broader sense, members of the society who, with their knowledge of their needs, solve social challenges as a new tool with their everyday challenges.

The success of a given company depends on knowledge-intensive products that it produces, on creative market solutions to response to different challenges and on effective organization. In this approach, obtaining a competitive advantage that is indispensable to the organization depends on innovation activity. Innovation process leads from the idea to the realization, to the achievement of market utilization. It can be stated that those innovations are successful, which increase the organization's competitiveness. The main task of innovation management is to develop the company's resources, competencies, different processes and programs, to form an innovation advantage on the market.

Birchenhall (1995) interprets innovation as technical progress and identifies innovation through a social learning process. He examines the learning process in a broader sense, one hand learning means reach of new knowledge, and on other hand learning is the spread of knowledge and new combinations. In my opinion, the former can be interpreted as a research strategy (exploration), while the latter is an exploitation, which combines and coordinates applications providing opportunity for effective innovation. A prerequisite for effective innovation is to achieve increased competitiveness and successful adaptation during application. The effectiveness of new ideas and new combinations can be verified during usage, and the potential of innovations is successful and can be successfully applied. According to the author (Birchenhall, 1995), innovation is a search process based on a novel combination of new ideas and existing ideas. The study points out that genetic algorithms (and neural nets) can use the selection operator to examine the processes that create technical changes under certain limitations. Birchenhall's model is well-suited to the well-being and competitiveness enhancement initiatives, which can be closely connected to the aspirations of innovations (including social innovations).

Simultaneously interpretation of continuous and radical innovations provides competitive advantage for enterprises. Innovation creates the unique value, and thus determines the competitive advantge that is decisive for competition for an organization, a region or even a national economy.

The main goal of increasing competitiveness is to increase living standards (Figure 1), while improving living standards is a function of high levels of employment and productivity. The starting point is to increase productivity, which is a prerequisite for more efficient technology. Technological development is driven by the promotion of R & D through the process of innovation.

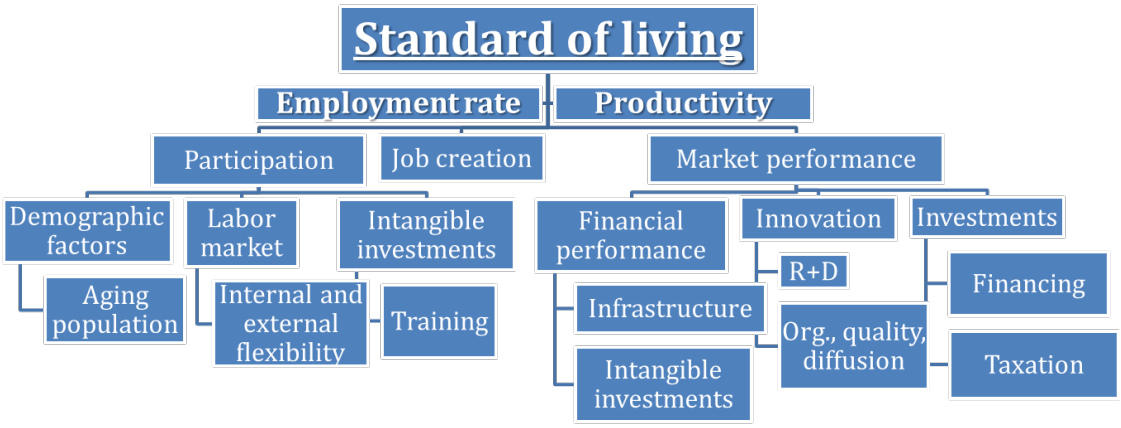

Figure 1: The basic components of competitiveness Source: Czakó, 2000.

Innovation, including the concept of social innovation, is an important factor in determining competitiveness. In the 1980s, the focus of the study on innovation and competitiveness was corporate-level analysis: firstly, innovations appeared at this level and, in general terms, the competitiveness of companies anticipates the country's competitiveness as well (Hortoványi and Balaton, 2016). Within the organization, you must constantly look for opportunities for development that can be shaped by innovation competition. The concept of Competitive Innovation Advantage (Hülsmann - Pfeffermann, 2011) is compounded by the concept of increasing success and competitiveness. Innovation is a new type of multi-stakeholder process that, through its activity, achieves organizational development and growth in the form of responses to opportunities and dangers of innovation needs and constraints (Piskóti, 2012). The key to enhancing competitiveness is the Competitive Innovation Advantage (CIA), and the tool for effective innovation portfolios. To increase competitiveness, it is not enough the exploitation of existing knowledge, but it is also necessary to develop a kind of research and exploration strategy that enhances the strength of each other as an "ambidextrous" strategy, providing the competitive advantage that is indispensable for sustainable growth.

Increasing competitiveness requires continuous development and development of opportunities within the organization. Innovation gives an answer to the questions of development opportunities and constraints. Innovation – in co-operation with organizational strategy and structure – provides an opportunity to realize the organizational goals required for effective implementation. However, the implementation of innovation often involves the modification of organizational culture. The goal is to make the new developments profoundly embedded in collective consciousness, trust, solidarity, enthusiasm and openness, and emphasize the key components of innovation (Jarjabka-Lóránd, 2012). The organization must find a balance between innovation activity and performance leading to continuous performance improvement. Innovation is not a goal in itself but a driving force for competitiveness and value creation (which is the long-term objective of companies) (Durand et al., 2004).

Innovation – as a key element of economic development – is an important factor in social processes. Social innovations are seen as inseparable companions of technological innovations. Social innovation provides new solutions to the problems of the community in order to improve the well-being of the

community, and as a tool to respond to challenges, it also provides a novel approach to managing regional disparities. Technological innovations in core areas are a solution to the quality of life development issues, but in the backward, peripheral areas, it is necessary to encourage new initiatives such as social innovations.

3 Measuring Competitiveness and Social Innovation

Examining the relationship between competitiveness and social innovation, the issue of measurement is an important factor. Competitiveness and innovation are linked, but there is the question, how can be quantified the role of innovation in competitiveness. The starting points for competitiveness measurement are two international comparisons (Figure 2): international compendium of International Institute for Management Development (IMD) on Competitiveness (63 countries) and the Global Competitiveness Index of the World Economic Forum (WEF) (GCI, 125 countries). The two methods show similarities and significant differences in their procedures and results (Szilágyi, 2008).

IMD				
Competitive factors				
	Economic performance (83 factors)	**Effectiveness of public activities (77 factors)**	**Business efficiency (69 factors)**	**Infrastructue (94 factors)**
Part of factors	domestic economy	state finances	productivity	general infrastructure
	international trade	tax policy	labor market	technological infrastructure
	foreign investments	institutional framework	finances	scientific infrastructure
	employment	legal regulation	management practicies	health
	prices	social framework	business conduct and value system	education
	GCI			
	Piles			
	Factors of production	**Efficiency factors**	**Innovation factors**	
	Institutes, Infrastructure, Macroeconomics, Health and primary education	Higher professional education, Market efficiency, Technology	Business conditions, Innovation	
Number of factors: between 6 and 23				

Figure 2: Measurement of competitiveness Source: Szilágyi, 2008.

IMD compares 4 competitive factors with five additional factors, so it averages within 20 groups, and as a main result, the 4 group average (unweighted) is taken. Accordingly, multicollinearity can be better distinguished, as the average of the 4 competitive factors is less correlated. The GCI index determines 9 (or 12) pillars which include a number of 6 to 23 variables. Both the pillars and the countries (according to their economic development) are differentiated in the index according to the following breakdown:

- Factors of production (institutions, infrastructure, macroeconomics, health and primary education) are key factors in less developed countries,
- Efficiency factors (higher education, market efficiency, technology) are the main elements in more developed countries,
- Innovation as a factor of competition is dominant in the most advanced countries and the business environment.

Both methods pay special attention to innovation, and measuring innovation potential. The measurement methodology has been defined in a very dif-

ferent way in the field of natural sciences, technical innovations and social innovation. There are a number of methodological recommendations for the measurement of technical innovations (e.g. Community Innovation Surveys – an innovation survey carried out every two years in EU member states), but the question of measuring social innovation has not been clarified methodologically for the time being. The question is: what do we measure? The measurement of social innovation is also important in order to generate potential innovations that lead to increased competitiveness and to the achievement of a higher standard of living and well-being. Similarly to the indicators for competitiveness measurement (IMD, GCI), variable groups should be determined by factor analysis to reduce the number of indicators. When determining variable groups, special attention is required:

- selection of appropriate indicators,
- short- and long-term effects assessment,
- handling outbound data,
- filter multicollinearity (Schmitz et al., 2013).

When separating the input, output, result and impact indicators, the following factors are necessary to identify the appropriate variables:

- clarity,
- accessibility,
- reliability,
- validity,
- relevance,
- timeliness (Babbie, 2008).

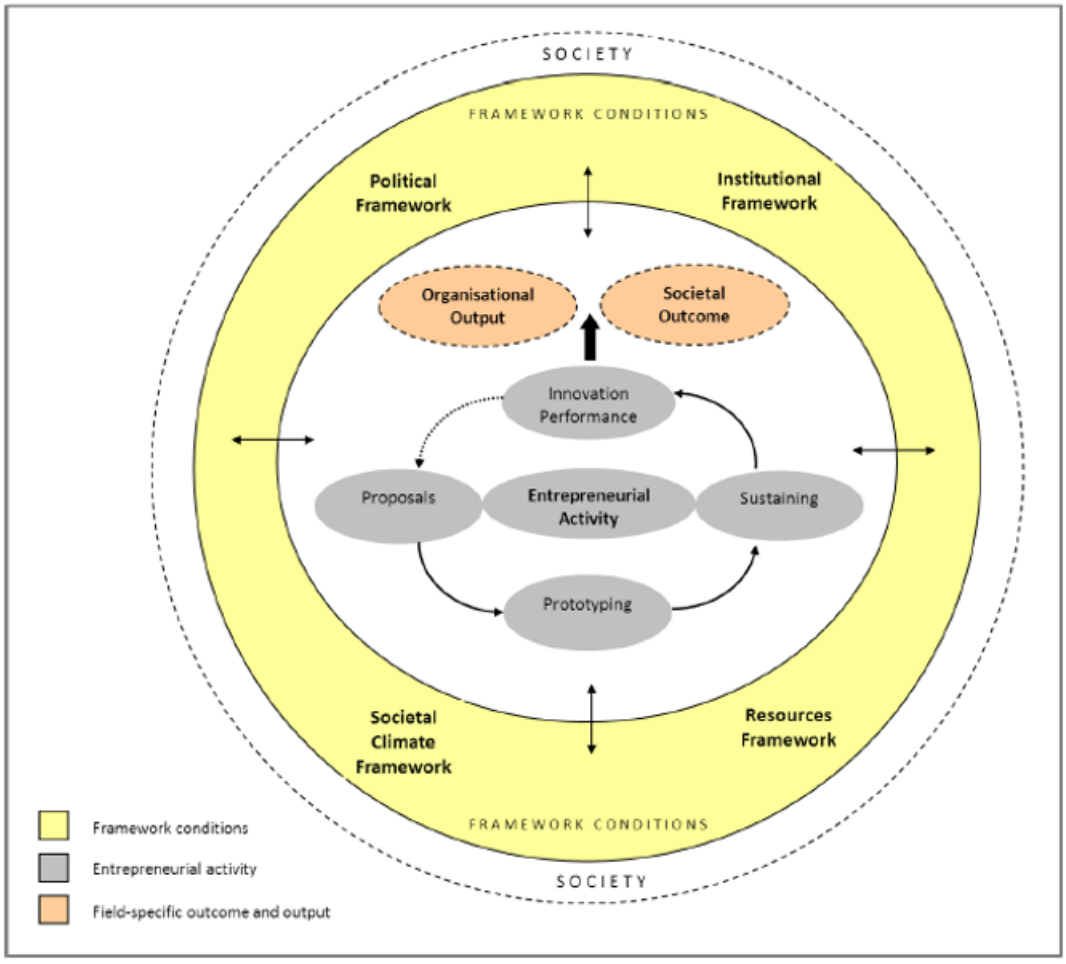

Figure 3: Measuring social innovation Source: Schmitz et al., 2013

Indicators supporting the measurement of technical innovations can help to produce indicators for measuring social innovation, but careful caution is needed during adaptation. On behalf of the Commission of the European Union, the TEPSIE - Growing Social Innovation project analyzed the indicators for measuring social innovation between 2012-2015 by cooperating with 6 european institutions. The project concluded that the indicators for measuring technical innovation which are the two best input-outputs are not always suitable indicators (Schmitz et al., 2013):

- patents: risky, not all cases,
- R & D activity: not observed in all sectors.

The focus of the measuring analysis is the entrepreneurial activity, which takes into account the role of civil society, informal groups or individuals as well as the measurement of technical innovation. Simplifying the model to handle innovation as a linear process, but the process is not done in a closed system, which also defines the framework conditions. The framework conditions are beyond the innovation process, can not be directly influenced (unlike entrepreneurship) and have a regulatory role in innovation activity as institutional, political, resource-based and social factors. The results (organizational performance and social outcomes) are a set of social innovations, interact with entrepreneurial activity and framework conditions, examining what special needs are achieved through innovation and social change.

4 Conclusion

According to the study (Schmitz et al., 2013), measuring social innovation, an integrated model needs to be able to examine the conditions (framework conditions), organizational activities and results in a complex way. In the analysis of the process of social innovation, it is crucial to identify the relationships that affect the interaction between the factors influencing the innovation activity (framework conditions and the impact of organizational activity on the outcome) and feedback loops in the innovation process (social innovation enhances the capacity to act and results in new innovations).

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About the author

My name is Krisztina Varga and I am PhD student. Previously I worked as a project manager for a media company and 1 year ago I started my PhD study at the University of Miskolc and I work for the Institute of Management Sciences. My research topic is measuring social innovation and in my paper I would like to present my research plan and the expected results. When I started my research I found different challenges. Defining the concept of social innovation, defining its levels and measuring possibilities are relevant challenges, but the literature on the topic does not or only partly address them.

My first task was to find some models and results, and then to compare the conditions of measuring technical and social innovation. There is a question: can be adapted the model of measuring technical innovation for measuring social innovation and if the answer is yes, then how can be adapted it? During my research I would like to analyze the relationship between competitiveness and social innovation similar to measuring competitiveness I would like to determine different variable groups and with cluster and factor analysis to reduce the number of indicators. My main goal to identify a multi-level measuring system which is able to measure the process and output, results of social innovation at micro, mezzo- and macro level. I accept the widened definition of social innovation which says: social innovation address the needs and problems in the society while new structures, cooperations and values are created. In the core areas, there are a lot of technical innovations but the catching up demand of the peripheral areas requires new solutions, models and the social innovation could be the new tool in catch up.

To examine this process I would like to use methodology of triangulation. It's really interesting to examine the relationship between local governments and NGOs or the society. 4 months ago I started to interview with NGOs and majors about their social innovation activity and I have some results which are useful in determining measurement system.

email:varga.krisztina@uni-miskolc.hu

Influence of Value Networks on the Effectiveness of Open Innovation Implementation

Angela Fajsi[1]

[1]PhD candidate, Faculty of Tecnical Sciences, University of Novi Sad, Novi Sad, Serbia

Abstract

New technologies force innovative companies to cooperate with other companies and organizations, in order to reduce uncertainties related to market requirements. This paper aims to examine the effects of Value Networks on the implementation of Open innovation, with the special focus on small and medium enterprises. The essence of value network concept is the co-creation of the value for all its members, regardless of their current position and the level of development. Each network participant has a different interpretation of the value for its organization: good or service, knowledge or specific benefit e.g. customer loyalty, brand recognition, etc. Some participants, such as small companies, could gain a number of benefits from other network members. The question is, what are the offered benefits for the companies that are representing the top innovators in their fields. They are financially stable, have the needed resources, global recognition, etc., thus, it is a challenge to provide them with added value and motivate them to participate in the network for a longer period. This paper aims to identify and examine different levels of value dimensions for each participant in the value network environment, especially for those who are innovation drivers.

Keywords: Value network, Open innovation, SMEs, Innovation drivers

1 Introduction

The complexity of contemporary business environment often exceeds the capabilities of individual companies; hence, inter-organizational networks are gaining a significant role in recent years, especially in the field of innovation and commercialization of new products. These kind of networks aim to provide value for all its members, allowing them to contribute in creating and developing new ideas, products or services and in sharing knowledge, resources and technologies.

Highly innovative companies have the benefits of being the members of business networks, by connecting with companies with different assets and competencies, as a response to the new market opportunities. This paper aims to examine the effects of Value Networks on the effectiveness of Open innovation (OI) concept. The core concept of the value network is the co-creation of the value for each network participant. This brings up the question: What is the added value for successful highly innovative companies in the value network? These companies have pivotal role in the development of efficiency in the entire value network by providing a number of benefits to its participants such as technology, expertise, knowledge, etc. However, Value network based on OI concept is a two-way model, where each of the network members needs to provide and to get some kind of new value within the network. There are three different types of value: tangible, intangible and benefits (Allee, 2008). Depending on the company's preferences and objectives, they can have different understandings of the type of the value they are gaining from the network. There is a need for additional research of the types of the values that pair up to every individual organization in the network, especially in the case of the highly innovative companies.

Author of the paper is in the early stage of the

PhD research, with the interest in value networks and their relations with supply chain, innovation, commercialization and communication. This paper has the aim to present the part of research related to OI, and to propose potential research questions and hypothesis that will be examined in the PhD research.

This paper is organized as follows. First chapter is an introduction, then the Value network concept is presented, with its implications on the modern business processes. Different authors state that companies that have close relationships with suppliers, customers, research institutions, universities, business partners and competitors, are more likely to achieve higher innovation success (Ritter, 2002; Powell et al, 1996; Ahuja, 2000). Thus, in the third chapter the correlation between value network and OI concept is presented. The last chapter includes concluding remarks and implications for the future research.

2 Value network concept: internal and external networks

Value network can be defined as "any set of roles and interactions in which people engage in both tangible and intangible exchanges to achieve economic or social good" (Allee, 2008). There are many different categorizations of value networks, however they can be placed into two categories: internal and external value networks (Allee, 2008).

Internal value networks include key business activities, processes and internal relationships in order to provide customer support, lead processing or innovation. This category of networks is not limited to business type; they exist in other areas, such as education, the army, civil society, etc., and provide its members with the advances in innovation, wealth, social good and environmental well-being. Allee (2008) states that internal value networks are focused on the relationships between individuals (e.g. the chief and team members), within work groups, and between and among organizational departments.

External value networks include all external participants – customers, stakeholders, intermediaries, suppliers, government, research institutions, open innovation networks, etc. According to Allee (2008) external value networks include the networks established between organizations and their suppliers, investors, strategic business partners and customers. Those kinds of networks are inter-organizational and open for any kind of collaboration, innovation and modernization. In this kind of context, it can be concluded that value networks and OI are in very close relationship.

3 Value network based on Open innovation (OI)

OI is a concept introduced by Henry Chesbrough. He defined OI as a "paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology" (Chesbrough, 2003). Concept of Value network is closely related to innovation in both ways, closed and open innovation. Networked environment is creating new opportunities for innovation activities.

Inter-organizational collaboration for innovation appears as an industrial response to changing economic and technological conditions. In the research conducted by Lalic et.al (2016), it is shown that companies which collaborate with other network members in research and development activities, are more innovative than the companies that are not in the process of collaboration. Those companies which actively participate in the product innovation activities within the network, are more likely to introduce new products within the company (65,9

Innovation within the value network can be managed in two ways, as it is shown in the book "Invisible Engines" written by Evans, Hagiu & Schmalensee (2008).

Centralized system ("controlling everything") – The advantage of this kind of approach is the position in the value network that allows easier coordination of the whole system, and promotes innovation activities A positive example of this type of innovation is Apple company which has chosen to control everything within the value network.. Negative side of this approach is strict control over the value network that can limit the scope of innovation.

Decentralized system ("controlling only the part of the network") – This approach is the opposite one, where the companies are controlling only the part of operating system. In this way, the range and number of innovation opportunities within the network are increased. Negative aspect of this approach is that innovation within this network takes longer time to spread out because there is no central

coordination.

Both systems include concept of the value network as one of the key elements for understanding and managing innovative ideas and its commercialization on the market. The better understanding of the value network means the company will be more effective and open at innovating.

3.1 Inbound and outbound innovation dimensions

Different authors state that OI concept has two dimensions: inbound and outbound open innovation (Savitskaya, 2003; Huzingh, 2011, Cassiman & Valentini, 2016). In the last decade companies have focused more on inbound OI, which means that external knowledge flows inside the company. Inbound open innovation considers knowledge acquisition and technology purchasing to be important contributors to the internal innovation process. Due to limited resources, expertise and finances, SMEs often exploit external knowledge from other companies. Those companies that provide knowledge flows outside their internal processes, are included in the process of outbound OI. (Savitskaya, 2003).

Value network consists of the number of various inbound and outbound innovation activities. Different connections between companies, government, consultants, technology innovators, universities, research institutions and platform application providers are shown in Figure 1 (Allee, 2008).

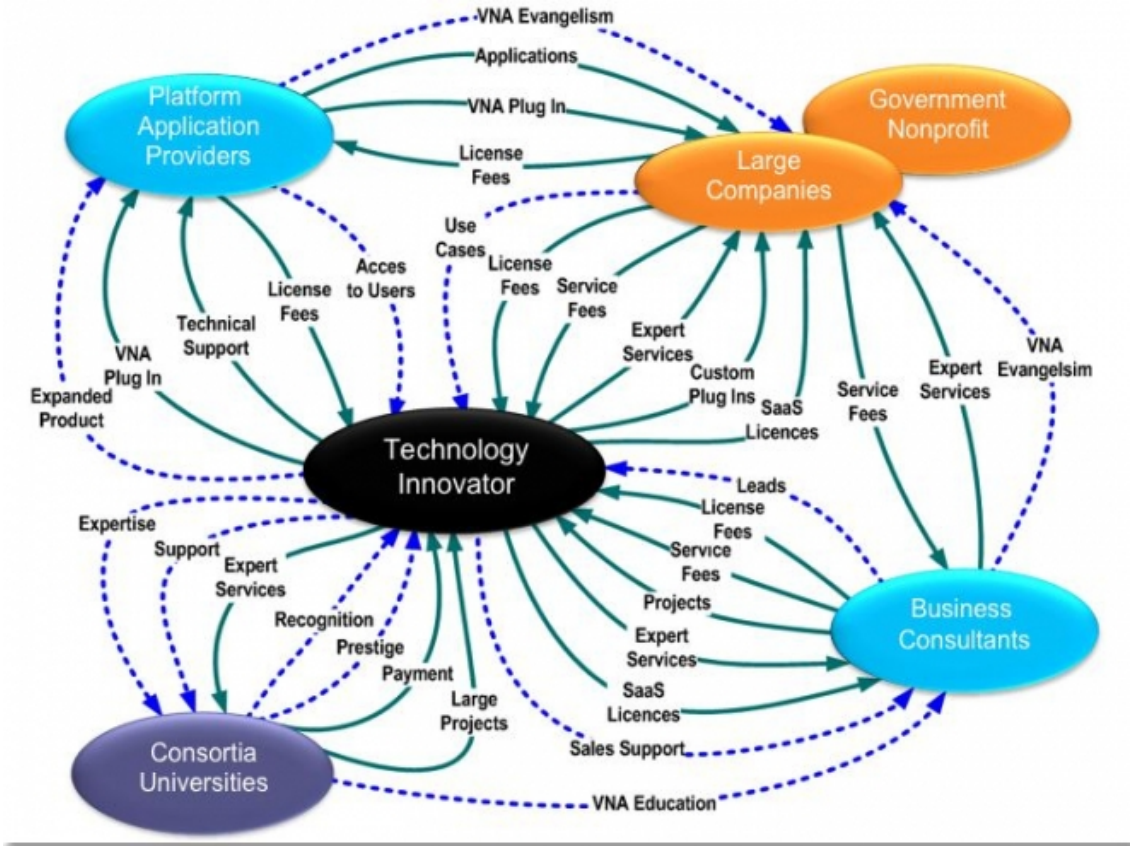

Figure 1: Value network model Source:Allee, V., 2008

This figure represents the value network model that includes various stakeholders. Since almost every company relies on IT services, there's a clear connection between business value and the platform application, which needs to provide the right set of services.

Technology innovators are in the center of the network, with the technical support, expert services, licenses, etc. Their main function is to create the value for other network participants. But this brings up the question on the benefits of innovation-driven companies. As aforementioned, the value

network ecosystem is organized on the principles of adding a new value for each of the network members. Highly innovative companies, or technology innovators, have a clear role in providing value to other members. With this position in the network, the question is what is the added value for them? Revenue represents the value for profit companies, but network business environment needs to provide wider range of values for each of its member.

Universities and research institutions often lead or coordinate large international projects and, for that purpose, they often choose project partners among the members of their value network. University-industry collaboration has shown its benefits for both parties, such as additional financial sources to researchers, stimulation of development of spin-offs and the enhancement of university's reputation (Jung et.al, 2014).

When it comes to large companies, they have numerous advantages of engaging in the OI process: exploring the new technological trends, creating new partnerships, identifying new business opportunities and shortening the time for completing their research and development activities (Talluri et.al, 1999). Companies eager to become top innovators in the field need to enhance collaboration, and include public and private initiatives (Fajsi et.al, 2015). On the other hand, large companies are less interested in the cooperation for innovation, due to the fact they already have technical and financial capability (Cassiman, 2002).

SMEs could get a number of benefits of participating in Value networks, based on OI. Smaller companies could accelerate their response to customer requirements by taking decisions faster and implementing them rapidly (Chesbrough, 2010).

All value network participants have the strategic objective to engage in the OI process. In the networked environment, end users have an opportunity to interact with other participants in order to co-create value (Prahald et.al, 2004) and to design, personalize and customize products for their own need (Fajsi et.al, 2015).

Value network participants do not compete with each other, but cooperate together, in order to build trust, and the environment suitable for innovation. Innovation process within the value network requires that many players that cooperate together, and co-create value.

Author of this paper suggests that the members of a value network should not be focused exclusively on one dimension of OI process - inbound or outbound. It is not enough for the company to use only external knowledge and the resources from others, but also, it has to provide the members of the network with some additional value in return. On the other hand, companies oriented to outbound activities often get the monetary compensation for their services, however, on the long run; some other kind of benefits needs to be provided to them.

4 Concluding remarks and implications for the future research

Successful integration within the Value Network provides an opportunity for the improvement of innovative capacities of the network members. It also creates a new value for SMEs and other participants, by increasing their research and innovation potential.

This paper proposes that the Value network is an important factor, which motivates their participants to successfully innovate. Level and type of innovation activities depends on participant's characteristics such as type of organization, its internal capabilities and resources, expertise, etc. It is not enough for the organization to become a formal network member, but also it has to actively participate in the network activities and co-create value for itself and the other network members (Allee, 2008).

Author suggests multiple case studies, based on the examination of the Value network participant's collaboration to OI in developed countries (Fajsi et.al, 2015). Economical and financial turbulences on the market have made unfavorable conditions for the companies that operate in under developed countries.

Proposition on Thesis Question: What are the benefits for the members of networked environments based on OI, especially for highly innovative companies?

Value creation is not only about adding value to the each step of the business process, but also in reconfiguration of the roles and relationships throughout the entire network. OI has to be analyzed at different levels of the value network, depending on the role of participants, their involvement and the type of OI dimensions, oriented to -inbound or outbound innovation.

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About the author

Angela Fajsi is a PhD student at Faculty of Technical Sciences, University of Novi Sad. She earned her master's degree in industrial engineering and management at same faculty. Her main interests are in value networks, clusters and project management.

email: asladic@uns.ac.rs

A Proposed Framework for University - Industry Interactions: The case of South - East European Countries

Besart Hajrizi[1], Panagiotis Ketikidis[2], Lenny SC Koh[2]

[1]PhD candidate, The University of Sheffield International Faculty: School of Management, South East European Research Centre, Thessaloniki, Greece
[2]South East European Research Centre, Thessaloniki, Greece

Abstract

The aim of this research is to propose a University - Industry Collaboration (UIC) framework for South East European Countries (SEEC). To facilitate the UIC the paper identifies the drivers, benefits and obstacles but also some of the organizations forms and types of interactions as initials to a proper UIC framework for SEEC. The main purpose of the paper is to address conceptual frameworks from different levels of stakeholders to a proper organizational form and type of an interaction at SEEC.
Keywords: Human factor in innovation, Human capital, Social capital, Psychological capital, Innovation measurement, Innovation index, Regional innovation systems.

Keywords: Conceptual frameworks, University - Industry Interactions, South-East Europe

1 Introduction

Nowadays, South East European Countries are embracing the need to create a more connected and functioning relationship between government, business and universities to increase the level employment, productivity and for economic development in general. Based on the importance of the interaction between government, industry and universities, a model, called Triple Helix model, was developed by Henry Etzkowitz and Loet Leydesdorff in the 1990s. The Triple Helix model of innovation means an extensive and active collaboration between actors and argues that the creation of the knowledge base depends on the synergies created between the main actors of the economy, university, industry and government. The Triple Helix of university, industry and government relations has been described as a „highly charged intellectual enterprise (Todeva and Etzkowitz, 2013).

This research study is focused on the collaboration between universities – industry that is possible by many factors, such as publications, workshops or conferences, staff recruitment and the most significant factors are personal exchange of information, knowledge and experiences advantage (Ankrah and Al-Tabbaa, 2015). Universities educate people for the region and train talented problem solvers, provide cultural amenities to a local area (Goddard and Chetterton, 1999, and provide direct assistance to industrial firms in their innovative activities (Chesbrough et al., 2006; Mowery et al., 2001). Firms that can build links with university research may be more productive and may be able to gain higher status and value in the commercial exploitation of their knowledge (Zucker et al., 1998). They may even be more likely to innovate if they interact together (Feldman, 1994). A framework of university – industry collaboration is proposed for the South – East European Countries as a tool which facilitates the collaboration between universities – industry actors.

There has been a substantial increase in these collaborations and interactions in several developed

and transitional nations, which is attributed to a combination of pressures on both industry and universities (Giuliani and Azra, 2009; Meyer-Krahmer and Schmoch, 1998). For industry, pressures have included rapid technological change, shorter product life cycle and intense global competition that have radically transformed the current competitive environment for most firms (Bettis and Hitt, 1995; Weight et al., 2008). With regards to universities, pressures have included the growth in new knowledge and the challenge of rising costs and funding problems, which have exerted enormous resource burdens on universities to seek relationships with firms to enable them to remain at the leading edge in all subject areas (Hagen, 2002). These pressures on both parties have led to an increasing stimulus for developing University – Industry collaborations that aim to enhance innovation and economic competitiveness at institutional levels, through knowledge exchange between academic and commercial domains (R et al., 2013).

2 Literature Review

A systematic review of the literature was performed to assess the current knowledge and collate scattered findings to present them in a way that is more relevant, reliable and provides collective insights and guidance to meet the needs of academics, practitioners and decision-makers.

2.1 Systematic Literature review method

The main objective of this study was to establish what is known about the key aspects of University – Industry collaboration, and find out how these aspects may be related. Guided by this objective, the methodology is based on the work performed by Tranfield et al. (2003) towards carrying out the review. The systematic review covered relevant articles to answer the following research questions related to UIC:

- What are the relations between geographical proximity with organizational forms and types of knowledge interaction between universities – industry?

- What are the drivers, benefits and barriers for university-industry co-creation in different tiers of geographical proximities?

To exclude some of the studies, in this article is used Farrington's methodological quality scale by implementing five criteria to assess the methodological quality of evaluation studies, including: internal validity, descriptive validity, statistical conclusion validity, constructs validity and external validity.

The first issue relates to the study's boundaries. The current research reports and discusses articles that have been included in academic journals during the period 2000 and 2016. This indicates the potential of some relevant studies to be excluded from the review. Nonetheless, this is an acceptable practice in systematic review (Pittaway and Cope, 2007), as all important contributions in each research field would usually appear continuously in subsequent journal papers. The second limitation concerns the selection of keywords applied to control in the inclusion criteria of the papers. However, to mitigate the consequences of this issue, a careful approach has been followed in the inspection process that incorporates three steps: title, abstract, and full text. Importantly, this would ensure that all relevant studies have been consulted. The table below shows the key and the most cited authors for the keywords of the paper.

2.1.1 Organizational forms and types of interaction between universities – industry in different geographical proximities

Geography is an important determinant of firms' collaborative behaviour regarding innovation, and this article argues that geographical proximity to universities and industries' propensity to collaborate with local universities in the innovation process is winding, as the relationship depends on the characteristics of firms and universities, and on the related choices made by managers in firms and academics working in universities (Laursen, Reichstein and Salter, 2015). Geographical proximity is important for knowledge exchange especially when knowledge is "person-embodied, concept-dependent, spatially sticky and socially accessible only through direct physical interaction" (Laursen and Reichstein, 2015.

The most famous forms pursued in practice and discussed in the literature are: Joint ventures, Networks, Consortia and Alliances (Barringer and Harrison, 2000), which varies depends on the degree to which participants are linked. Different researchers present different typologies on University – Industry relationships. For instance, Chen (1994) classified the forms of University – Industry collaboration

for technology exchange according to the duration of the relationship and the technology flow. Santoro and Gopalakrishnan (2000), on the other side suggest four classifications for University – Industry collaborations, including: research support (i.e. endowment/Trust fund), cooperative research (i.e institutional agreements, group arrangements, institutional facilities, and informal intentions), knowledge transfer (i.e. hiring of recent graduates, personal interactions, institutional programs, cooperative education), and technology transfer (i.e. product development and commercialization activities through university research centers.

However, another framework proposed by Bonarccorsi and Piccaluga (1994) consisted on six main categories, namely: Personal Informal Relationships, Personal Relationships, Third Party, Formal Targeted Agreements, Formal Non-Targeted Agreements and Creation of Focused Structures. This framework has been extended by Bonarccorsi and Piccaluga (1994) to reflect additional information in terms of three dimensions: a) Organizational resources involvement from the university, b) Length of agreement, and c) degree of formalization. So, if the firm's contact with the university is with an academic without any agreement signed with the university there is no organizational resources involvement. The length of the agreement between universities and firms could vary from short in the case of Personal Formal Relationships, too long in the case of specific or Focused Structures. The issue of formalization is very important because of the argument that increasing formalization and monitoring of the relationship in a University – Industry collaboration could lead to conflict and distrust among the parties in their attempt to maintain the autonomy of their organizations in the face of increasing interdependence (Santoro and Gopalakrishnan, 2000, Ring and Van De Ven, 1994).

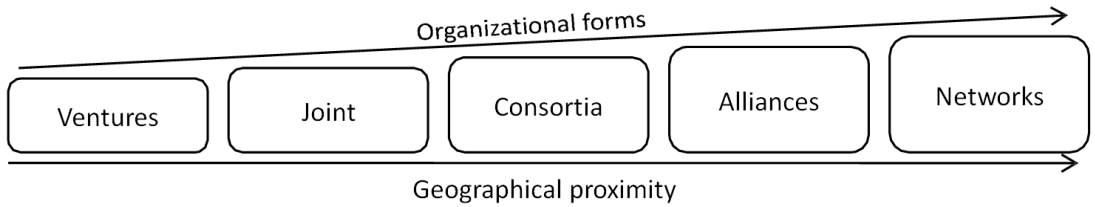

Figure 1: Geographical proximity and organizational forms Source: Adapted from Ankrah and Al-Tabbaa, 2015

The relationship between geographical proximity to universities and firms' propensity to collaborate with local universities in the innovation process is winding, as the relationship depends on the characteristics of firms and universities, and on the related choices made by managers in firms and academics working in universities. So, based on the most famous pursued in practice and discussed organizational forms, the literature show that the most famous organizational forms if Universities and Industries are far away from each other are Networks and the most famous organizational forms if Universities and Industries are nearby each other are Joint Ventures as an organizational form advantage (Ankrah and Al-Tabbaa, 2015) The term knowledge interaction is used to describe all types of interactions between organizations and/or individuals from the firm side and the university side, directed at the exchange of knowledge within innovation processes.

Mohnen & Hoareau (2002) find that size, government support, patenting and scientific industry status contributes positively towards explaining R&D collaborations with universities relative to other types of cooperation. Capron & Cincera (2002) also confirm the importance of firm size and government support as significant drivers for R&D cooperation with universities (Veugelers and Cassiman, 2003). Based on the table above, collaborative research (joint research programs) between universities and firms involves formal agreements and requires personal (face to face) contact. On the other hand, reading of publications and patents typically involves no formal agreements and no personal contacts between people from two different institutions (Schartinger, Rammer, Fischer and Frohlich, 2002).

To exchange knowledge, direct face-to-face contact is often required to help individuals explain to one another knowledge emerging from research activities that are still fluid and only partial formed

Table 1: Types of knowledge interactions between university and firms Source: Schartinger et al., 2002

Types of knowledge interaction	Formalization of interaction	Transfer of tacit knowledge	Personal (face to face) contact
Employment of graduates by firms	+/-	+	-
Conferences or other events with firm and university participation	-	+/-	+
New firm formation by university members	+	+	+/-
Joint Publications	-	+	+
Informal meetings, talks, communications	-	+	+
Joint supervision of PhD and Masters theses	+/-	+/-	+/-
Training of firm members	+/-	+/-	+
Mobility of researchers between universities and firms	+	+	+
Sabbatical periods for university members	+	+	+
Collaborative research, joint research programmes	+	+	+
Lectures at universities, held by firm members	+	+/-	+
Contract research and consulting	+	+/-	+
Use of university facilities by firms	+	-	-
Licensing of university patents by firms	+	-	-
Purchase of prototypes, developed at universities	+	-	-
Reading of publications, patents etc.	-	-	-

+: interaction typically involves formal agreements, transfer of tacit knowledge;
+/-: varying degree of formal agreements, transfer tacit knowledge, personal contacts;
-: interaction typically involves no formal agreements, no transfer of tacit knowledge, no personal contacts.

(Storper and Venables, 2014). However Gertler posits that firms have to find ways of establishing common interests and aligned incentives with their academic partners and this can only be done by "being there" in order to establish a common background and shared set of expectations and understandings about the nature of the collaboration (Gertler, 2015).

Finally, geographical proximity can play an important role in shaping university-industry collaboration, but that the type of university in the local area shapes the likelihood that a firm will collaborate with a university.

2.1.2 Drivers, benefits and barriers for university-industry co-creation

A large variety of potential drivers exists for university and industry to collaborate, which drivers for both actors are discussed separately. Governments are actively encouraging collaborations between universities and industry as a means of improving innovation efficiency and thereby enhance wealth creation (Barnes et el., 2002). Universities are increasingly turning their attention to encouraging University – Industry collaboration in response to government policy and as an institutional strategic policy (Howells et al., 1998; Perkmann et al., 2011). Universities offer extensive access to a wide variety of research expertise and research infrastructure, whiles industry offers extensive access to a wide range of expertise in product development/commercialization, market knowledge (Sherhood et al., 2004) and employment opportunities for universities graduates (Lee and Win, 2004; Santoro and Betts, 2002). So, one of the most significant reasons why universities can be motivated to build relationships with industry is to take advantage of these strengths for mutual advantages (Ankrah and Al-Tabbaa, 2015). Universities are motivated to collaborate with industry because they reduce their dependence on public pur-

sue (Logar et al., 2001), but also Industry funding usually involves less bureaucratic red tape than public funding. Faculty members may be motivated by personal financial gain to enter into relationships with industry (Siegel et al. 2004). Furthermore, Harman and Sherwell (2002) suggest that an important incentive for universities to partner with industry is publication in journals, as producing accessed-publicly information would emphasize the original mission of universities in disseminating the knowledge (Newberg and Dunn, 2002.

On the other side, Industry has a large variety of potential benefits to collaborate with universities and constantly is trying to get benefits from governmental programs by collaborating with the universities. A very significant driver for industry to enter into University – Industry collaboration is to seek to commercialize universities – based technologies for financial gain (Siegel et al. 2003). Another driver for industry to enter into University – Industry collaborations is to gain access to students for summer internships or hiring (Ankrah et al., 2013; Siegel et al., 2003), but also faculty member or senior researchers can also be hired to consult during the time they are allowed to work outside of the universities (Perkmann et al., 2011). Firms also partner with universities because of the possibility of benefiting financially from serendipitous results of research activity, innovative outputs, cost savings especially those relating to knowledge creation and exploitation (George et al., 2002).

The level of incentives does not correspond with the level interaction between actors, because the level of interaction depends significantly on the possibilities to communicate. So, if motives are higher to interact internationally because of the benefits, the possibilities are higher in a regional orientation perspective to interact.

A report of the Joint Project of the U.S. National Council of University Research Administration and the Industrial Research Institute recommends the following principles for university – industry endeavors in regional and international orientations:

- Successful UIC should support the mission of each partner;
- Institutional policies should focus on fostering appropriate long-term partnerships between actors;
- Universities and Industry should focus on the benefits of each actor to ensure timely conduct of the research and the development of the research findings.

Below, is a summary of the motives for interaction between university and industry:

Table 2: Driver for University – Industry Collaboration Source: Rohrbeck and Arnold, (2006)

University	Industry
Enhancement of teaching	Sourcing latest technological advances
Funding/financial resources	Laboratory usage
Source of knowledge and empirical data	Personnel resources/cost savings
Political pressure	Risk sharing for basic research
Enhancement of reputation	Establishing long term research projects
Job offers for graduates	Recruiting channel

There is high degree of interactions between academics and external organizations, but there are also a range of factors that constrain such interactions. Lambert has considered companies and universities as two different entities which are natural partners even though their cultural and mission's differences are significant and sometimes tend to constrain their interactions (Lambert, 2003). The most important constraints considered by the scientists are lack of time, bureaucracy, and insufficient rewards and these constraints vary by the disciplines. At the core constraints to University – Industry collaborations are the different institutional norms governing public and private knowledge (Dasgupta and David, 1994). Based on Brunnel, D'Este and Salter perspective, they focus on three potential mechanisms to reduce the obstacles to University - Industry collaboration: experience of collaboration, breadth of interaction and inter-organizational trust.

Research on inter - organizational alliances shows that collaboration experience is a critical determinant of the success or failure of subsequent alliances (Hagedoorn and Schakenraad, 1994). Involvement in a variety of channels of collaboration may contribute to better equip the firm to manage conflicts over the orientation of research for engaging in a broad range of interaction channels which creates

substantial synergies between channels, and this broad engagement contributes to strengthening the firm's capacity (Brunnel, D'Este and Salter, 2010). High level of trust helps to reduce the dears that one of the partners will act opportunistically, expresses the capacity of firm and university to work together to resolve problems, and demonstrates a willingness to understand and adjust behavior to align with the needs and expectations of partners (Zaheer et al., 1998).

3 Research methodology

To propose a framework on UIC, the use of qualitative research method for the whole research is necessary.

Focus groups will further support the research proposed model. Thus, through a systematic literature review, besides identifying different types of interactions, organizational forms, barriers and drivers of interaction, on the second stage through the focus groups the research was oriented to the actor's and stakeholder's behavior according to the levels and conceptual frameworks considering the components of each level.

Essentially, qualitative analyses are based on hypotheses raised before starting the focus group discussions. To test the following hypotheses, focus groups were organized in different countries from SEE:

H1: There is a positive correlation between geographical proximity and the level of knowledge and innovation capacity;

H2: Industry has a positive tendency for collaboration with university, more than university with industry;

H3: The level of education at industry is positively related with the level of collaboration with university;

H4: Micro level of the stakeholders is the base of a proper UIC?

3.1 Research outcomes

Recently, there has been an increasing role of the Universities that can play in contributing to economic growth. Results show that there is a negative correlation between geographical proximity and the level of knowledge and innovation capacity. This means that as lower as the distance between University and Industry is, the higher is the level of knowledge exchange and innovation capacity, but results even show that industry is more interested in collaboration with universities rather than university with industry (Laursen K., 2015).

Above there is a broad scale of conceptual frameworks and components which are going to be researched and analyzed on the next stages. Because the study is an inductive study, it will start from the micro level with individual stakeholders to the macro level with community stakeholders, which will result with a framework for this community (SEEC).

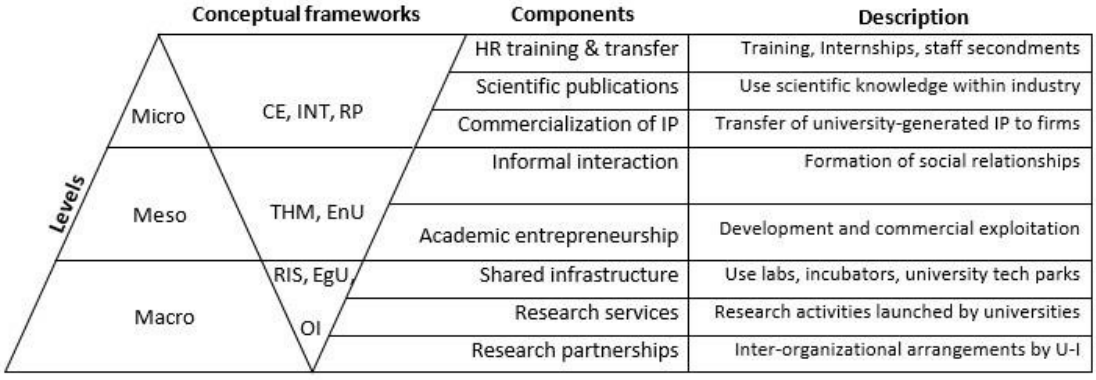

Figure 2: Conceptual frameworks in different levels and components

The paper after identifying drivers and barriers, organizational forms and types of interactions, identified some conceptual frameworks considering the level of the stakeholder. The application of these conceptual frameworks at SEEC facilitates UIC, which enables the generation of the innovations and makes more efficient the utilizations of resources. So, SEEC need more entrepreneurial

and engaged universities who are willing to interact with government and industry through cross-emplyoments, internships, research projects etc. As the final common proposal from the focus groups was a proper framework to organize the exchange between actors.

4 Conclusion

The initial stage of thesis was identifying organizational forms and types of university – industry co-creation, drivers and barriers for university – industry co-creation, the relation between University and Industry in different tiers of geographical proximities, and getting deeper understanding on entrepreneurial and engaged universities and their changing role in different periods and modes.

Based on these theoretical foundations, we show that the lower as the distance between University and Industry is, the higher is the level of knowledge exchange and innovation capacity, but even the higher is the level of education the higher are chance to collaborate with universities. Results even show that industry is more interested in collaboration with universities rather than university with industry, and the possibility of collaboration between university and industry depends on the functionalization of the conceptual frameworks, which means that conceptual frameworks are considered as significant factors which impact on the performance and development of all actors and stakeholders.

As the final common proposal from the focus groups was a proper framework for SEEC to organize the exchange between actors which is shown above.

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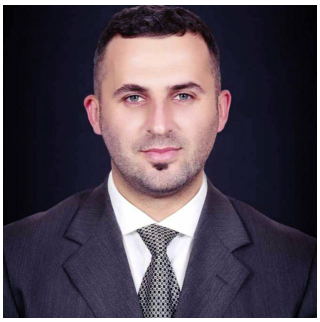
About the author



Mr. Besart Hajrizi has been awarded a BSc in Economy in 2010, from the University of Prishtina where he has also been awarded as a distinguished student with the highest GPA (10). After his graduation in BSc, he enrolled MSc in Management and Informatics at the University of Prishtina in 2010, where he graduated in 2013. Meanwhile, he used to work in an NGO so-called Business Support Centre Kosovo (BSCK) as business consultant.

He was also serving as a researcher on Entrepreneurship and Small Business Development in Kosovo research report published from 2010 until 2014 by BSCK. He is now a full time PhD Candidate under the Doctoral Program offered by the University of Sheffield and SEERC. His research interest involves determinants of innovation and the impact of the innovation on the performance of small and medium enterprises. He also serves as lecturer at the University of Mitrovica "Isa Boletini"(UMIB), Faculty of Economy.

email:bhajrizi@seerc.org

The effect of human oriented factors on innovations: The mediating role of knowledge management capability

Amna Aščić[1]

[1]School of Economics and Business, University of Sarajevo, Sarajevo, Bosnia and Herzegovina [6em]

Abstract

Keywords: Human factors, Knowledge management, Organizational culture

1 Introduction

At the end of the 20th and beginning of the 21st century great changes have taken place in all activities and areas of social activities. Rapid and profound changes, first of all, in technique and technology have led to fundamental changes in approach and business philosophy and management. Human resources, with their knowledge, skills and abilities become one of the most important factors of company success, the resources which make company different from the competition. The quality and work of human resources determines success of the financial and material resources and ultimately the business performance of the company. In the New economy, knowledge is the sine qua non of growth and development of every enterprise. In today's globalized economy, traditional factors of production, material resources and physical work give rise to the primacy of intangible capital manifested in the form of knowledge and information that is intellectual capital. Defining knowledge is complicated and there is no single definition. According to Davenport and Prusak (2000) knowledge is defined as a current mix of experience, values and information within some context and professional knowledge that provides a framework for the assessment and use of new experiences and information. Sucahyou et al. (2016) define knowledge as an individual and organizational asset that is used to obtain competitive advantage.

Knowledge management can be defined as the process that creates or locates knowledge and manages the dissemination and use of knowledge within and between organizations (Darroch, 2003). Knowledge management is a new yet insufficiently researched economic discipline that has been developing for the last 20 years from a simple concept to business concept in many organizations. KM was established as an organizational discipline (Serenko et al., 2010). The purpose of establishing KM in organization is to achieve competitive advantage in increasingly information and learning intensive work environment (Park and Hong, 2012). Enablers and processes are basic dimensions in knowledge management (Santoro et al., 2017). Enablers are mechanisms that facilitate knowledge management activities (Ichijo et al., 1998), stimulate knowledge creation, sharing and protection, and provide infrastructure necessary for improving the knowledge processes (Yeh et al., 2006). Heisig (2009) categorized critical success factors of the KM in four blocks:

1. Human – oriented factors: Culture – People – Leadership
2. Organization: processes and structures
3. Technology: infrastructure and applications
4. Management – process: strategy, goals and measurement

The purpose of this study is to research innovativeness of companies in Bosnia and Herzegovina from a human oriented perspective with mediating role of knowledge management capabilities. In the context of the New economy where knowledge is crucial for growth and development of every enterprise this study will show in which degree KM practice is developed in companies in Bosnia and Herzegovina. Also, in the same context, KM develops environment for innovations which are essential for

achieving and maintaining their competitive advantage. It is very important to establish the link between KM and innovations under the specific conditions in which businesses operate in Bosnia and Herzegovina. Relationship between human oriented factors (culture, people and leadership), as one of the critical success factors of the KM, and innovations with mediating effect of knowledge management capabilities will also be examined. The study will show whether the innovativeness of companies varies depending on their organizational culture, human resources management and leadership and how knowledge management capabilities mediate this relation. Findings of the study will help companies to realize importance of people, organizational culture, leadership and knowledge management capabilities in raising innovativeness. The study will also give guideline for companies how to manage their knowledge. This will be the first research of firm's innovativeness from a human oriented perspective with mediating role of knowledge management what is the scientific contribution of this study.

According to (Lee and Choi, 2003) knowledge management processes are structured coordination of managing knowledge effectively. Model of knowledge management capabilities developed by Gold et al. (2001) consists of the following processes: knowledge acquisition, knowledge conversation, knowledge application and knowledge protection. Darroch (2003) identified knowledge acquisition, knowledge dissemination and the use and responsiveness as three processes of knowledge management capability.

Ju, Li, Lee (2006) cited the acquisition, application and the conversation as key processes of knowledge management capability. Model of knowledge management capabilities developed by Gold et al. (2001) consists of the following processes: knowledge acquisition, knowledge conversation, knowledge application and knowledge protection. For the purpose of this study we tend to adopt four key KM processes: knowledge creation, knowledge transfer, and knowledge storage/retrieval and knowledge application distinguished by Martelo-Landroguez, S. & Cepeda-Carrión, G. (2013). The same authors defined every process in the following way:

- Knowledge creation - knowledge accumulation in the firm resulting from its ability to absorb external knowledge.
- Knowledge transfer – the act of making knowledge available to others within the organization
- Knowledge storage/retrieval – the retention of stored information from an organization's history and its quick and easy access in order to be applied on present decisions.
- Knowledge application – the use of the knowledge generated in the phase of knowledge creation and retained in the phases of transfer and storage/retrieval.

With regard to the challenges companies face in today's economy, innovation is crucial for achieving and maintaining their competitive advantage. According to Subramaniam and Youndt (2005) a firm's ability to innovate relies mostly on its intellectual assets and its ability to utilize knowledge. Innovation is defined in many different ways. Herkema (2003) defines innovation as a knowledge process aimed at creating new knowledge geared towards the development of commercial and viable solutions and states that innovation is the adoption of an idea or behavior that is new to the organization. The innovation can be a new product/service innovation, process innovation and managerial innovation.

Du Plessis (2007) defined innovation as creation of new knowledge and ideas to facilitate new business outcomes, aimed at improving internal business processes and structures and to create market-driven product and services (Palacios et al., 2008).

Innovations are not only focus of knowledge management but it develops a suitable environment for innovations. There are three main drivers of the application of knowledge management in innovation (Du Plessis, 2007):

1. Knowledge management's role in innovation in today's business environment is to create, build and maintain competitive advantage through utilization of knowledge and through collaboration practices.
2. Knowledge is a resource used to reduce complexity in the innovation process, and managing knowledge as resource will consequently be of significant importance.
3. The benefit of the innovation process is the integration of knowledge both internal and external to the organization, thus making it more available and accessible.

Du Plessis (2006) concludes that knowledge management systems have a distinctive contribution in the development of sustainable competitive advantage through innovation.

Many authors reported significant positive relationship between knowledge management and innovation (Demarest, 1997; Daroch and McNaughton, 2003; Gloet and Terziovski, 2004; Darroch, 2005; Kianto, 2011; Burnet and Williams, 2014).

The human resources with their competencies, knowledge and skills are very valuable assets in organizations. According to Thompson (2003) the types of employee knowledge, skills and abilities are key resources for the innovations. One of the few studies investigating link between human resource management and innovation with mediating effect of knowledge management perspective is that carried out by Currie and Kerrin (2003). Results of their study showed that strategic HR practices relate positively on innovation performance through the capacity in knowledge acquisition, sharing and application. Currie and Kerrin (2003) adapted five aspects in the construct of strategic human resource practices with development of a sixteen-item scale. To provide empirical evident of mediating role of knowledge management capabilities on the relationship between people as a human – oriented factor (Heisig, 2009) we shall adapt five aspects in the construct of strategic human resource practices including staffing, training, participation, performance appraisal and compensation used in the study conducted by Currie and Kerrin (2003).

Organizational culture is one of the determinants of knowledge management in the organization. According to Janz and Prasamphanich (2003) organizational culture is factor with the most powerful influence on knowledge management. Difficulties that arise in the KM process between people are connected to the psychological climate of the organization witch depends on the organizational culture (Schein, 2000). Organizational culture consists of the symbols, language, ideology, beliefs, rituals and myths in an organization (Lee et al., 2015).

To provide empirical evident of mediating role of knowledge management capabilities on the relationship between organizational culture as a human – oriented factor (Heisig, 2009) we shall adopt conceptual framework suggested by Cameron and Quinn (1999) who identified four characteristic kinds of organizational culture: group (tribal) culture, developmental culture (adhocracy), hierarchical culture and market (logical) culture based on a theoretical model known as the Competing Values Framework.

The group culture is characterized as a very friendly place to work. People share a lot of them and accept others as an extended family. The leaders are considered as mentors and even as parents. Organizations with group culture are characteristic by loyalty, tradition and high commitment. In organizations with this culture cohesion, moral and human resources development is very important. Sensitivity for customers and concern for people are measures of organizational success.

Creativity, dynamism, entrepreneurial, taking risk, innovation are characteristic for developmental culture (adhocracy). Success is described as being a product or service leader so emphasize is on gaining unique and new products or services.

Hierarchical culture is characteristic for formalized and structured organizations witch are led by formal rules and policies. Dependable delivery, smooth scheduling and low cost are measures of organizational success.

The market culture is oriented on competitive advantage and achieving measurable goals and targets. Leaders in this culture are hard drivers, producers, competitors, tough and demanding. Market share and penetration are measures of success in this culture.

The study carried out by Büschgens et al. (2013) conducted meta-analysis, which comprises 43 studies with a combined sample size of 6341 organizations, about the relationship of organizational culture and innovation. The results of the study showed that the Competing Values Framework can be used to describe and compare organizational cultures and could be a concept which is commonly used in this field of research.

In a study carried out by Lau and Ngo (2004) was found that developmental culture has a direct effect on the development of new products and services. Naranjo-Valencia et al. (2010) found that product innovation is positively associated to adhocracy cultures and has a negative relation with hierarchical cultures and their findings suggested that effect is the same for manufacture and service industry.

Many researchers were investigating and analyzing influence of specific managerial characteristics on innovation in organization. A large number of studies identified leadership style as one of the most important factor affecting organizational innovation. Burns (1978) introduced concepts of transactional and transformational leadership styles explaining the difference between those two styles is in what leaders and subordinates offer to each other. Transformational leadership is a style of leadership that emphasizes the importance of collective interest among the organization's members and helps them to achieve collective goals (García-Morales et al., 2011). Transactional leadership is focused on individual interests and achieving the satisfaction

of contractual obligations by establishing objectives and monitoring and controlling the results (Bas and Avolio, 2000). Jung et al. (2003) found direct and positive link between transformational style of leadership and organizational innovation. Birasnav (2014) indicated strong and positive effects of transformational leadership on KM processes and organizational performance after controlling for the effects of transactional leadership.

This study will be focused on transformational and transactional leadership. Relationship between those two styles of leadership with knowledge management processes and innovations will be researched.

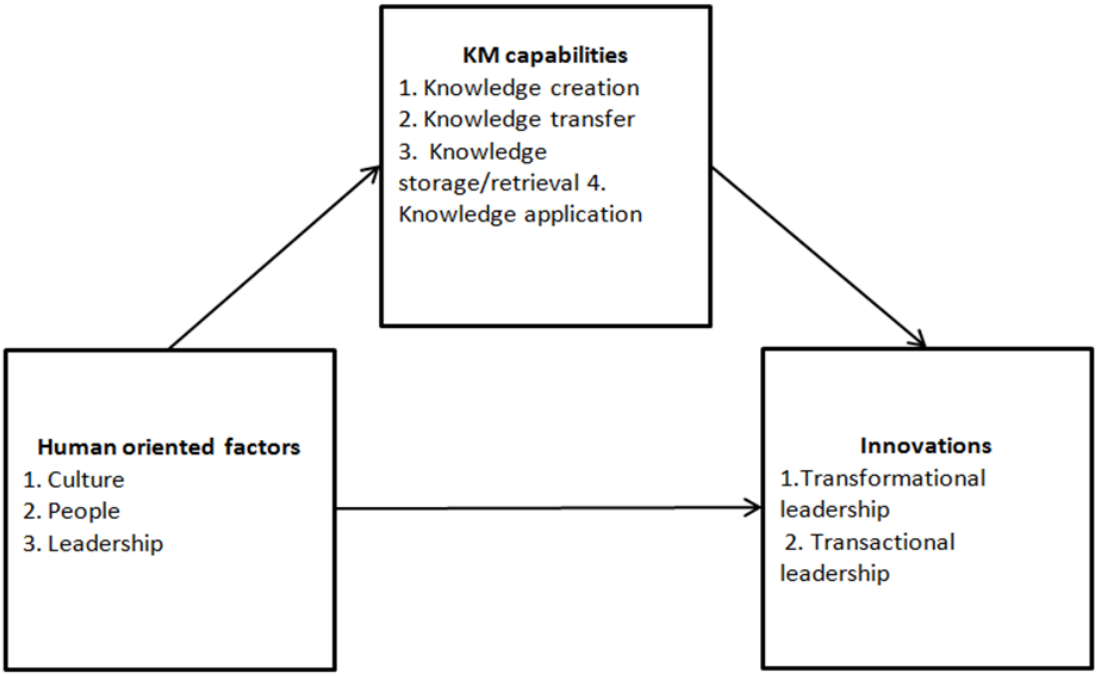


Figure 1: Research model

Based on the literature review above study is hypothesized as follows:

H1. Human oriented factors statistically significantly affect innovation

H2. Human oriented factors statistically significantly affect knowledge management capabilities

H3. Knowledge management statistically significantly affects innovation

H4. Knowledge management statistically significantly mediates relationship between human oriented factors and innovation

2 Research methodology

In order to test our hypotheses, collecting primary data will be conducted through the organization of field research using a polling survey on management of selected companies. The instruments for collecting required information will be questionnaires validated and used in previous researches. The survey will be conducted on a sample of 200 companies in the territory of Bosnia and Herzegovina. In the selection of the sample, the technique of the quota sample will be used, whose proportions will be based on the features: geographic distribution, branch affiliation and business results. Data collection tools will use specially created.

Data processing and analysis will use statistical methods that are commonly used in social sciences. Testing and validation of the hypothesis will be done using the SPSS software. Construct validity will be assessed by using Exploratory Factor Analysis with varimax rotation method. Kaiser – Meyer – Olkin (KMO) test will be used for assessing sampling adequacy. Homogeneity of variance will be tested with Bartlett's test of spehericity. Cronbach's aplha-coefficient will be used to test the reliability of the study constructs. Hypotheses will be tested with regression analysis. Four separate

regression analysis will be applied to identify the existence of a mediation effect.

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About the author

Amna Aščić was born in Travnik, Bosnia and Herzegovina, in 1983. She is currently second year PhD student in Management/business at School of Economics and Business at the University in Sarajevo. Since 2007 she has been employed at the Institute for Statistics of FB&H. She received the bachelor's degree from Faculty of Economics, University of Tuzla and the master's degree from Faculty of Economics, University of Mostar.

She has published many papers at domestic and international conferences and journales and was a member of an organizing board of an international conference. In 2017 the University of Sarajevo nominated her for the Erasmus+ scholarship at Radboud University in Nijmegen, Netherlands. She was selected to receive this scholarship and in August 2017 she attended the programme in Positive Psychology: The Science behind Flourishing Individuals and Organizations at Radboud University. Her doctoral work explores innovativeness of companies in Bosnia and Herzegovina from a human oriented perspective with mediating role of knowledge management capabilities.

email: amnatravnik@gmail.com

Openness of External Search Strategy and Innovation Performance of Egyptian SMEs and Large Firms

Hamdy Ellahamy[1] and Carsten Dreher[2]

[1]Ph.D. Student at School of Business and Economic, Freie Universtät Berlin, Berlin, Germany
[2]Professor of Innovation Management, Freie Universtät Berlin, Berlin, Germany

Abstract

Firms innovation strategy have been recently shifted to be more opened, with firms growingly depending on external sources of knowledge to draw key inputs into firms' innovation process (Laursen & Salter, 2006) and research collaboration (Cassiman & Veugelers, 2006) to develop new products, services, and process. This new trend has been labelled as shifting form closed innovation to open innovation strategy OI (H. W. Chesbrough & Crowther, 2006). This paper explores the relationship between firms' external search strategy' degree of openness" and their innovative performance in both Small and Medium Enterprises SMEs and large firms to figure out whether firm size a matter or not?

Keywords: Open innovation, Strategy, SMEs, Large firms

1 Theoretical Background and hypothesis

1.1 External Search strategy

OI concept has been cultivated over a bulk of innovation management literature about the role of networks, communities, outsourcing, licensing, and strategic alliance (Brunswicker & Vanhaverbeke, 2015; Narula, 2004). The early Schumpeterian model of the lone entrepreneur bringing innovations to markets has been enlarged by a rich picture of different actors working together in iterative processes to commercialize successful new ideas to the market (Schumpeter, 1942/87; Rosenberg, 1982; von Hippel, 1988; Freeman and Soete, 1997; Tidd, Bessant, and Pavitt, 2000). These newer models of innovation have highlighted the interactive character of the innovation process, suggesting that innovators rely heavily on their interaction with lead users, suppliers, and with a range of institutions inside the innovation system (von Hippel, 1988). In this respect, innovators are no longer innovate alone. They tend to work together in teams and coalitions based on 'swift trust,' nested in communities of practice and embedded in a dense network of interactions (S. Lee, Park, Yoon, & Park, 2010). Chesbrough (2003) in a creative rhetoric manner- cumulated all these prior fragmented ideas under the umbrella of OI concept. This model suggests that the advantages that firms gain from internal R&D expenditure have declined. Accordingly, many innovative firms are able to successfully innovate by drawing in knowledge and expertise from a wide range of external sources. Chesbrough (2003b) suggests that firms cannot hire all creative people and millions of innovators will remain outside the firms' boundaries. He suggested that firms that are 'too focused internally' are 'prone to miss a number of opportunities. An example of this open innovation model can be seen in "connect and innovate strategy" of Proctor & Gamble (P&G's). From that point forward on, During the last few years, a Strand of extensive prior endeavors sought to understand the complex features of openness towards external partners in SMEs and large firms. Innovation management scholars focused on understanding the process itself(Gassmann, 2006), role of intermediary organi-

zations(Y. Lee, Park, & Song, 2009), fundamentals of building network of external partners(Narula, 2004; Joel West & Bogers, 2014), contextual determinants of openness(Cassiman & Veugelers, 2006; Verbano, Crema, & Venturini, 2015), measuring the degree of openness and its impact on innovation performance(Laursen & Salter, 2006). This focus on understanding the process external search strategy degree of openness and its innovative impact. From the process perspective, authors distinguished three major open innovation dimensions namely Inbound OI, Outbound OI, and couple process OI (Enkel, Gassmann, & Chesbrough, 2009). The term inbound OI refers to exploring external information sources to complement, strengthen or speed up in-house R&D activities, while outbound OI describes external paths to commercialize internal innovations that are not used by the innovating company to develop new products or services. Coupled OI focusses on strategic alliances that unite both in- and outbound OI (Andre Spithoven, Vanhaverbeke, & Roijakkers, 2013). Depending on the financial flows involved, both inbound and outbound innovation can be either pecuniary or non-pecuniary in nature (Dahlander & Gann, 2010). Since Inbound open innovation activities are the most common practiced (Huizingh, 2011), we address it in this study. A review of existing empirical research on open innovation reveals that a firm's open innovation search strategy describes an important form of non-pecuniary inbound innovation (Dahlander & Gann, 2010). Open innovation search strategies define how firms organize their search for external knowledge outside their organizational boundaries sources (van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009). Previous research has documented a variety of useful information sources: customers, suppliers, competitors, universities, public research organizations, consultants, professional and industrial associations, among others (Laursen & Salter, 2006; Vahter, Love, & Roper, 2015). To figure out how do small and medium- sized enterprises (SMEs) open up to external innovation sources, André Spithoven, Vanhaverbeke, & Roijakkers, (2012) have clustered four types of external search strategies based on with whom firms are partnering and which type of knowledge is targeted; (1) Closed innovator: refers to those who are depending on their internal R&D competences to innovate, (2) Supply-chain searcher are characterized by relatively intensive interactions with direct customers and suppliers in comparison to other external sources. (3) Technology-oriented searcher, are characterized by a relatively high degree of interaction with universities, research organizations and IPR experts, and (4) Application-oriented and demand-driven searcher. This type of SMEs regularly interacts with value chain actors such as customers and suppliers to get access to new ideas. Network partners do also play an important role for new ideas. These firms rank highest in the active involvement of indirect customers. Depending on Spanish CIS, Barge-gil, (2017) provided an explanation for the degree of openness though distinguishing three strategies of external search; closed innovators, semi-opened, and opened innovators based on the firms' needs and their absorptive capacity. One of the most regular referred study in this regard is the study of Laurance and Salter (2006). In their empirical study, they have constructed a measurement for the degree of openness based on the depth and breadth of a firm's search strategy. External search Breadth represents the number of different external innovation actors each firm draws upon in its innovation activities to source external knowledge. External Search depth refers to the extent to which firms draw deeply from different external sources or search channels (Laursen & Salter, 2006).in line with Laurnce and Slater 2006 and Barge-gil,2017, we will operationalize Egyptian innovation survey question to understand How do Egyptian small, medium and large firms open and organize their external search strategy for innovation.

Open search strategy are highly relevant for SMEs since they struggle with the liability of small- ness, facing resource constraints and scale limitations and having fewer technological assets to bargain with(Chesbrough & Brunswicker, 2014; Dahlander & Gann, 2010; Narula, 2004). Therefore, smaller firms have to open up more than their larger counterparts to access external knowledge and technology for innovative purposes ((Christensen, Olesen, & Kjær, 2005). However, Smaller firms have fewer human resources to screen the external environment for valuable information than larger firms (van de Vrande et al., 2009)(J West, Salter, Vanhaverbeke, & Chesbrough, 2014). In addition, Companies heavily involved in open innovation strategy may run the risk of losing their inventions for the interest of external partners while ideas can be stolen or imitated. Inventions protection requires high degree of appropriation regime, which may potentially be more challenging for SMEs than for large enterprises. So that we expect that external search strategy degree of openness will be narrower in SMEs than large firms.

H1, Degree of openness of external search

strategy in SMEs will be narrower than degree of openness in large firms.

1.2 Degree of openness and innovation performance

Our key concern here is the relationship between openness in terms of external knowledge linkages and innovation performance. Many authors use patent activity as a key indicator for innovation (see, for example, Katila and Ahuja 2002). Patents have two complementary functions: (1) they are assumed to protect the innovation from being imitated and so generate additional profits for the innovating firm and (2) they can be licensed-out to third parties ((Teece, 2007)). However, patenting behavior is presumed to be sector dependent and is often related to the size of the firm as large firms tend to patent more than smaller ones(Belderbos, Faems, Leten, & Looy, 2010)). Others, used turnover generated from innovation activities by the firm (Cassiman & Veugelers, 2006; Vahter et al., 2015). Following Clausen & Pohjola (2009) and Brunswicker & Vanhaverbeke (2015) we use two distinctive innovation performance measures: firms' product innovation and process innovation as defined in CIS by OCED. A bulk of prior studies assured the positive impact of external search strategy on innovation performance of small, medium and large firms. For example Mowery(1990) indicated that external innovation linkages may also increase firms' access to technology developed elsewhere. Moreover, having more extensive networks of linkages or more different types of linkages is likely to increase the probability of obtaining useful knowledge from outside of the firm ((Yun & Mohan, 2012).Empirical evidence also points to the conclusion that knowledge gained from alternative sources tends to be complementary, and also complementary with firms' internal knowledge in shaping innovation performance (Cassiman & Veugelers, 2006; Vahter et al., 2015).

Openness in innovation in the form of a larger number of different types of external knowledge linkages has also some potential disadvantages. There may be difficulties with managing and protecting intellectual property rights. Having a larger number or variety of types of innovation partner may also lead to problems with the management and monitoring of these relationships and the simultaneous absorption of knowledge from a number of different sources(Katila, 2002). These disadvantages are likely to increase as firms' number of linkages increases with the potential for the firm to reach a "saturation level" where the innovation benefits of external linkages are maximised. Beyond that level, the addition of another innovation linkage will result in a deterioration of the innovation performance of the firm as the attention of managers is diluted between large numbers of different knowledge sources. Laursen and Salter (2006) reflect this in their notion f "over-searching", and some empirical analyses of innovation performance do find evidence of external and internal knowledge being substitutes rather than complements under certain circumstances (Love and Roper 1999). The balance between the positive effects of firms' external innovation linkages and the potential for oversearching led Laursen and Salter (2006), Leiponen and Helfat (2010) and Love, Roper, and Vahter (2014) to expect an inverted U-shaped relationship between the breadth or number of innovation linkages and innovation performance, an expectation confirmed by their empirical analyses. (Vahter et al., 2015).

Based in previous section we expect that opened innovation strategy will affect positively on firms' ability to innovate new product and process. However, little studies that address impact of openness on innovation performance in SMEs and large firms simultaneously. In this line we follow (André Spithoven et al., 2012)(André Spithoven et al., 2012) to figure out whether there is a difference in the impact of these OI practices n firm performance between large companies and SMEs. In other words, do SMEs benefit more or in a different way from opened strategy compared to large firms. To benefit from opened strategy for innovation firms need high level of absorptive capacity that allows them to scan external environment, spot the relevant knowledge, assimilate and integrate it into its internal innovation system. it also requires high level of protection that enable firms to engage with external partners without losing their inventions. According to liabilities of smallness, we expect that large firm will benefits more from opened strategy of innovation.

H2 openness of external search strategy have a positive impact on the introduction of new products or process on the market.

H2a, Openness of external search strategy has a positive impact on product innovation performance in large firms greater than in SMEs.

H2b, Openness of external search strategy has a positive impact on process innovation performance in large firms greater than in SMEs.

2 Data and Method

2.1 Sample

The dataset underlying our analysis is drawn from the CIS carried out in Egypt. CIS data have been used in over 200 recent academic articles, mainly in economics (for recent prominent contributions using CIS data; see Cassiman and Veugelers, 2002; Mairesse andMohnen, 2002). The Egyptian Innovation Survey performed in 2015 was based on the guidelines of the Organization for Economic Cooperation and Development's (OECD) Oslo Manual (OECD 2005). It also adopted the methodological recommendations for CIS 2006 provided by Eurostat, the Statistical Office of the European Commission. The first edition of Egyptian Innovation Survey was in 2009, the Questionnaire from this period was slightly modified for Egypt through piloting exercises with businesses, and the research field has been made by Central Agency for Public Mobilization and Statistics (CAPMAS).

Egypt NIS was implemented in 2009, 2012, and 2015, and organized in 18 pages. It Included a page of definitions and questions about innovation performance, intellectual property rights and innovation activities. Respondents were asked a number of questions about the sources of knowledge for innovation. These couple of questions will be used to measure the breadth and depth of external openness in innovation as we will explain in the next section. It was sent to the firm's official representative for filling in information on the firm's activities. It was normally completed by the Managing Director, the Chief Financial Officer, or by the R&D manager of the firm. The implementation of the survey was administered by the Central Agency for Public Mobilization and Statistics CAPMS in corporation with The Egyptian Science Technology and Innovation Observatory (ESTIO) at the Academy of Scientific Research and Technology (ASRT). The survey was sent to 3000 business units Egypt in April 2015 distributed over 20 governorates and data collection lasted for 6 months. It received a response rate of 98 percent as the survey is implemented by governmental official agency that has a high level of credibility in Egypt. The sample is a representative stratified random sample which allows precise information on relevant characteristics that selected from the recently updated frame of the last Egyptian's establishments economic census 2013. The stratification is by sector of activity, firm size, and geographic location. The target population is limited to firms with at least 10 employees. Stratification by firm size divides the population of firms into 3 strata: small firms (10-49 employees), medium firms (50-249 employees), and large firms (250 and more employees)(European Commission definition). Geographical distribution is defined to reflect the distribution of activities and firms over different regions (Urban governorates, Lower Egypt, and Upper Egypt). For the sake of our research objectives, we will investigate only innovative firms that innovate either product or process during the determined period $2012 - 2014$. So that our sample downsized to 1750 firm.

3 Results

Drawing on Egypt National Innovation Survey NIS of 1411 innovative SMEs and 339 large firms, we conclude that not only large firms that adopt open innovation strategy but also SMEs do so. In all, open innovation is relevant and present in business life, i.e. it applies not just to MNEs but also to a much broader group of small- and medium-sized enterprises. Drawing on an existing database, open innovation was operationalized along two dimensions, external search breadth and external search depth based on a list of nine external sources of knowledge. Firms perceived that on average fife out of nine external sources of knowledge (i.g. breadth of search strategy) are important partners for innovation. However they only rated on average one source as a high important source of knowledge for their innovations (i.g. depth of external source strategy). Most of Egyptian firms are supply chain oriented as they draw knowledge extensively form their suppliers and customers. Firms have evaluated market sources (customers, supplier, and consultants) and other sources like exhibitions and trade association as more important sources of knowledge than scientific research institutions. Egyptian firms are preferring to draw knowledge form free available resources than official R&D agreement with research institutions due to their financial constraints. More research is required to compare between industrial sectors and different firm size. Firms also rated Universities and research institution as the lowest important sources of knowledge for innovation. This can be attributed to the gap between industry and research institution in Egypt. Some reports indicated that both industry and universities are going on different directions. In other word scholars are working on research areas which are not highly repre-

sented in practical economic sectors. On the other hands, there a timescale miss-matching between both world. Scientific research requires a long time while time to the market is so important for the industrial partners. More research is required to consider the real reasons of this isolation.

Building on the review of the OI literature by (Dahlander & Gann, 2010), (Barge-gil, 2017), and depending on the breadth of external search strategy(Laursen & Salter, 2006), we are distinguishing between three main strategies of innovation; closed innovator, semi opened innovators and opened innovators. Emerged results showed that semi-open strategy is the most common between large firms and SMEs as well. In contrast to (André Spithoven et al., 2012), Open innovation strategy is more adopted in large firms than closed innovation, whereas closed innovation strategy is more adopted in SMEs. This result might be changed if we consider the number of IO practiced activities compared to number of employee in both SMEs and large firm as he did (i.g intensity of OI) . Overall, as we assumed in H1, firms size has a significant impact on degree of openness even its low significant. Furthermore, we find that degree of openness of external search strategy has a positive effect on the introduction of new products and process SMEs and large companies. However, results showed that SMEs are benefiting from open strategy greater than large firms to introduce new products and services. This may explained by the high flexibility, less bureaucracy, high degree of concentration of SMEs which enable them to explore the new ideas faster than large firms.

In conclusion, SMEs are increasingly adopting open innovation strategy even they still lag behind large firms regarding the degree of openness due to their internal liabilities if smallness.

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About the author

Before moving to Germany Hamdy Ellahamy was working a Teaching Assistant at business school of Cairo university since 2009 till 2015. He had completed his bachelor and master degrees of business administration at the same institution. In 2015, Hamdy joined the chair of innovation management at FUBerlin school of business and Economic as a PhD student funded by DAAD scholarship. Hamdy's research focus is innovation management in general and open innovation in particular. In this research, Hamdy is exploring the status of open innovation adoption in one of the most important Arabic and African emergent markets, namely Egypt. He is going to question the extent of adopting open innovation model in terms of inbound and outbound practices. He aims at discovering the degree of collaboration between SMEs and its ecosystem's entities (e.g. Customers, suppliers, educational and research institutions, intermediary private or public organizations) along their journey for creating value. The study also aims to figure out the external environmental determinants and internal organizational factors that may deter or prompt the adoption of open innovation in such contexts. Hamdy seeks to detect the challenges that counter the innovative endeavors of Egyptian SMEs' to help them in catching up with international SMEs supply chain through comparing the Egyptian case with the more developed European statues. Other areas that Hamdy is interested in including, knowledge and innovation management, networking, entrepreneurship, and SMEs internationalization.

email:hamdy_ellahamy@foc.cu.edu.eg

Measuring innovation performance of work teams: a state of the science review of approaches and guiding framework for selecting indicators

Philipp ter Haar[1]

[1]University of Applied Sciences Hamburg, Hamburg, Germany

Abstract

The level of innovation is essential for a company's competitive advantage and the ways to measure it are manifold. The nucleus for innovations are work teams. So it is essential to know their level of innovation performance to be able to decide on actions to foster it. To identify a method to assess a work team's level, a new definition of innovation performance was proposed. Then, relevant existing approaches were selected based on a 4-level-of-analysis-framework. Criteria were defined describing requirements for indicators applicable in this specific context. These criteria were applied to assess the indicators which have been defined by the literature. The results showed that there is no single framework fitting to the situation but indicators from various advances should be merged. With regard to the process underlying an innovation indicators should not be fixed but should be selected depending on the situation while covering the aspects time, costs and quality. Furthermore, new output indicators such as "proposals for settings to be optimized" and "positive decisions achieved" are required to provide an objective picture of the situation. While this study is a significant leap forward, further research should focus on developing a comprehensive tool for evaluating a work team's innovation performance level.

Keywords: Measuring innovation, Innovation performance, Innovation output indicator, Controlling

1 Introduction

It is broadly accepted in today's literature that 'it [concept of innovation] is considered one of the essential ingredients of competitive advantage given that it is an intangible component that is difficult for competitors to replicate.' (Marin-Garcia et al.)

Thus, this topic is on the one hand in the focus of nowadays research and on the other hand many companies invest (significantly) to improve their innovation performance in the next couple of years.

Within companies the nucleus for innovations are single persons or teams (Kurz, 2013). Due to the need for innovation, it is highly relevant for companies to achieve a high innovative performance in as many teams as possible. Decision makers would like to transfer working processes, settings, skills etc. effectively in increasing innovation performance to as many teams as possible. This should help to improve the company's overall innovation performance.

Though to evaluate the effect of activities to increase innovativeness or to identify the most innovative team one must be able to assess the level of innovation performance of work teams. This paper analysis how innovation performance of teams can be measured.

Today the literature on innovation measuring is continuously growing (please refer to Figure 1). Approaches on innovation measuring are manifold. To just name a few, some companies use an adapted form of the balanced score card - the innovation balanced scorecared to measure innovation (Fischer et al., 2015), others are measuring the return on R&D

(Vahs & Brem, 2015). Alternatively, Bloomberg is offering the "Bloomberg innovation index" to measure innovation (Coy, 2015) while other authors use use an "Innovation Competence Barometer" (Butter & van Beest, 2017). Within this study it will be evaluated whether these approaches – or at least single indicators used by an approach – can also be applied on work team level or whether additional indicators are needed.

To identify an advance to measure innovation performance on work team level, firstly a new definition of innovation performance will be proposed and the structured approach the literature was reviewed will be described. Secondly, based on a 4-levels-of-analysis framework relevant approaches will be identified. Based on the evaluation of these approaches an overview over existing indicators will be given. Finally, based on requirements for controlling criteria it will be discussed which indicators one should use to measure innovation performance of teams.

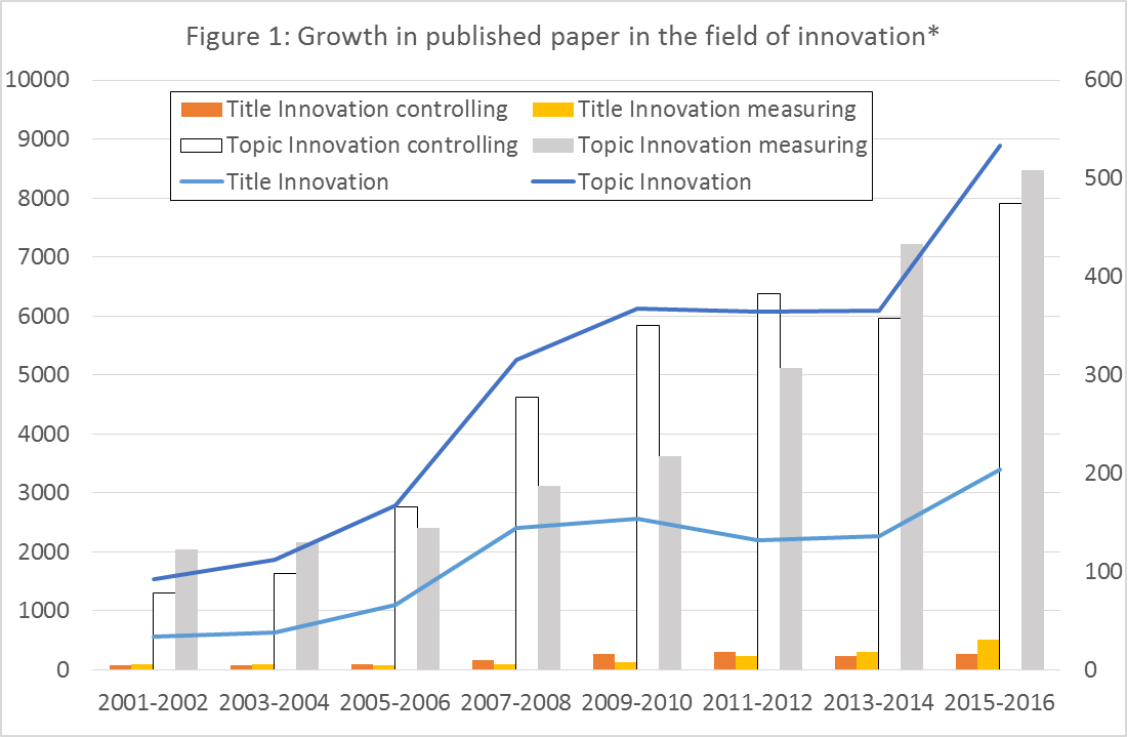

Figure 1: Growth in published papers in the field of innovation *The literature research was undertaken in the Web of Science using innovation and innovation controlling as keywords in the subject fields business, management and business finance

2 Methodology

2.1 Definition of innovation performance

Various definitions have been proposed with regard to innovation. All authors agree that innovation consists of at least 2 stages: idea generation and realization. The aspect “realization” is generally used to clarify the difference to creativity and inventiveness, both of them focusing on generating ideas only. By reviewing the literature one can find definitions with up to 5 stages (for details please refer to table 1). Most authors however are in favor of a 3 stage process also including the need for idea promotion (Kurz, 2013). Due to todays need to market ideas before an implementation is agreed on, this review will follow the 3 stage concept and include this into the definition.

To value the innovativeness of a work team one should assess innovative results of the team. On the other hand, the way from idea generation to the final realization might be long and difficult. Therefore innovation performance is also characterized by

the quality the process is managed and it is also necessary to take the way the results are achieved into account (Goffin & Mitchell, 2010), due to the fact that it can be assumed that a higher level of innovation performance will lead to reduced resource needs while implementing the innovation. Hence, the definition should include the word "produced" to describe a strong output orientation and also include a reference to the underlying process to take the second aspect sufficiently into account.

It has to be discussed whether input to foster innovativeness (e.g. by workshops, well equipped laboratories, etc.) should also be included into the definition. The Oxford dictionary defines performance as 'the action or process of performing a task or function' , the aspect input is not covered by this phrase. This will also find approval from a management perspective 'as Marco Iansiti of Harvard Business School has pointed out, 'after all, what a company gets for the money it spends on R&D is what ultimately matters'.' (Goffin & Mitchell, 2010).

Thus, to provide a scope for the present study the following definition of innovation performance of work teams is proposed:

The total innovation produced by a single work team, which includes the value created with regard to the three stages of an innovation (idea generation, promotion and realization) and their underlying process.

To sum up, this definition describes innovation performance by focussing on the innovative output created by a team as well as the quality the team manages the process until realization.

2.2 Selection of approaches

To ensure a comprehensive overview over the existing and relevant methods of innovation measuring a review strategy based on stages was applied (Pittaway et al., 2004; Rousseau et al., 2008). The following steps were taken (Spender et al., 2017):

1. Based on a preliminary review of the literature on the topic of innovation and his own experience, the author identified a set of key words by using the mindmapping technique. Exemplary key words were "innovation", "measuring", "assessment" and "controlling".

2. Search strings were used to find the relevant citations, e.g. the string [innovate* AND measure* OR control* OR assess*] was used at the beginning.

3. This string was used for an initial search in Google Scholar to determine additional key words. For example, additional words such as "performance", "capability", "R&D", "indicator" and "index" were found to be relevant and added to the analysis.

4. As a base a search using the string ["measur* innovat*" OR "control* innovat*"] was undertaken in 3 search engines: Elsevier's Scopus (576), Web of Science (372) and EconBiz (240).

5. Due to the highest number of resulting citations, Scopus was selected to apply the strings identified in step ii) and iii). These strings were continuously refined up to the most complex. 321 citations were gained using the final string.

6. Inclusion and exclusion criteria were defined (see table 2). The reasoning was to include all methods and tools included which describe a way to measure innovation independent from the measured object (e.g. single product, individual or country). Due to the fact that organizations or specialized companies offer to evaluate innovativeness, this aspect was included as well in cases a description of the method could be obtained. However, the vast majority of literature is addressing the need for being innovative and activities or methods to increase the level of innovation. With regard to the focus of this review these papers were excluded.

7. The inclusion and exclusion criteria were used to assess the gained citations in two steps: to begin with, the titles and keywords of the articles were evaluated based on the inclusion and exclusion criteria, secondly, the abstracts of supposedly relevant articles were analyzed accordingly.

8. Due to the fact that tools and methods offered by companies or organisations were also included into the work, the author also used the search string from step iv) in Google and Bing to ensure the completeness of the search results.

9. Finally, the reference sections of all included search results was crosschecked to assess the search strategy.

   The remaining 30 approaches to measuring innovation were included in the study.

10. Each approach was evaluated based on the aspects focus, measuring technique and indicators used.

11. After reviewing the advances once again, a framework was identified to evaluate whether the approaches for innovation measuring are covering all levels of analysis.

These 30 approaches were clustered by using a 4-levels-of-analysis framework: individual level, team level, company / business unit level and region / country level (see figure 2). (Anderson et al. (2014) used a framework of 4 levels to evaluate innovation and creativity in organizations: the individual, the work team, organizational, and multi-level approaches. Due to the fact that many frameworks exists to measure innovation on country level (e.g. Global Innovation index or Bloomberg Index), which cannot be categorized in one of the other levels, the country level has to be added. By doing so, the advances are too different so that multi-level approaches over 3 or 4 categories are not possible.)

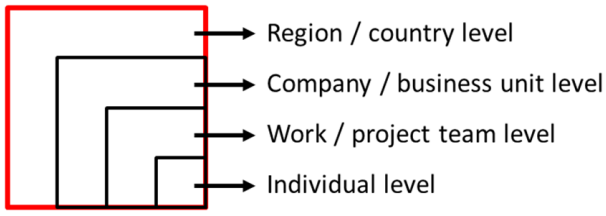

Figure 2: Levels of Analysis for approaches to measure innovation

The application of the 4-levels-of-analysis-framework proves that only ways to measure the performance of innovation project teams exist. Fischer and Hauschildt describe an approach for operative innovation controlling focussing on projects (Fischer et al., 2015). Similarly to the Integrated Evaluation Method indicators of a typical project controlling, such as milestone or budget controlling are proposed (Maier et al., 2007; Vahs & Brem, 2015). Other advances measure innovative performance by length of development time, costs of development etc. compared to market average or turnover (Fuchs, 2014) or the return of investment of innovation projects (Hauschildt & Salomo, 2007). These indicators are particularly working well with innovative product development projects. It is also stated that the only way to assess innovation activities is to evaluate the progress of these innovation projects (Littkemann & Derfuß, 2011).

To sum up, these ways do not differ from typical project controlling measuring time, budget, quality (Littkemann & Derfuß, 2011), thus describing only the process part of the definition above. Advances also covering the first part of the definition and designed to measure innovation performance of work teams cannot be found (please contact the author for adetailed overview over approaches). However, due to the fact that work teams are part of companies, it has to be analyzed whether it is possible to transfer the indicators used by approaches focussing on company and business unit level to close this gap.

2.3 Types of indicators used

Measuring innovation performance of work teams supports management decision making. For example based on the actual level of a team's innovation performance activities to improve the team's innovativeness might be taken or incentives granted. This presupposes an objective evaluation of the situation. Generally speaking three different techniques to measure an indicators' value are used: quantitative, semi-quantitative and / or qualitative. Semi-quantitative techniques are basically qualitative judgements that are converted to numbers. They differ from quantitative technique in that no attempt is made to use a sophisticated formula to complete the data. Qualitative techniques are intuitive judgements ((Pappas & Remer, 1985)). Due to the decision makers interest in unambiguous results quantitative measures should be used. Only if this is not possible, one should also analyze semi-quantitative approaches in more detail.

To sum up, only the indicators of quantitative and semi-quantitative approaches focusing on company or business unit level will be analyzed with regard to their fit to measuring a team's innovation performance.

3 Analysis

The approaches measuring innovation performance on company and business unit level use indicators to describe the input to facilitate innovation, the process the innovation is realised and the output generated (Goffin & Mitchell, 2010). Input aspects are usually investments facilitating the innovation, e.g. by providing well-equipped laboratories or offering innovation workshops. Process aspects ensure a professional approach to achieve the innovation, e.g. staying in time and budget while creating a new product, thus a vice versa relationship exists. Assessing the output implies evaluating the value of the results of the innovation stages, such as ideas created or product implemented (Tidd &

Bessant, 2014). This should be linked to the three stages of innovation to assess which indicators can be used for measuring a team's innovation performance (figure 3).

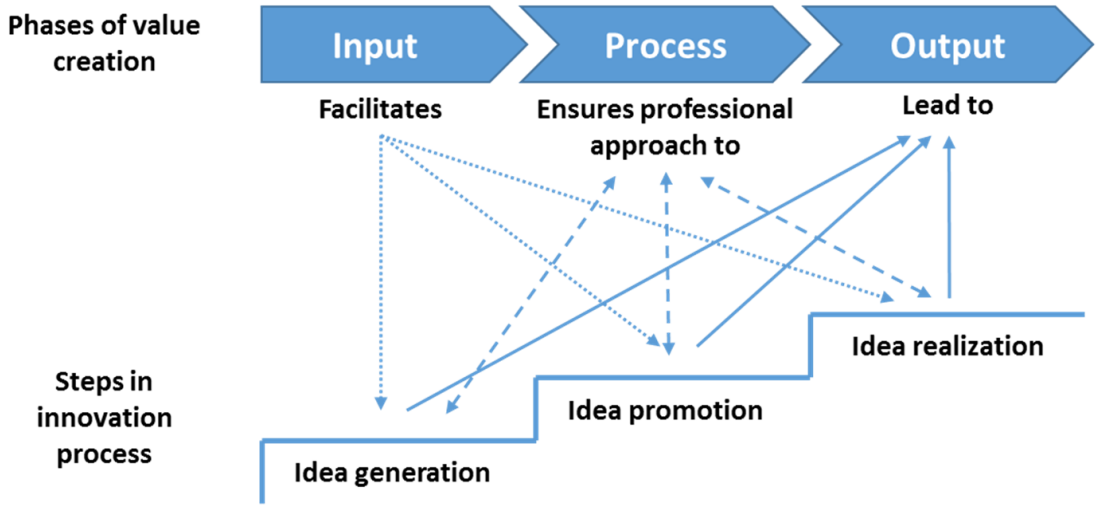

Figure 3: Relation between phases of value creation and innovation stages

Within the literature, the bean counting approach, the Input-Process-Output-Outcome (IPOO) approach (Möller et al., 2011), and the advances from a job center (Burgess et al., 2012), Tidd & Bessant (2014), Fuchs (2014) and Goffin & Mitchell (2010) are using (semi-) quantitative indicators focussing on company or business unit level found (please contact the author for more details). In a first step, the indicators proposed by these were analyzed in detail (please contact the author for more details).

Secondly, the indicators were clustered by the phase of value creation and their innovation stage (Table 1 *Similar or identical indicators of different authors are only counted once. Indicators being suggested for more than one stage, e.g. development man hours per completed innovation are counted in each stage.*). Due to the scope of the definition of innovation performance input indicators are not focussed on in the further progress of this study.

The analysis displays the limited number of output indicators for the idea generation and promotion stages and makes a broad range of indicators with regard to the idea realization stage and the underlying process visible.

4 Discussion

This section assesses whether the indicators to measure innovation performance proposed by todays literature are sufficient. The number of indicators, however, is not linked with the quality of an approach measuring innovation performance in work teams. The indicators used for measuring the innovation performance of a company or business unit are manifold and not all can be possibly transferred on work team level. Due to the particularities of the innovation process approaches to measure innovation should fulfill specific requirements (Vahs & Brem, 2015). Generally speaking, evaluation criteria should be coherent with the (strategic) goal of the approach, minimize the effort of data gathering and provide an objective picture of the situation (Gleich & Schimank, 2015; Goffin & Mitchell, 2010).

4.1 Alignment with goal of measuring: prompt results

The analysis of the output indicators of the realization stage shows that they are covering a long time period. Even though the terminology differs they differentiate between the innovation's concrete result (e.g. a product, prototype, chance in process) and its effects (e.g. gain in market share, cost reduction) (Hauschildt & Salomo, 2007; Pappas &

Table 1: Overview over process and output indicators proposed by existing approaches

	Process Indicators	Output Indicators
Idea generation	5 indicators, e.g. - number of problem solving teams - per cent of projects killed to late	2 indicators, - Number of new ideas - Number of new ideas per employee
Idea promotion	9 indicators, e.g. - Number of overruns in development time - Process innovation average lead time for introduction	0 indicators
Idea realization	18 indicators, e.g. - quality performance - number of complaints	18 indicators, e.g. - Implemented improvement ideas - Patents - Prototypes - Honors / awards from peer groups - Growth in revenue by innovations - Earnings from patent licensing - Profit from new products / services

Remer, 1985; Tidd & Bessant, 2014). As described above, measuring innovation performance of work teams supports decisions on activities to improve the team's innovativeness. This requires an objective and ideally prompt picture of a team's actual innovation performance level. To facilitate decision making and fulfill this goal, it can be assumed that only indicators describing the actual result are relevant in this context.

In the idea generation and promotion phase indicators such as development man hours per completed innovation (Goffin & Mitchell, 2010), number of new ideas (Fuchs, 2014; Pappas & Remer, 1985), or failure rates (Tidd & Bessant, 2014) can be measured without major delay. This is not the case by using output indicators focusing on the effect of an innovation such as market share derived from innovation (Tidd & Bessant, 2014) or cost savings by process innovation (Goffin & Mitchell, 2010). Hence, with regard to output indicators of the idea realization stage, the following are in alignment with the goal (please contact the author for details): indicators describing that the innovation is (*With regard to indicators showing a relation to something, such as number of ideas per employee or new products compared to existing products in portfolio just the underlying criteria they are composed of will be discussed in the progress of the paper.*):

- tested: number of prototypes / testing / lines of code
- realized: implemented improvement ideas, number of new products / services / processes introduced
- shows an additional inventive value: number of patents received or commercialized, number of publications / quotes / speeches, honors / awards from peer groups.

Even though the literature categorizes the group of indicators proving an additional inventive value within the output phase (Tidd & Bessont, 2014), these indicator might also be categorized as result of the idea generation stage. They do not necessarily represent the realization of the innovation but might also be on a theoretical level. Nevertheless, achieving one of these indicators proves a high validity and quality of the innovation so the literature's categorization will be followed in the course of this study.

4.2 Minimizing effort for data gathering

Obviously, the effort for data gathering could be minimised by reducing the number of indicators. As shown in table 4, the number of process indicators proposed is high. However, they will not all fit to every situation, e.g. quality of service to job seekers is only applicable in the very specific context of a job agency, time to market usually requires the introduction of a product or service. But they can be clustered in the categories linked to time (e.g. time

to market, overruns in time), cost (e.g. overruns in costs) and quality (e.g. number of complaints) aspects.

Even though most authors propose these indicators in detail (Goffin & Mitchell, 2010; Tidd & Bessant, 2014), this cannot be followed. To account for the potentially difficult and long process from idea generation until final implementation one should better select a minimum number of indicators depending on the situation but ensure that all aspects of the magic triangle of project controlling (time, cost and quality) (Wegmann & Winklbauer, 2006) are covered.

4.3 Ensuring objectivity of the resulting picture

Using context-specific process indicators based on the magic triangle ensures that an objective picture of the situation and potential difficulties in realisation are represented. The number of potential indicators is not limited to the indicators mentioned in the evaluated approaches, so depending on the situation, additional indicators can be used. Especially with regard to the process during the idea generation stage team members must embrace a creative process of taking risks, experimenting, and frequently experiencing failure. Thus, one should also think of extend the list to indicators derived from creativity measuring such as mistakes or failures (Thompson & Choi, 2006).

The lack of output indicators in the idea promotion stage as well as the little number of indicators in the idea generation phase indicates a lack of objectivity while measuring innovation performance in work teams as proposed by the literature. Firstly, it can be recommend to also collect "hints/proposals for settings to be optimized" during the idea generation stage. Following the idea of the lean six sigma approach one begins with a deep analysis of the situation while it is required not to think in solutions. This step is essential to find unbiased and optimal solutions while progressing with the project (Meran et al., 2013). Transferring this idea to measuring innovation performance on work teams it might be the case that the team identifies a problem but needs experts to create an idea for a solution. By just measuring ideas generated this innovative input would be neglected. Still the team should be regarded as innovative, thus this criterion should be added to the list of indicators.

Secondly, situations exists in which teams create innovative ideas and manage to get a positive decision for implementation but the idea is not realized, e.g. due to a lack of IT capacity. Based on the definition proposed above, this team shows a higher innovation performance compared to teams just creating ideas without getting a decision. Thus, the indicator "positive decisions for an innovation achieved" should be added to assess the output during the promotion stage.

Thirdly, output indicators as proposed by the literature have strong focus on new products, services or processes. The implementation of new organisational methods, such as changes in business practices or workplace organisation, can also be seen as innovations (OECD & Europäische Kommission, 2005). Thus, also introduction of methods such as knowledge management, which might not have a specific measurable effect on products, services or processes should be taken into account while using the existing indicator "number of new products / services / processes introduced" during the idea realization stage.

5 Conclusion

This study investigated the availability of advances to measure innovation performance on work team level. While a specific approach for this setting does not exist, it was analyzed whether indicators of existing frameworks for innovation measuring on company and business unit level, as proposed by the literature, can be transferred and whether they fit to the specific situation of work teams. The main results are:

- Various indicators are used by the proposed advances. Due to the fact that none of the existing framework can be used solely to measure innovation performance of work teams, an adequate combination has to be sought.
- Indicators can be found to evaluate the output and the underlying process of the three stages of innovation. The overview of the indicators shows the existence of a limited number of output indicators for the idea generation and promotion stages and a broad range of indicators for the idea realization stage and with regard to the underlying process.
- Process indicators should not be generally fixed but determined depending on the situation to reduce the effort to collect the required data. However, one must ensure that the aspects time, costs and quality and the expected difficulties in the realization process are covered.

- To ensure obtaining an objective picture of the innovation performance the output criteria already suggested by the literature (number of patents received or commercialized, number of publications / quotes / speeches, honors / awards from peer groups, implemented improvement ideas, and number of prototypes / testing / lines of code) should be complemented by the indicators "hints / proposals for settings to be optimized" and "positive decisions achieved". The indicator "number of new products / services / processes introduced" should be extended to contain all new organisational methods.

To sum up, the study proposes indicators to measure innovation performance of work teams. This is a significant step forward in innovation measuring. Yet, it can be recommended that further research develops the proposed indicators to a new and comprehensive method. Ideally, this should then be tested for its validity and usability in a quasi-experimental setting. Such a tool would enable assessing a team level of innovation performance, thus support decision makers deciding on activities to foster innovation in teams.

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About the author

email:p.terhaar@tresolutions.de

Philipp ter Haar's background spans the field of studying law in Germany, finishing his MBA in UK, serving as a management consultant and now working as a manager at a German insurance group. He is currently preparing a quasi-experiment on measuring innovation performance of teams to complete his PhD at Hamburg University of Applied Science in cooperation with Universitat Politecnica de Valencia.

Philipp is particularly interested in developing innovativeness amongst employees and seeks to match theoretical concepts with his experiences in daily business.

Secondary, Philipp is co-owner of a training company and sharing his experiences in project management by offering workshops on working in projects and the efficient creation of convincing presentations.

Comparative analysis of the most influential parameters that impact innovations in two EU states: Romania as "Modest Innovator" and Italy as "Moderate Innovator"

Dušan Marković[1]

[1]PhD candidate, Faculty of Tecnical Sciences, University of Novi Sad, Novi Sad, Serbia

Abstract

The aim of this paper is to conduct comparative analysis of the most influential parameters that impacts innovations in two EU states, Romania as "Modest Innovator" and Italy as "Moderate Innovator", by applying one of the methods of statistical learning. Twelve different parameters of innovation potential (factors that influence innovations) on macro level have been chosen for analysis in both states. The number of patents represents the output of the model, as well the indicator of innovativeness for both states. The results reveal that different parameters have the greatest impact on innovation in EU states with different levels of development.

Keywords: Influencing factors, National innovation potential, R&D Investment, R&D Personnel

1 Introduction

Innovation is the basis for achieving sustainable competitiveness and development of a state. Measuring innovation becomes very important due to the fact that obtained results are the basis for defining the development state policy and represent necessary element of its implementation. Most used indices for innovation measures are: Global Innovation Index, Europe 2020 Competitiveness Index, Innovation Scoreboard, Comparison of Innovation and Competitiveness of the EU and the US, Global Innovation Technology Index, Global Innovation Policy Index. In the above mentioned indices, the goal is to determine the degree of innovativeness and competitiveness of a state. In this research, the main focus is to identify and rank factors that influence innovations in states, with different levels of development.

The aim of this paper is to conduct comparative analysis of the most influential parameters that impact innovations in two EU states, Romania as "Modest Innovator" and Italy as "Moderate Innovator", by applying one of the methods of statistical learning. This is the initial research, which will be also applied to other EU states (Germany, Bulgaria, Estonia, UK etc.]. The research will be also conducted for the whole EU as a unique region. Twelve different parameters of innovation potential (factors that influence innovations) at macro level have been taken into account in the model and chosen for the analysis in both states. These parameters represent the inputs of the model:

- Input 1 Density of population (Degree of urbanization)
- Input 2 Number of researchers in the higher education sector
- Input 3 Number of researchers in the government sector
- Input 4 Lifelong learning (Training of employees)
- Input 5 R & D allocation in the government sector (
- Input 6 R & D allocation in the higher education sector (

- Input 7 Total number of researchers in the private sector
- Input 8 Total R & D expenditures (
- Input 9 Knowledge Intensive Services (Number of employees in knowledge-based services)
- Input 10 Human resources in science and technology (the talent of the nation)
- Input 11 GDP per capita (wealth of the nation)
- Input 12 Employment rate

The inputs were identified and selected based on literature analysis: (Gossling & Rutten, 2007; OECD, Main Science and Technology Indicators; Lynn, Teichler & Kearney, 2009, Report on the UNESCO; RIO-H2020-PSF).The selected inputs cover the main generators (pillars) of innovations at the national level: Private sector, Government sector, Universities. It should be emphasized that interaction of the pillars couldn't have been analyzed through the model due to the lack of available data. This represents the limitation of the model.

The number of patents represents the output of the model, as well the indicator of innovativeness for both states. The best indicator of the country's innovation potential is the number of patent applications (https://www.ifia.com). The number of patents is taken as an innovation output in many studies that measure innovativeness on macro level (Audretsch & Feldman, 1996; Bottazzi & Giovanni, 2002; Gossling & Rutten, 2007; RIO-H2020-PSF; Zoltan & Audretsch, 1989). The goal of any inventor in a commercial or business sense is to patent a particular product or service in order to achieve a market monopoly and competitive advantage. The goal of the paper Caviggioli (2011) was to determine some of the possible factors that could play a significant role in increasing the annual foreign patent applications in the Japanese Patent Office. Hu and Mathews (2008) concluded that patents represent the pillar of China's national innovation system.

2 Statistical data

The data for the analysis have been taken from EUROSTAT (http://ec.europa.eu/eurostat), for different NUTS regions and different years for both states. Statistical learning ANFIS method has been applied for data processing and analyzing. For Romania, NUTS 1 and NUTS 2 regions have been taken into account: Macroregiunea unu, Nord-Vest, Centru, Macroregiunea doi, Nord-Est, Sud-Est, Macroregiunea trei, Sud – Muntenia, Bucuresti – Ilfov, Macroregiunea patru, Sud-Vest Oltenia, Vest. The years that have been taken into account are: 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011 and 2012.The sample is 120. 50

For Italy, also, NUTS 1 and NUTS 2 regions have been taken into account: Nord-Ovest, Piemonte, Valle d'Aosta/Vallée d'Aoste, Liguria, Lombardia, Nord-Est, Provincia Autonoma di Bolzano/Bozen, Provincia Autonoma di Trento, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Centro (IT), Toscana, Umbria, Marche, Lazio, Sud, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Isole, Sicilia, Sardegna. The years that have been taken into account are: 2003, 2004, 2005, 2007, 2008, 2009, 2010, 2011 and 2012.The sample is 234. 50

3 Results

The results reveal that different parameters have the greatest impact on innovation in EU states with different levels of development. The smallest RMSE in training set of the input parameters represents the most influential input parameter on the output (number of patents).

Regarding Romania, the most influential factor on innovativeness is: Input 8: Total R & D expenditures (% of GDP)

It means that investment by the state in R & D is of a crucial importance for innovativeness in Romania. The second most important factor is related to human resources in science and technology. The private sector in Romania relies more on transferring technology from developed countries than on radical innovations in private companies. That is the reason why private sector in Romania is not dominant factor of innovativeness as it is in developed EU states.

The results for Italy are shown in the Figure 2.

Regarding Italy, the most influential factor on innovations is:

Input 7 Total number of researchers in the private sector

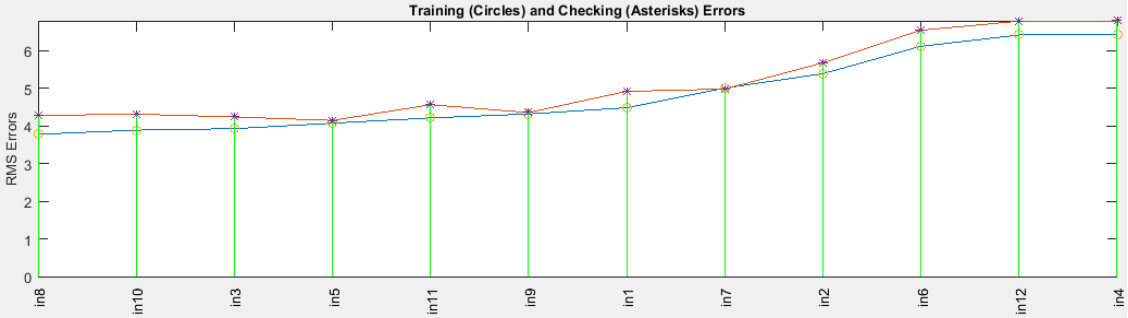

Figure 1: Ranking of the parameters of innovation potential based on smallest RMSE for Romania

The results show that the private sector and knowledge intensive services fuel innovations in Italy. The private sector, based on innovativeness is crucial component of competitiveness and economic growth in Italy.

In order to improve innovativeness as well as competitiveness, modest innovator state of Romania should follow the model of more developed states and incorporate it in its national innovation strategy. Following the results from this research, the main emphasis of modest innovator states must be on supporting the private sector and knowledge intensive services. Development of the innovation potential of the private sector, especially the SMEs sector is the key to success in the modern business. To reach regional leadership in technology, postulated in to the third pillar of National Research, Development and Innovation Strategy (SNCDI) 2014-2020 (http://gov.ro/en/government/cabinet-meeting/national-research-development-and-innovation-strategy-sncdi-2014-2020-engine-of-economic-and-social-development), Romania needs to further develop its own private sector and the knowledge intensive services. The results in this paper are different from numerous studies on innovation measures. In this research, the main focus is to identify and rank factors that constitute the innovation potential of a state, i.e. factors that enable creation of innovations at the state level. The high innovation potential is the basis for achieving sustainable competitiveness and development of a state. Determination of weight and ranking of the factors that fuel innovations could improve the existing methodologies on innovation measures.

4 Conclusion

Considering the fact that innovation processes are very complex, systemic and comprehensive, there is a need for their constant monitoring and evaluation. This analysis is important for two reasons. First, most of the analysis of innovation performances at both, micro and macro levels, are carried out in the most developed and innovative states of the world. Developing states are poorly present in these surveys. Second, from the point of view of "modest innovator" state of Romania, due to the possibility of applying the model of more developed states as well monitoring and correcting existing national innovation strategies, this research could be useful. This analysis could be also useful to other states with similar level of economic development and in-

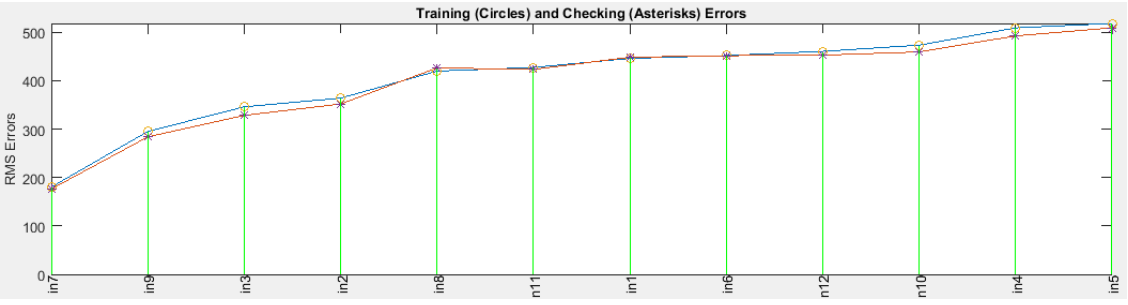

Figure 2: Ranking of the parameters of innovation potential based on smallest RMSE for Italy

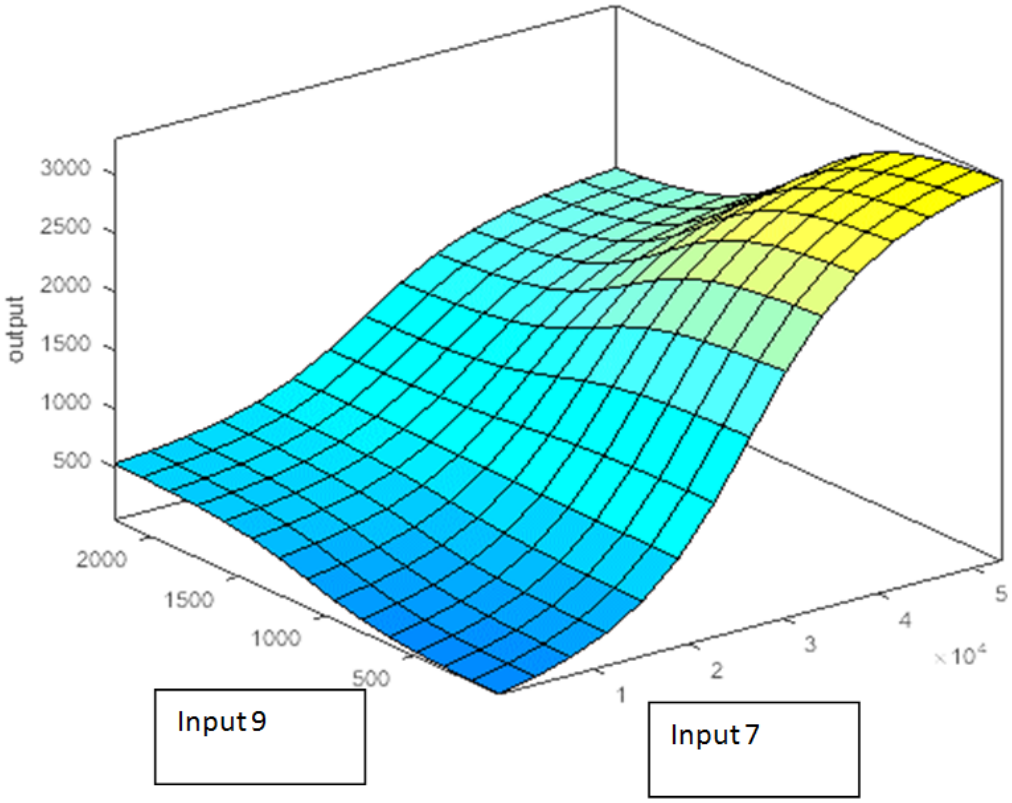

Figure 3: Two most influential parameters on innovations in Italy

novation policy background as Romania. Moving from one model to another is possible where there is not such a big gap, as it is, for example between Romania and Germany.

The models in this research are typical regression problems. The data set is used from previously recorded observation and obtained from EUROSTAT, and then portioned into training and checking set. Considering the fact that for both states, the training and checking errors are comparable, which implies that there is no over fitting, as well the fact that methods of statistical learning were applied in many other fields of science when responsible set of data for inputs and outputs variables are available (Budescu, 1993; Grömping, 2006 ; Grömping, 2007; Grömping, 2009; Rahimi ,2017), it could be concluded that these methods could be also very useful tool to rank the factors of innovation potential at macro level (National and Regional).

Further research can be directed toward improvement of the model by incorporating ratio of turnover from innovation in total turnover as another innovation output. At this moment, due to the lack of available data for the EU states, this output can't be taken into consideration.

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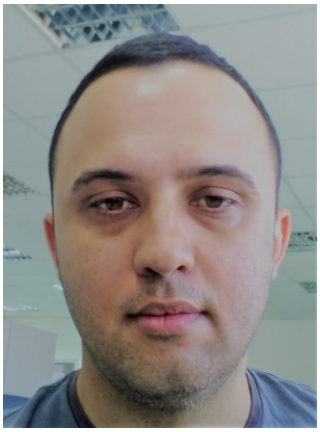
About the author



Dušan Marković is a PhD student at the University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Engineering Management. He works as an associate expert on international projects at the Faculty of Mechanical Engineering of the University of Niš, Serbia. He holds a degree in Mechanical Engineering as well Master of Science degree in the Engineering Management (Module: International Project Management and Entrepreneurship) from the University of Niš, Serbia. He was awarded by The Institute of International Education for superior academic achievements and was scholarship holder of The Ministry of Science and Technological Development of the Republic of Serbia. He is the author and co-author of more than 20 scientific papers in the field of innovation, economic growth, LCA, waste management and energy, as well the author and co-author of several international projects financed by EU. He is the Legal Entity Appointed Representative of the Faculty of Mechanical Engineering in Niš for H2020 program.

Trainings and courses : UNESCO course on Technology Selection for Sanitation and Municipal Wastewater Management in the Western Balkan, The Nederlands 2010 ; UNESCO School of "SUSTAINABLE ENERGY GOVERNANCE IN UNESCO WORLD HERITAGE SITES" in 2014, Dubrovnik, Croatia ; 6 months PhD course on Advances Energy Planning at the Faculty of Mechanical Engineering and Naval Architecture at the University of Zagreb, Croatia; 3 months professional development in the field of international project management at the international relation office of the University of St. Kliment Ohridski in Sofia, Bulgaria in 2015, in the scope of EUROWEB + program.

email: dusanm219@gmail.com

Innovation in the Hungarian educational sector

László Horváth[1] and Gábor Halász[2]

[1]Doctoral School of Education, ELTE Eötvös Loránd University Institute of Education, Budapest, Hungary
[2]Institute of Education, ELTE Eötvös Loránd University, Budapest, Hungary

Abstract

Keywords: Innova Research, Educational innovation, Innovation management, Diffusion of innovations

1 Introduction

This research paper is part of the research project funded by the Hungarian Scientific Research Fund called „The Emergence and Diffusion of Local Innovations and their Systemic Impact in the Education Sector" (2016-2019) (from now on: "Innova Research") coordinated by the Research Centre on Higher Education and Innovation of the Faculty of Education and Psychology of ELTE Eötvös Loránd University, Budapest.

The main aim of the basic research is to uncover the specific conditions of the emergence and diffusion of bottom-up innovations in schools, universities and other educational institutions in Hungary. In this first phase we have conducted a literature review on general innovation theory, innovation management and innovation research then we focused on the service sector and the public sector specifications and finally on the educational sector. The second phase was marked with a preliminary survey for heads of educational institutions about general organizational characteristics and innovation activity and specifications of a chosen innovation example in their organization. This paper summarize the first theoretical and empirical results.

1.1 Global, European and Hungarian Context

Innovation plays a major role in competitiveness and development of organizations and nations and could be a solution for societal, environmental and economical problems. It is evident that we need to better understand the nature and processes of innovation and this notion is reflected in global, European and national policy as well. The educational sector plays a complicated role in this as it is a site for developing innovation capabilities and a subject to innovation efforts as well. This dual task reappears in the innovation strategy of the OECD (2010) and in national systems of innovation (see Lundvall, 2010). Educational innovation is supported by the European Commission as well (targeted research, pilot programmes, direct support, sharing of good practices) focusing on innovative teaching and learning in its strategy (European Commission, 2013).

Activity on educational innovations in Hungary is well documented from '80s supporting on the governmental level local bottom-up innovations in schools. Following that in the '90s a new national curriculum regulation was introduced which basically put institutions under 'innovation pressure' by expecting them to create their own local curricula. Later different funds (Soros Foundation, EU-funds) supported the field and it became intertwined with quality assurance and development. Despite the incentive national and international environment, local innovations often go unnoticed even by their creators not perceiving them as 'something innovative' which makes it a hard field for empirical study.

On the other hand the research on innovation is also a multi-faceted issue, inviting interdisciplinary

approach. The importance of the field is well known in the business and management, economics and sociology literature (Halász & Horváth, 2017). In the next section we will deal with this different conceptual questions and models.

1.2 Innovation in education – conceptual questions and possible models

Innovation can be characterized as creating something new opposed to exploit something that is already there (according to the exploitation and exploration dichotomy of March (1991)). Our focus is on bottom-up innovation which usually characterized as "hidden innovation" (Dede, 2006; Harris & Halkett, 2007) which are usually employee-driven and work-based processes. This notion appears in the work of Fraser (2005) who uses the term teacher-led innovation and Avadhanam and Chand (2016) who are focusing on teacher-led workplace innovations. This world, that we are trying to describe and understand is rather chaotic, which emphasizes creativity, entrepreneurship and risk taking as important aspects (Darsø & Høyrup, 2012). Underpinning the choice of our focus is the forecast of Martin's (2016) about the challenges of innovation research, namely the shift of focus from the manufacturing industry to the service industry (Fagerberg, 2006). Therefore the understanding of innovation as product must be supplemented with the understanding of innovation as process. That's why we focus on innovation as object (product) and diffusion and dissemination (process) as well. Regarding services, the importance of the customer comes into mind, which is relevant for the educational sector as well (parents, local community, future employers, society etc.) and that is why we emphasize in our approach, the relevance of the so-called user- or client-driven innovation.

When dealing with innovation, we cannot miss the dimension of time, we need to focus on the emergent nature of innovation as well. This is reflected in the complexity theory approach of innovation (Glor, 2013, 2015) which is well documented for example in the Minnesota Innovation Research Project (Van de Ven, Angle, & Poole, 2000). We also focus on the different levels ((inter)national, institutional, group and individual) and from that perspectives, different organizational models seems quite interesting (e.g. ambidextrous organizations by Duncan (1976)). Bearing these aspects in mind, we have constructed the theoretical model (Figure 1) for our research which served as a basis for our empirical research.

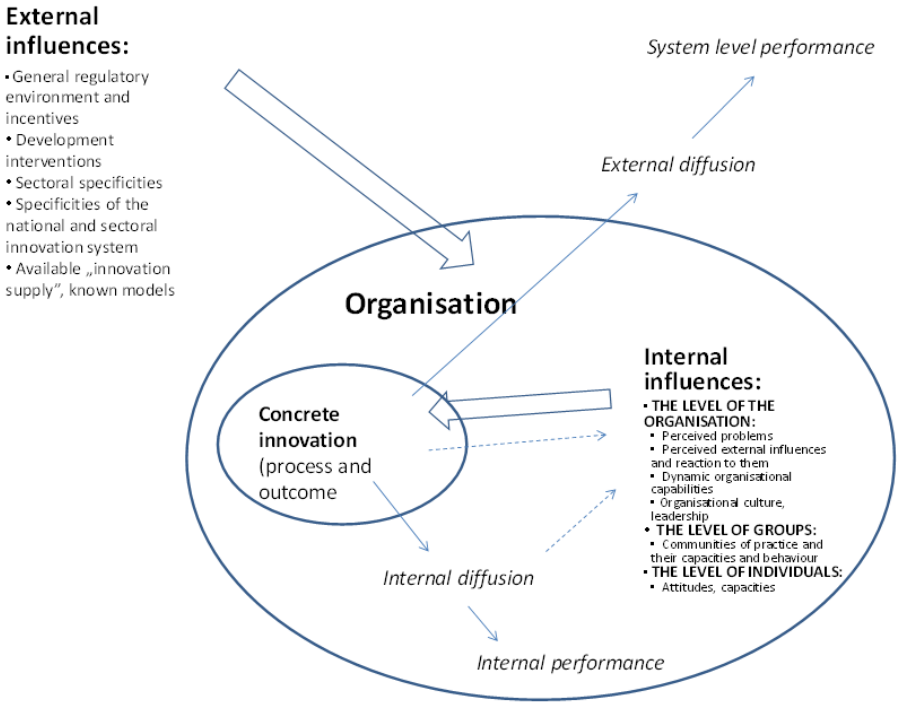


Figure 1: The dynamic model used in the Innova Research

Our model is based on four plus two different perspectives:

- innovation as a product
- the birth or emergence of innovations (process)
- the agents involved in creating or adopting innovations
- the spread or diffusion of innovations (process)
- time (e.g. state of innovation at a given moment and their change in time)
- space (e.g. one-centred or multi-centred; considering contextual factors as well)

These aspects are detailed in our model and our first questionnaire was developed based on this dynamic model. The summary of the theoretical foundations can be read in Hungarian in our synthesis study (Halász & Horváth, 2017). The details of methodology is described in the next chapter.

2 Methods

The Innova Research first two phase aimed to have a general overview of innovation activity in the Hungarian educational sector. Our aim was to detailed descriptive picture of different aspects of innovations (prevalence, typology, activity, good practices etc.) and to be able to compare the different sub-systems of education. Because of the later, we needed to form general statements to be understandable for nursery school principals and for heads of departments in higher education institutions at the same time. In order to get a comprehensive picture we developed a short online questionnaire with the following aspects:

- general questions:
  - innovation activity (innovation as product)
  - innovation typology and areas (innovation as product)
  - dissemination and diffusion activity (innovation as process)
  - changes in the organization and its environment (contextual factors)
  - innovative individuals and groups (agents)
  - organizational learning (contextual factors)
- questions regarding a concrete, selected example of innovation
  - short description
  - details (emergence, sustainability, change, cause and effect)
  - innovation typology, area
  - dissemination and diffusion activity

The questionnaire was checked by experts and practitioners in a workshop and an extensive piloting phase ensured face validity. Cooperating with the Educational Authority we created an e-mail list with the heads of all educational institutions:

- public education institutions (pre-primary, primary, secondary general and vocational education)
- higher education institutions (departments, institutes and doctoral schools)
- private for- or non-profit educational institutions (mainly adult education profile)

The details of the sample will be discussed in the next sub-chapter. The data-gathering was conducted using the Qualtrics platform from autumn 2016 to winter 2017 and obtained a 30% of return rate altogether. After cleaning the database, we have got 4853 cases which was analysed in terms of descriptive statistics and other correlation studies with SPSS 24.

2.1 Sample

The sample consisted of the educational institutions (both public and private) of Hungary. We asked the heads of these institutions to fill out our questionnaire, so one case represents one organization by the perception of its manager. Altogether we sent out 17.767 online invitation for our questionnaire and received 4853 usable answers (after data cleaning). The detailed statistics can be seen in Table 1 grouping by institutional profiles.

In the next chapter we will review the basic results of our survey and discuss some implications regarding innovation management in the educational sector.

Table 1: Distribution of the population and the sample by institutional profiles

Institutional profiles	Surveys sent	Surveys received	Return rate (%)	Percentage of the sample (%)
Only pre-primary educational profile (ISCED 0)	4452	1724	38,7	35,5
Only primary general educational profile (ISCED 1-2)	2800	1123	40,1	23,1
Only secondary general educational profile (ISCED 2-3)	407	103	25,3	2,1
Only secondary vocational educational profile (ISCED 2-3)	988	193	19,5	4,0
Only secondary general and vocational educational profile (ISCED 2-3)	319	61	19,1	1,3
Mixed profile educational institutions (e.g. primary and secondary school)	5432	1037	22,0	21,4
Higher education department/institution (ISCED 5)	1858	446	24,0	9,2
Higher education doctoral school (ISCED 6)	173	58	33,5	1,2
Unidentifiable higher education data provider	-	9	-	0,2
Private for- and non-profit educational institutions (various ISCED levels, mainly 3-4)	1338	99	7,4	2,0
TOTAL	17767	4853	27,3	100,0

3 Results

Considering the nature of our study, even the descriptive statistics are meaningful regarding the understanding of the innovativeness, innovative activity and practice of the Hungarian educational sector. Most of the results will be presented comparing public education, higher education and adult education institutions.

Regarding general innovation activity altogether 28% (Rate of 3 and 4 answers together compared to 1 and 2 answers on a 4-point Likert scale) of the respondents indicated that in the previous years they started to apply significantly different solutions for their problems. This proportion is 27% for public education, 34% for higher education and 38% for adult education. Moreover 38% of the respondents think that thanks to these new solutions, their institution became more effective (public education: 37%, higher education: 45%, adult education: 56%).

Applying a basic typology for innovation we can arrive to the conclusion from our data that in public education institutions the majority of innovations are related to methods and tools inside or outside the classroom (44%), while in the higher education institutions the main type of innovations are ICT related (37%). The adult education institutions excelled in organizational innovations (44%) and innovations regarding external relations (36%).

The next are of our inquiry was the dissemination and diffusion activity. Only 15% of both public educational and higher education institutions indicated that they adopted an innovation from a domestic organization, while in the case of adult education institutions, this is 23%. Regarding dissemination activity (whether or not a successful local innovation was adopted by an external organization), 8% of public educational institutions, 10% of higher education institutions and 12% of adult education institutions indicated that it happened several times. Furthermore what is interesting regarding dissemination and diffusion is the role of higher education institutions. Respondents could identify the institution which they are adopted the concrete innovation from. This allowed us to draw an imperfect sociogram (only one-way). Only higher education institutions (mainly teacher education profile) clustered larger number of institutions that are selected them as the source for innovation. This relationship

calls for further investigation.

Finally, with the help of FACTOR 10.5.03. software (Lorenzo-Seva & Ferrando, 2013) we conducted semi-confirmative factor analysis on the variables regarding innovation and on the variables regarding organizational learning (adopted from (Bess, Perkins, & McCown, 2010). The unidimensionalty assessment (Unidimensional Congruence > 0,95; Explained Common Variance > 0,85 and Mean of Item Residual Absolute Loadings > 0,25) and parallel analysis (based on minimum rank factor analysis) suggested once factor to extract in each case. Therefore without rotation a minimum rank factor analysis extraction was made which is robust to normality supported with bootstrapping. For Innovation Index, after sorting out items with low loadings, 14 items remained which created one factor. The Bartlett's statistic were significant (7866,7 on df=91; p<0,001) and the Kaiser-Meyer-Olkin test showed a very promising result (0,925) with the 14 items explaining 68,15% of the common variance. Regarding Organizational Learning Capacity, the Bartlett's statistic were significant as well (36290,5 on df=91; p<0,001) and the Kaiser-Meyer-Olkin measure was very good (0,927) and the 14 items explained 69,6% of the common variance. The items and their loadings is represented in Table 2.

The created two variables (Innovation Index and Organizational Learning Capacity) was used to analyse the differences between different institutional profiles. Of course, for the whole sample the mean of these indicies are 0, therefore the results of the sub-groups can be seen from this perspective on Figure 2.

It seems that the correlation between Innovation Index and Organizational Learning Capacity is very low (r=0,158; p<0,001). This could mean that the measures of innovativeness and organizational learning in this questionnaire shows two different constructs that are basically unrelated, or rather signifies two different processes which are hard to employ both at the same time. This could be explained by the different nature of exploration (innovation) and exploitation (organizational learning) activities (March, 1991) from the perspective of ambidexterity theory (Duncan, 1976).

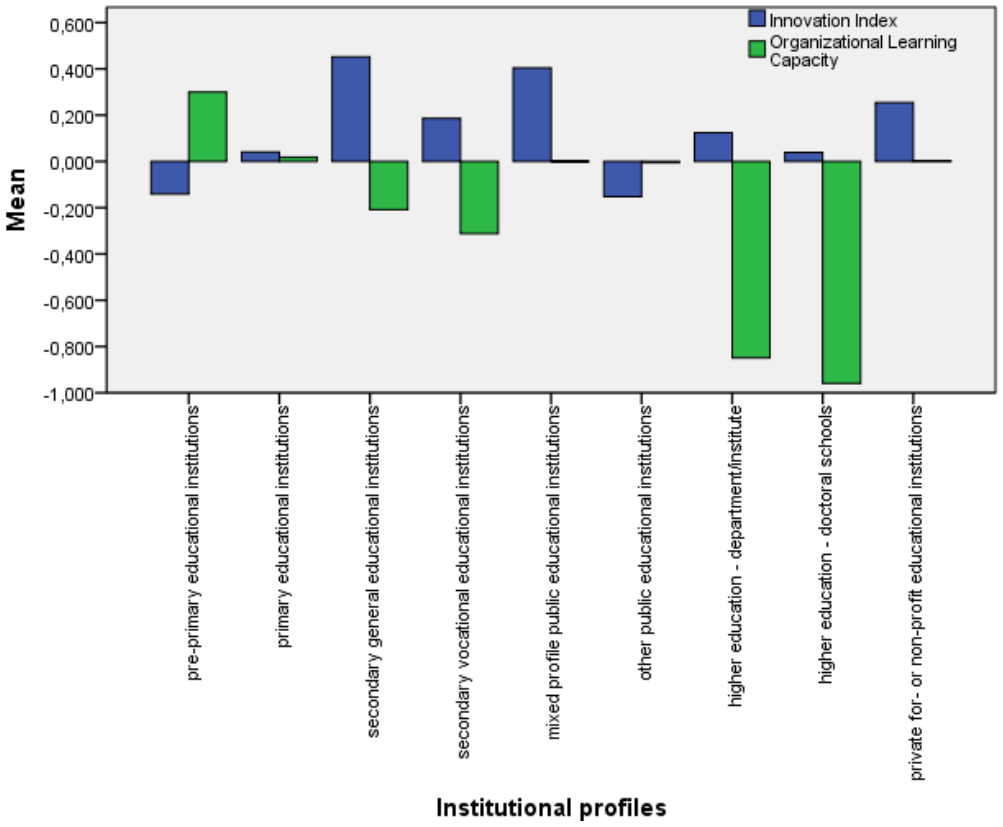


Figure 2: Innovation Index and Organizational Learning Capacity values of different institutional profiles

Table 2: Items and factor loadings for Innovation Index and Organizational Learning Capacity

Items of Innovation Index	Factor loadings	Items of Organizational Learning Capacity	Factor loadings
5.1. One of our employees started to apply pedagogic solutions significantly different from his/her earlier practice	0,578	11.1. My organization encourages people to think from a community perspective	0,724
5.2. We started to apply new solutions invented by our own colleagues to make our organisation/institution more effective	0,761	11.2. My organization works together with the outside community to meet mutual needs	0,617
5.3. The effectiveness of our work has improved significantly following an innovation initiated by our own colleagues	0,775	11.3. In our organisation/institution there is an aspiration of unifying ideas regarding the organisation's vision	0,741
5.5. Our stakeholders (e.g. pupils, students, parents, economic organisations, NGOs) have played an active role in the development of our innovations	0,674	11.4. My organization considers the impact of decisions on employee morale	0,637
6.1. Major pedagogical innovations related with learning and teaching methods and tools in classrooms	0,723	11.5. My organization encourages people to get answers from across the organization when solving problems	0,534
6.2. Major pedagogical innovations related with learning and teaching methods and tools outside classrooms (e.g. field work, students' independent work at home)	0,679	11.6. In my organization, people openly discuss mistakes in order to learn from them	0,694
6.3. Major pedagogical innovations related with the use of technical devices (e.g. computers, digital devices, computer networks)	0,580	11.7. In my organization, people give open and honest feedback to each other	0,689
6.4. Major pedagogical innovations related with the internal operations of your organisation/institution (e.g. management, leadership, infrastructure)	0,638	11.8. In my organization, people view problems in their work as an opportunity to learn	0,679
6.5. Major pedagogical innovations related with the external relationships with stakeholders (e.g. local community, parents, employers, NGOs, students)	0,663	11.9. In my organization, people are rewarded for exploring new ways of working	0,768
7.1. We have prepared a description on the good practice/innovation within our organisation/institution with the purpose of documenting and sharing innovations with others	0,719	11.10. My organization enables people to get needed information at any time quickly and easily	0,747
7.2. We have collected and analysed data on the impact of good practices and innovations within our organisation/institute	0,696	11.11. My organization recognizes people for taking initiative	0,800
7.4. Our organisation/institution has borrowed or adopted innovations and good practices from other (foreign) organisations	0,633	11.12. My organization gives people control over the resources they need to accomplish their work	0,600
7.5. Innovations and good practices developed at our organisation/institution have been borrowed or adopted by someone else	0,611	11.13. In my organization, leaders generally support requests for learning opportunities and training	0,658
7.6. Innovations and good practices invented at our organisation/institution have been reported in media	0,693	11.14. In my organization, the number of individuals learning new skills is greater than last year	0,621

4 Discussion

Innovation is a multi-facated phenomenon which is strongly influenced by environmental, organizational and individual factors. Innovation can be considered as a product and as a process and we can differentiate between several approaches (adopting an existing solution, inventing something new, recombination of existing elements to create something new, disseminate working solutions etc.). It seems that the constructs that we measure (innovation, organizational learning) are showing two different sides of the same coin. While the first is dealing with creating or adopting something new and managing this process, the other mainly focusing on making existing processes routine and existing products (e.g. knowledge) part of the organizational memory. Very different approaches needed for both processes for an organization to successfully manage these as the ambidexterity theory states. Dividing the sample in two times two by the Innovation Index and the Organizational Learning Capacity, we can draw the following 2x2 matrix (Figure 3).

Figure 3: Existing feeding subassembly

Ambidexterity theory is not new to innovation studies, it appears in the works of (Anderson, Potočnik, & Zhou, 2014) and its importance regarding the effectiveness of an organization is well supported by the meta-analysis of Junni et al. (2013). In order to uncover the underlying relationship between innovation, organizational learning and effectiveness, further studies may be needed which is an important aspect of the continuation of the Innova Research.

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About the author

László Horváth is a doctoral candidate and a junior research fellow at Eötvös Loránd University (Hungary) Institute of Education. He has an MSc degree in economics (leadership and management) and an MA degree in adult education (andragogy).

Currently he is working in a state-funded research project concerned with the emergence and diffusion of local innovations in education.

Previously he engaged in several national and international public and higher education development projects. His research interests are higher education management, learning organization, knowledge management and educational innovations.

email:horvath.laszlo@ppk.elte.hu

Open Innovation Intermediaries across Africa: An Approach to Managing the Sustainability of Open Innovation Projects

Lerato Mohalajeng[1]

[1]North West University, Potchefstroom, South Africa

Abstract

Keywords: Open Innovation Intermediaries, Sustainability, Africa

1 Introduction and background

Entrepreneurship has proven crucial in the path to economic growth and progression as it contributes significantly towards the quality, development and progress of an industry, economy and country (Soriano & Huarng, 2013:1964). The level and growth of GDP, unemployment, inflation, interest rate levels and investments determine entrepreneurship, particularly across the African continent (Braunerhjelm, 2010:11). Quite often developing countries have an immense agricultural industry driven by high levels of unemployment, high inflation and a weak manufacturing base since the majority of its population live in rural areas and therefore sustain themselves with natural resources (Turton & Herrington, 2012:14). Entrepreneurship is these countries is undertaken as a method of survival and a way to increasing the country's standard of living and economy. Fostering and supporting entrepreneurship therefore becomes the main source of economic development in these so called factor-driven countries (Hague et al., 2011:156; Herrington & Kew, 2016:28).

As level of entrepreneurship increases and economies emerge, these least developed countries become efficiency-driven. This means more focus is placed on the labour, goods markets, technology, financial efficiency and higher education (Turton & Herrington, 2012:14). Africa is largely comprised of factor-driven and efficiency-driven countries. Entrepreneurship and innovation have deliberately become a key driver of socio-economic growth in these factor- and efficiency-driven countries (Dutta & Lanvin, 2013:307). Developing countries across Africa have turned towards entrepreneurship, innovation and Small and Medium-sized Enterprise (SME) development in an effort to reduce a variety of these socio-economic challenges (Fu et al., 2016; Cunningham et al., 2016). This is evident by the number of initiatives and incentives aiming to achieve this across the continent namely the 2013–2022 African Development Bank Group Strategy: focus on African entrepreneurship as pillar of private sector development; the UNCTAD-Entrepreneurship Policy framework; AU Science, technology and Innovation strategy for Africa 2024. In spite of these efforts, the average innovation levels remain significantly low (20%) across Africa (Herrington & Kew, 2016:28; Dutta et al., 2016).

One of the reasons for the relatively low entrepreneurial activity and innovation, is that, while there has been policy pronouncements at a macro-level, there has been very little follow-up at the meso-level, as well as not much interest from the micro-level (Bodhanya, 2008:7). The meso-level is made up of government and private agencies including science parks and incubators, as well as intermediaries who serve to translate government policy into tangible benefits for the micro-level, i.e. en-

trepreneurs and SMEs. While most of these meso-players have concentrated on traditional incubation services, there has been a recent interest in using innovative approaches, such as open innovation, to stimulate entrepreneurship (Cunningham, 2012; Cunningham et al., 2016:2). The African Union Commision (2014) has acknowledged the need for open innovation and entrepreneurship for the improvement of Africa's socio-economic challenges.

Chesbrough and Boger (2014:12) have newly defined open innovation as 'a distributed innovation process based on purposively managed knowledge flows across organisational boundaries using both pecuniary and non-pecuniary methods in line with the organisations business model'. This implies that various role-players across all levels are less confidential with their innovation practices and have leaned towards the idea of leveraging each other's innovation assets. Across Sub-Saharan Africa, small business incubators, science parks and innovation spaces in have leaned towards the role of an Open Innovation intermediary (OII), which Howells (2006:720) explains as an organisation or body, acting as an agent in any facet of the innovation process. These open innovation intermediaries support businesses in executing open innovation projects by either running the open innovation project on behalf of their clients or aid their clients in building their own open innovation proficiencies (Piller & Diener, 2013:4).

The OIIs incorporate input from a network of contributors, in the form of solutions to seemingly impenetrable problems of a technical nature. The OII, through a web-based platform, assists businesses in identifying and clearly defining these highly-technical problems and connects the businesses with potential solution providers ranging from government, private sector, academia and research institutions, as well as venture capitalists, SME's and entrepreneurs (Huston & Sakkab, 2006:4; Krause & Schutte, 2015:170; Mohalajeng & Kroon, 2016:897). Once this connection has been initiated, the OII withdraws from further engagement and deal-making becomes a negotiation between solution seeker and the solution provider.

This model creates a platform helps identify technologies that are being researched, emerging, maturing or in decline, thus allowing businesses with no or poor R&D capabilities to leapfrog their competitors whilst sourcing innovative and advanced solutions from across the African continent. However, from case studies conducted on public OII's (OpenIX, Regional Connect, Eskom OI exchange) across Southern Africa, it's clear that no support is provided further than the initial engagement between solution seeker and provider, therefore resulting in businesses failing to successfully integrate the innovation into their core strategy or bring it to market (The Innovation Hub, 2013; West & Bogers, 2014:823). It's evident that the role played by OII's in connecting internal business problems to external solution providers do not automatically lead to improved innovation or commercialisation (Vanhaverbeke et al., 2014: 291). Previous research by Chesbrough, 2003; Laursen & Salter, 2006 and West & Gallagher, 2006 has emphasised the importance of organisational culture on the willingness and ability of a business participating in the inbound open innovation to successfully profit from external sources of innovation. The business needs the correct internal administration and management in order to profit from open innovation. Vanhaverbeke et al. (2014: 291) stresses the significance of organising and managing collaboration with external innovation partners for successful commercialisation.

For public OIIs in across Africa, relevant aspects regarding organising and managing open innovation beyond just sourcing external innovation remain relatively unexplored. Most research in these domains has focused on the economic and technology adoption of innovation-driven (developed) countries (West & Bogers, 2014; Randhawa, 2016). It is consequently not possible to transplant open innovation implementation and management models in developing countries without modification due to the significant difference in the innovation value chain in innovation-driven countries compared to factor- and efficiency-driven countries (Riechman, 2005; Scheel & Parada, 2008). This emphasises the importance of literature addressing the role that open innovation intermediaries in developing countries in managing the open innovation process to ensure that businesses with low open innovation competencies successfully absorb and/or commercialise external solutions. The primary goal of this study is thus to propose an approach to be used by Open Innovation intermediaries in further organising and managing the integration and commercialisation of external solutions into businesses with low open innovation competencies.

Furthermore, the provider of the external solution (which in most cases are SMEs) also plays a critical role in taking the solution to market. This is because the successful implementation and sustainability of the solution is contributed by his capability to manage the collaborative partnership and his innovation network (Vanhaverbeke et al., 2012). Cases studies show persuasively that the

entrepreneur or SME manager plays a crucial role when participating in outbound open innovation since he perceives the new business opportunities, and his personal commitment and conviction help define the success and development of the innovation network. As a result, there is a need to utilise entrepreneurship literature for analysing open innovation in SMEs. This secondary objective of this study is thus to examine the role of the entrepreneur or SME as a key contributor of the successful implementation of outbound open innovation.

The study will help policy makers and organisation across Africa in making better decisions regarding what is needed to encourage success in taking ideas to market through open innovation practices and in essence further promoting early-stage entrepreneurial activity. The study can also help inventors make better decisions in taking their ideas to market by enabling them to better understand the intricacies and complexities of what it takes to successfully take an idea to market.

2 Proposed research objectives

1. To explore the role that public OIIs can play in further managing the OI process to ensure that businesses implement and/or commercialise external solutions successfully.

2. To examine the role of the entrepreneur or SME as a key contributor of the successful implementation of their solution in various businesses.

3. To propose an approach to be used by public OIIs in ensuring the sustainability of external solutions into businesses with low open innovation competencies.

3 Proposed Methodology

The research will be exploratory in nature employing a qualitative approach. Multiple case studies of various open innovation intermediaries across Africa will be conducted through interviews and observations. Since the purpose of the study will be to capture insight from different perspective across the continent, semi-structured interviews will be conducted (Berndt & Petzer, 2011:46). In-depth interviews aim to address the research objectives through one-on-one dialogues. Since the researcher and the participant are alone, the latter receives no pressure from other individuals or group members (Bradley, 2010:234). With qualitative data collection, participants will be purposefully selected to gain an in-depth understanding rather than to make generalisations of the results (Patton, 2002:230). This method of sampling is referred to as purposive sampling. Purposive sampling is generally associated with small, in-depth studies based on gathering data focused on exploring and interpreting perceptions (Mathews & Ross, 2010:167). The logic and strength of purposive sampling lies in the selection of 'information-rich' participants for an in-depth research. The identified participants for this study have an in-depth understanding of Open Innovation in the African context. The participants are involved in both the design and management of the Open Innovation intermediaries or have extensive knowledge on supporting mechanisms for taking ideas to market through the use of Open Innovation. Additionally, SME's and innovators whose solutions have been identified for implementation in businesses through open innovation intermediaries will also participate in interviews in order to gain an understanding of their role in successfully collaborating with external parties.

All semi-structured interviews will be recorded and transcribed for analysis. A content analysis method will be utilised. Content analysis involves systematically categorising participants' responses with the aim to identify overall trends and patterns (Vaismoradi et al., 2013: 400). The aim of content analysis is to obtain a condensed and broad description of the phenomenon, and the outcome of the analysis is concepts or categories that describe the phenomenon (Elo & Kyngäs, 2008:108). A content analysis will thus serve to determine the characteristics of the transcribed interviews' content by examining who says what and with what effect (Bloor & Wood, 2006:58).

Inductive content analysis is used for cases about which no previous research has been conducted (Elo & Kyngäs, 2008: 109). Therefore, the qualitative data of this research procedure will undergo a content analysis process that concerns deriving categories from the qualitative data, but not according to previously defined structures or previous knowledge (Elo & Kyngäs, 2008:110).

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About the author

I am passionate about Entrepreneurship! I grew up believing the single strongest predictor of entrepreneurship was parental entrepreneurship. Having grandparents for entrepreneurs had me thinking that I too would become an entrepreneur. Little did I know this perception would change when I enrolled for my Entrepreneurship degree a couple of years ago. I've came to realize that entrepreneurship is more than just a mind set or behavior, it has social and economic impacts on the African continent! Now I'm hooked on finding ways to develop "average Joe's" into successful entrepreneurs that compete in the global market.

Some career highlights:

- Successful execution of Social Media campaign for 5th Global Forum on Innovation and Technology Entrepreneurship. National trending on Twitter #GF2013 for two consecutive days.
- Implementation of Online Marketing strategy for The World Bank Group-InfoDev.
- Content development for SA Innovation Summit publication called "Sparkbook" designed by K and I Design Studio. Book was previously nominated for a Loerie Award.
- Collaboration with Mail & Guardian to release SA Innovation Summit supplement in August publication.

Outside my entrepreneurship "bubble" I am a charity cyclist for a special needs school called Wiggles and Squiggles School. The school offers children between ages 2-16 with varied special needs (Cerebral Palsy, Autism Spectrum Disorders, various syndromes and multi-sensory impairments, as well as those children without a diagnosis) a nurturing educational environment.

email: Lerato.mohalajeng@nwu.ac.za

CIP - Каталогизација у публикацији
Библиотека Матице српске, Нови Сад

005:001.895(082)

DOCTORAL students conference on innovation management (1 ; 2017 ; Novi Sad)
[Conference proceedings] / 1st doctoral students conference on innovation management DSCIM-2017, October 3rd-6th 2017, Novi Sad ; [editors Petar Vrgović, Amila Pilav-Velić, Carsten Dreher]. - Novi Sad : Faculty of Technical Sciences, 2017 (Petrovaradin : Futura). - 76 str. : ilustr. ; 29 cm

Tiraž 40. - Bibliografija uz svaki rad.

ISBN 978-86-7892-972-4

a) Менаџмент - Иновације - Зборници
COBISS.SR-ID 317274119

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