

# *Knowledge Management and Innovation in the Digital Era: Providing a Sustainable Solution*

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**Abstract** — Aiming to provide a theoretical background and empirical insight regarding knowledge management and innovation in the digital era, this study offers a comprehensive literature review on how contemporary organizations develop strategies for knowledge creation, sharing, and exploitation. Since innovativeness can have a significant impact on knowledge management practices in different organizations, this study aims at exploring the diversity of approaches labeled as knowledge management as well as the relationship between knowledge management, innovation and organization's performance. Hence, understanding how this concept works has become crucial for encouraging breakthrough innovations that will have a major impact on global economic growth. Since, in order to create an environment for knowledge-driven growth, it has become absolutely necessary to ensure the investments in knowledge, science, technology, education, and human capital, the Global Innovation Index was introduced as a key tool of detailed metrics for 126 countries worldwide. According to the Global Innovation Index, significant investments in innovation and the creation of knowledge as well as other intangible assets are central to this goal. This study aims at providing an overview of how significant investments in knowledge, science, technology, education, and human capital can foster innovation, and adequately address the knowledge management - while ensuring a sustainable solution.

**Keywords** — *knowledge management, innovation, Global Innovation Index*

## I. INTRODUCTION

In the digital era, the majority of authors agree that it is important to encourage contemporary organizations to develop strategies for knowledge creation, sharing, and exploitation [1]. Often presented or perceived as an effortless acquisition and/or use of knowledge, frequently treated as an asset that is transferred by routines [2], the notion that knowledge management could enhance organization's performance as well as competitiveness in today's global competitive market place, has received recent attention [3].

While the majority of authors agree on major potential these new knowledge management practices could have in contemporary organizations, there are still questions about what knowledge management is and how it differs from other forms of organizational knowledge. Moreover, the literature suggests that contemporary organizations do not always understand such differences between common knowledge management practices, and their employees often do not tend to search the relevant literature looking for answers [4].

This study aims at addressing several issues. First, the study aims at addressing some generally accepted definitions in the field of knowledge management, thus offering some common characteristics that are usually associated with this term. Second, the study aims at providing a literature review in the field of knowledge management, thus aiming to explore the relationship between knowledge management, innovation, and organization's performance. To determine how much knowledge outputs one country is getting for its inputs, the Global Innovation Index (GII) is introduced as a key tool of detailed metrics for 126 countries worldwide.

Since, in order to create an environment for knowledge-driven growth, it is absolutely necessary to ensure the investments in science, technology, education and human capital as well as innovation and knowledge management itself, understanding how this concept works has become crucial for encouraging breakthrough innovations that will have a major impact on the global economic growth. Therefore, this study aims at providing an overview of how significant investments in knowledge, science, technology, education, and human capital can foster innovation, and adequately address the knowledge management – while ensuring a sustainable solution.

## II. LITERATURE REVIEW

For the last couple of decades, various researchers have been focusing on knowledge management in the digital era [5, 6, 7, 8, 9, 10, 11]. Up to now, the focus has mainly been up to the knowledge transfer within an organization [12, 13, 14], innovation [15, 16, 17], and organization's performance [18, 19, 20]. Having in mind that these knowledge management practices differ significantly between organizations, employees do not always understand what does it mean to support the development of such knowledge management practices as well as how different knowledge management practices differ from each other.

Hence, prior to exploring different knowledge management practices, this study aims at providing some common characteristics that are usually associated with the development of knowledge management.

### A. What is Knowledge Management?

Though there are no universally accepted definitions for all of the forms of knowledge management, the study of Calantone et al. [21] offers some common characteristics that are usually associated with the development of knowledge management in contemporary organizations. First, these

authors propose a conceptual framework commonly known as *learning orientation*. This concept refers to the wide pool of activities organizations develop aiming to acquire and use knowledge to enhance their competitive advantage [21]. This framework has also been stressed by Hurley and Hult [22] especially in relation to innovation and market orientation. These authors argue that, when it comes to learning orientation, such activities may be manifested at various levels in an organization (e.g. organization's strategy, processes, structure, behaviors, and culture). In line with this argument, Calantone et al. [21] underline that the rationale for developing such knowledge management practices in contemporary organizations is predominately linked to their learning orientation. Second, the *commitment to learning* or the "degree to which an organization values and promotes learning" [23] indicates that more an organization values learning, the "more likely it is that learning will occur" [21].

This means that if there is no commitment to learning within an organization, employees will not be motivated to foster individual learning, as well [21]. Third, the literature suggests that if there is no *shared vision* within an organization, individual learning will often be insignificant [21]. Shared vision helps employees to focus the knowledge management practices thus enhancing knowledge quality [4]. Fourth, the focus should often be on the *open-mindedness* when dealing with the emerging economies. Fifth, Calantone et al. [21] indicate that successfully implemented knowledge management practices often result from an accumulation of knowledge acquired from learning by the individuals.

Hence, *intra-organizational knowledge sharing* must be paid special attention. In a similar vein, Petkovic et al. [24] address the organizational design and its major impact on knowledge management. Smith and Webster [25] conclude that in order to thrive in such an environment, it is not sufficient to cope. Contemporary organizations must develop such innovative knowledge management practices that will help them achieve a major impact on global economic growth [25].

### B. Formal and Informal Knowledge Management

Of the various knowledge management practices, formal knowledge management is usually seen as the most adequate approach aiming to achieve knowledge creation, sharing, and exploitation in the global economy [1]. There may be some logical justification for common associations between formal knowledge management and large organizations since formal knowledge management practices are often characterized by the development of new knowledge management structures and knowledge management roles such as *Chief Knowledge Officer* [1]. All this, together with the complexity of formal organizational structures has led to the situation in which large organizations have devoted substantial resources to the development of formal organizational structures, thus aiming to enhance the knowledge transfer within the organization [26]. However, the majority of authors agree that the benefits are still constrained, even though contemporary organizations tend to make significant investments in this field [27].

Moreover, Allen et al. [26] argue that organizations with decentralized research and development function (R&D) usually tend to develop a number of different activities, thus creating formal knowledge management structures. The same

authors highlighted that these formal structures should often be developed in accordance with the informal organizational structures rather than be forced in a "top-down manner" [26].

An alternative to this formal approach is informal knowledge management which still remains to be explored in the relevant literature. Informal knowledge management includes knowledge creation, sharing and/or exploitation activities that are "not so labeled or constituted" [1]. The importance of informal organizational knowledge has also been stressed by other surveys [26], the results of which showed that the formal knowledge management in large organizations can often be jeopardized by "the tendency of organizational boundaries between divisions or functions". Hence, when it comes to formal organizational structures, they should be associated with informal structures, as well. Otherwise, all this, together with the rising challenges associated with the terms of knowledge management could result in the formation of what is popularly known as the "islands of knowledge" within the organization [26].

### C. Knowledge Management, Innovation and Organization's Performance

As innovativeness has become the main precondition for an organization's "success and survival" [28], the majority of authors tended to examine what drives it [29]. In order to enhance their competitiveness in the digital era, organizations need to strategically manage their businesses, thus offering new values for customers, stakeholders and business partners [30].

However, despite the number of studies addressing what actually drives innovativeness, there still remain questions about the impact of innovativeness on knowledge management and the organization's performance and how knowledge transfer within an organization influences these relationships. Moreover, another element that must be taken into consideration is the fact that such innovativeness can have a significant impact on global economic growth in the knowledge-driven economy.

Following the same reasoning, an initial consideration built upon a comprehensive literature review on knowledge management, innovations and organization's performance, have given the potential drivers of innovativeness in contemporary organizations. These elements were proposed as the main prerequisite for innovativeness, which actually influences knowledge management. The literature suggests that significant investments in these five areas remain crucial when it comes to enhancing innovativeness in organizations:

- 1) *Investments in Knowledge,*
- 2) *Investments in Science,*
- 3) *Investments in Technology,*
- 4) *Investments in Education, and*
- 5) *Investments in Human Capital.*

The other side of this conceptual framework often remains neglected. The majority of authors agree that very little is known about the way in which an organization's innovativeness influences knowledge creation, sharing, and exploitation. The conceptual framework in Fig. 1 was derived from the relevant literature review on knowledge management.

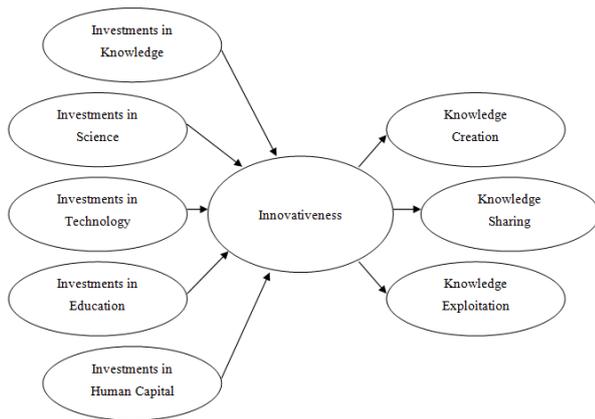


Fig. 1. A framework linking investments in Knowledge, Science, Technology, Education and Human Capital with Innovativeness and Knowledge Management (Creation, Sharing and Exploitation)

### III. THE FRAMEWORK OF THE GLOBAL INNOVATION INDEX

Since, in order to create an environment for knowledge-driven growth, it is absolutely necessary to ensure the investments in knowledge, science, technology, education, and human capital as well as innovation itself, the Global Innovation Index (GII) [31], was introduced as a key tool for fostering the knowledge-driven growth in the digital era. According to this framework, investments in knowledge, science, technology, education, and human capital are central to this goal. Hence, this section summarizes the conceptual framework in which contemporary organizations can develop and implement innovative knowledge management practices, thus achieving a major impact on global economic growth.

The current figures predict that global economic activities will soon escalate making it even 4% in 2019 [31]. Although different analysis indicates positive perception towards this conceptual framework, there is a belief that contemporary organizations need to better prioritize such practices that foster knowledge-driven growth [31]. Since, in order to create an environment for knowledge-driven growth, it has become absolutely necessary to ensure the investments in knowledge, science, technology, education, and human capital, the Global Innovation Index was introduced as a key tool of detailed metrics for 126 countries worldwide. The conceptual framework of the GII calculates four measures:

- 1) Overall GII Score,
- 2) Innovation Input Sub-Index,
- 3) Innovation Output Sub-Index, and
- 4) Innovation Efficiency Ratio.

The Overall GII Score is the simple average of the Input and Output Sub-Index Scores [31].

The Innovation Input Sub-Index is divided into five input pillars that foster innovation and knowledge-driven growth [31]:

- Institutions,
- Human Capital and Research
- Infrastructure,
- Market Sophistication, and

- Business Sophistication.

The Innovation Output Sub-Index include two output pillars that provide an overview of knowledge-driven outputs [31]:

- Knowledge Outputs, and
- Creative Outputs.

The Innovation Efficiency Ratio is the ratio of the Output Sub-Index Score to the Input Sub-Index Score. "It shows how much innovation output a given country is getting for its inputs" [31]. Note that each individual pillar and each sub-pillar measures its individual indicators, thus counting for a total of 80 indicators [31].

The framework of the GII is presented in Fig. 2.

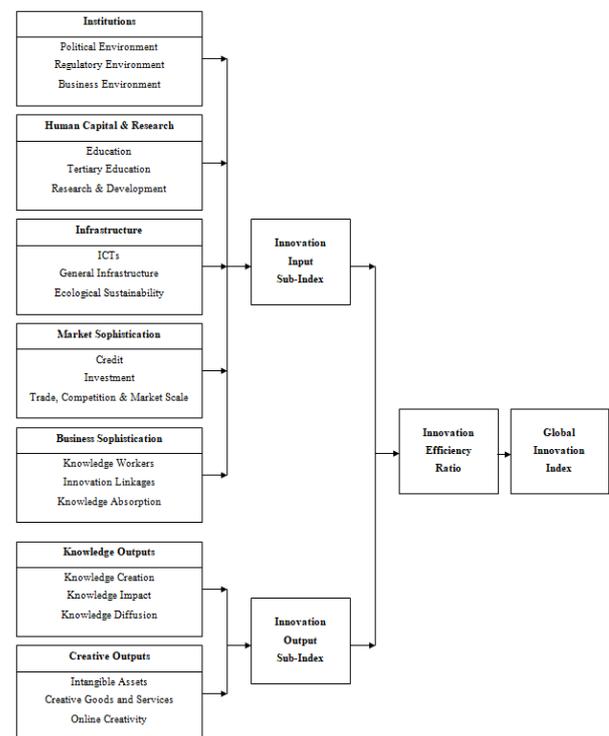


Fig. 2. The framework of the Global Innovation Index (GII) [31]

### IV. DISCUSSION

Despite the significant contribution which has been made in this area, knowledge outputs usually tend to be neglected when it comes to GII. Therefore, the questions still remain. How does the economy translate major investments in knowledge, education, science, technology and/or human capital into adequate knowledge management practices? How do economies with strict resource limitations actually manage to achieve a surprising number of knowledge-driven outputs? How do economies with a significant amount of resources invested in knowledge, education, science, technology, and human capital still remain, underachievers, when it comes to knowledge management? These questions are just some of the most important questions to most academics, educators and elevated policymakers [31]. Hence, this section summarizes key activities that can be developed

in economies from all over the world, thus aiming to create a contemporary environment for knowledge-driven growth.

When analyzing the GII conceptual framework, it is important to address each pillar individually. The first pillar – *Institutions* – consists of three main sub-pillars – Political, Regulatory and Business Environment, and it captures the institutional framework of the country. Nurturing this pillar which provides governance and protection to all of the contemporary organizations is essential for knowledge-driven growth. The second pillar – *Human Capital and Research* – tends to determine the human capital of the country. The level of Education, Tertiary Education as well as R&D activities within the country significantly influences the knowledge-driven outputs. While the first sub-pillar aims at determining considerable achievements within elementary and secondary education, higher education remains critical for countries from all over the world [31]. The last sub-pillar captures the R&D activities, with a special emphasis on the quality of educational and research institutions and centers within a particular country. The third pillar – *Infrastructure* – includes three sub-pillars – Information and Communication Technologies (ICTs), General Infrastructure and Ecological Sustainability. This is especially significant as infrastructure fosters innovation and enhances knowledge-driven growth [31]. The fourth pillar – *Market Sophistication* – aims at exploring the Credit, Investment, Trade, Competition and Market Scale as critical for contemporary organizations to achieve competitive advantage through innovation-driven growth. The fifth pillar – **Business Sophistication** – remains critical when it comes to knowledge-driven growth. It includes three sub-pillars – Knowledge Workers, Innovation Linkages and Knowledge Absorption – and it provides additional reasoning for the contemporary organizations to employ highly qualified professionals and technicians. Accordingly, business sophistication is especially important for all of the knowledge-driven outputs. The sixth pillar – *Knowledge Outputs* – refers to all those indicators related to Knowledge Creation, Knowledge Impact and Knowledge Diffusion. As such, it is crucial for answering all of the aforementioned questions. The first sub-pillar – *Creation of Knowledge* – consists of five main indicators: (1) patent applications at the national level, (2) patent applications at the international level, (3) utility model applications at the national level, (4) scientific and research articles in relevant journals and (5) number of articles (H) of an economy that have received at least H citations [31]. Furthermore, it should be noted that, in recent times, "patents, trademarks and other forms of intellectual property are increasingly being seen as trading assets rather than protection agents" [32]. The second sub-pillar – *Knowledge Impact* – refers to vital indicators representing the influence of such practices at the local and global economy. Such indicators may include: (1) increases in productivity at the national level, (2) the entry density of new organizations, (3) the significant investments in computer software, (4) the number of issued certificates for ISO 9001 and other management systems standards and (5) the number of technologically advanced industrial outputs over the total number of industrial outputs within the economy. The third sub-pillar – *Knowledge Diffusion* – is the 'mirror image' of the *Knowledge Absorption*, the sub-pillar of the fifth pillar [31]. Following the same argument, the study of [33] explored the main factors of knowledge management (Knowledge Management Tools, Knowledge Warehouses

and Knowledge Distribution) in organizations engaged in the implementation of capital projects [33]. The results indicated that contemporary organizations were duly cognizant about how to apply knowledge management concepts and shared the same values and perceptions when it comes to applying this concept. The seventh pillar – *Creative Outputs* – includes three sub-pillars – Intangible Assets, Creative Goods and Services, and Online Creativity. Despite the significant contributions made to knowledge-driven growth, creative outputs somehow always remain neglected when it comes to GII. However, adequately used, these outputs can enhance knowledge creation, sharing, and exploitation in the digital era.

To date, the GII has made several attempts to discover different ways in which countries from all over the world successfully create, share and exploit knowledge. Hence, the GII 2018 results show interesting scales in the top 10 innovators. According to the GII 2018 results, Switzerland took the 1<sup>st</sup> place, the Netherlands took the 2<sup>nd</sup> place, and Sweden took the 3<sup>rd</sup> place. The UK took the 4<sup>th</sup> place, and Singapore took the 5<sup>th</sup> place. The USA moved down from 4<sup>th</sup> to 6<sup>th</sup> place. Finland moved up and took the 7<sup>th</sup> place, and Denmark moved down and took the 8<sup>th</sup> place. Germany and Ireland took the 9<sup>th</sup> and 10<sup>th</sup> place, respectively [31]. Table 1 shows the top 10 ranked economies in the GII (2018).

TABLE I. GLOBAL INNOVATION INDEX 2018: TOP 10 [31]

Rank	Country
1	Switzerland
2	The Netherlands
3	Sweden
4	United Kingdom
5	Singapore
6	United States of America
7	Finland
8	Denmark
9	Germany
10	Ireland

## V. CONCLUSION

In recent years, various methods, techniques, tools, approaches, strategies, and activities have been developed for knowledge creation, sharing, and exploitation within the organizations in the digital era. These initiatives usually tend to broaden the previous experience of contemporary organizations, aiming to differentiate such innovative knowledge management practices from traditional organizational knowledge. However, despite the significant contribution which has been made in this area, there are still questions about what knowledge management is and how it differs from other forms of organizational knowledge.

Moreover, there are still questions about the impact of innovativeness on knowledge management and the organization's performance and how knowledge transfer within an organization influences these relationships. Hence, this study aimed at providing an overview of how significant investments in knowledge, science, technology, education,

and human capital can foster innovation, and adequately address the knowledge management – while ensuring a sustainable solution. Therefore, understanding how the GII works has become crucial for a better understanding of the relationship between knowledge management and innovation in the digital era.

#### REFERENCES

- [1] V. Hutchinson and P. Quintas, "Do SMEs do knowledge management? Or simply manage what they know?", in *International Small Business Journal*, vol. 26 (2), 2008, pp. 131-154.
- [2] L. A. Pittaway, R. Thorpe, A. Macpherson, and R. Holt, "Knowledge within small and medium-sized firms: A systematic review of the evidence", The Lancaster University Management School, 2005.
- [3] L. Cantú, J. Rialp Criado, and A. Rialp Criado, "Generation and transfer of knowledge in IT-related SMEs", in *Journal of Knowledge Management*, vol. 13 (5), 2009, pp. 243-256.
- [4] G. C. De Zubielqui, N. Lindsay, W. Lindsay, and J. Jones, "Knowledge quality, innovation and firm performance: a study of knowledge transfer in SMEs", in *Small Business Economics*, vol. 53 (1), 2019, pp. 145-164.
- [5] R. McAdam, and R. Reid, "SME and large organization perceptions of knowledge management: comparisons and contrasts", in *Journal of Knowledge Management*, vol. 5 (3), 2001, pp. 231-241.
- [6] M. Corso, A. Martini, L. Pellegrini, and E. Paolucci, "Technological and organizational tools for knowledge management: in search of configurations", in *Small Business Economics*, vol. 21 (4), 2003, pp. 397-408.
- [7] K. Wong, "Critical success factors for implementing knowledge management in small and medium enterprises", in *Industrial Management and Data Systems*, vol. 105 (3), 2005, pp. 261-279.
- [8] K. C. Desouza, and Y. Awazu, "Knowledge management at SMEs: five peculiarities", in *Journal of Knowledge Management*, vol. 10 (1), 2006, pp. 32-43.
- [9] R. K. Pillania, "Leveraging knowledge for sustainable competitiveness in SMEs", in *International Journal of Globalisation and Small Business*, vol. 1 (4), 2006, pp. 393-406.
- [10] R. K. Pillania, "Strategic issues in knowledge management in small and medium enterprises", in *Knowledge Management Research and Practice*, vol. 6 (4), 2008, pp. 334-338.
- [11] J. Han, G.S. Jo, and J. Kang, "Is high-quality knowledge always beneficial? Knowledge overlap and innovation performance in technological mergers and acquisitions", in *Journal of Management and Organization*, vol. 24 (2), 2018, pp. 258-278.
- [12] L. Cantú, J. Rialp Criado, and A. Rialp Criado, "Generation and transfer of knowledge in IT-related SMEs", in *Journal of Knowledge Management*, vol. 13 (5), 2009, pp. 243-256.
- [13] D. Pollard, and J. Svarcova, "Promoting knowledge transfer to Czech SMEs: the role of human resource development in increasing absorptive capacity", in *International Journal of Entrepreneurship and Small Business*, vol. 8 (4), 2009, pp. 499-515.
- [14] C. Martin-Rios, and N. Erhardt, "Small business activity and knowledge exchange in informal interfirm networks", in *International Small Business Journal*, vol. 35 (3), 2017, pp. 285-305.
- [15] F. Malerba, and M. McKelvey, "Knowledge-intensive innovative entrepreneurship integrating Schumpeter, evolutionary economics, and innovation systems", in *Small Business Economics*, vol. 1-20, 2018, unpublished.
- [16] A. Lasagni, "How can external relationships enhance innovation in SMEs? New evidence for Europe", in *Journal of Small Business Management*, vol. 50 (2), 2012, pp. 310-339.
- [17] H. Matlay, J. Mitra, and P. Barr, "Managing learning, knowledge, and innovation in SMEs: an empirical approach", in *Management Research News*, vol. 25 (8/10), 2002, pp. 126-128.
- [18] S. Cohen, and N. Kaimenakis, "Intellectual capital and corporate performance in knowledge-intensive SMEs", in *The Learning Organization*, vol. 14 (3), 2007, pp. 241-262.
- [19] K. H. Leitner, and S. Guldenberg, "Generic strategies and firm performance in SMEs: a longitudinal study of Austrian SMEs", in *Small Business Economics*, vol. 35 (2), 2010, pp. 169-189. M. Massaro, K. Handley, C. Bagnoli, and J. Dumay, "Knowledge Management in Small and Medium Enterprises: A Structured Literature Review", in *Journal of Knowledge Management*, vol. 20 (2), 2016, pp. 258-291.
- [20] R. J., Calantone, S. T. Cavusgil, and Y. Zhao, "Learning orientation, firm innovation capability, and firm performance", in *Industrial Marketing Management*, vol. 31 (6), 2002, pp. 515-524.
- [21] R. F. Hurley, and G. T. M. Hult, "Innovation, market orientation, and organizational learning: an integration and empirical examination", in *The Journal of Marketing*, vol. 62 (3), 1998, pp. 42-54.
- [22] J. M. Sinkula, W. E. Baker, and T. Noordewier, "A framework for market-based organizational learning: Linking values, knowledge, and behavior", in *Journal of the Academy of Marketing Science*, vol. 25 (4), 1997, pp. 305-318.
- [23] M. Petković, A. Mirić, M. Čudanov, "Designing a learning network organization", in *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies*, vol. 19 (73), 2014, pp. 17-24.
- [24] J. M. Smith, and L. Webster, "The knowledge economy and SMEs: a survey of skills requirements", in *Business Information Review*, vol. 17 (3), 2000, pp. 138-146.
- [25] J. Allen, A. D. James, and P. Gamlen, "Formal versus informal knowledge networks in R&D: A case study using social network analysis", in *R&D Management*, vol. 37 (3), 2007, pp. 179-196.
- [26] L. Bryan, and C. Joyce, "The 21<sup>st</sup>-century organization", *The McKinsey Quarterly*, 3rd ed., vol. 21-29, 2005.
- [27] D. H. Whittaker, B. P. Fath, and A. Fiedler, "Assembling capabilities for innovation: Evidence from New Zealand SMEs", in *International Small Business Journal*, vol. 34 (1), 2016, pp. 123-143.
- [28] J. Rhee, T. Park, and D. H. Lee, "Drivers of innovativeness and performance for innovative SMEs in South Korea: Mediation of learning orientation", *Technovation*, vol. 30 (1), 2010, pp. 65-75.
- [29] R. Milutinović, B. Stošić, M. Mihić, "Concepts and importance of strategic innovation in SMEs: Evidence from Serbia", in *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies*, vol. 20 (77), 2015, pp. 35-42.
- [30] S. Dutta, R. E. Reynoso, A. Garanasvili, K. Saxena, B. Lanvin, S. Wunsch-Vincent, ... and F. Guadagno, F., "The global innovation index 2018: Energizing the World with Innovation", *The Global Innovation Index*, 2018.
- [31] B. Bilen-Katić, N. Radovanović, "The role of intellectual property in developing a knowledge-based society", in *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies*, vol. 19 (70), 2014, pp. 87-93.
- [32] I. Jovanović, N. Milijić, A. Stojanović, "Modelling of knowledge management factors in project organizations", in *European Project Management Journal*, vol. 7 (1), 2017, pp. 13-23.