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Knowledge Management – from its Inception to the Innovation Linkage

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Abstract

Knowledge management started to be perceived as a scientific discipline relatively recently. Since its beginnings in the 1990s, the interest for this research field has been constantly growing especially in the past two decades. However, it seems that the peak of interest has already passed. In this paper, we provided the review of the most important research documents that are related with this topic, all collected from the Web of Science. The most important scholars and journals in the field are identified via documents and citations among them. In addition, the purpose of this paper is also to analyse the existing linkage between knowledge management and innovation. For this purpose, a network of keywords was constructed with keywords performing as actors in the network and the co-occurrence as a relation. The network obtained of keywords is undirected and weighted by the number of documents in which adjacent keywords which co-occurred on the topic of knowledge management. The content analysis with traditional network analytic techniques was used. In other fields, similar methods were already applied; however, this is the first attempt to construct this kind of research in knowledge management related to the topic of innovation. The results revealed significant linkage between knowledge management and innovation in the documents which were analyzed. We believe that the network analytic procedures used in this paper provide an excellent tool to study such a relevant phenomenon.

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1. Introduction

The phrase "knowledge management" was firstly used in the last decade of previous century. This two-word expression can be understood in several connotations. There exist many similar but also contrastive definitions. For instance, Davenport already in 1994 postulate knowledge management as "the process of capturing, developing, sharing, and effectively using organizational knowledge" (Davenport, 1994). Later Duhon (1998) provided another definition: "Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers." However, to understand the inside of knowledge management as a scientific discipline we must to review the work of the authors in the last period.

Serenko & Dumay (2015a) categorized knowledge management discipline "as at the pre-science stage with progression towards normal science". Moreover, they produced a list of scientific documents on the topic of knowledge management. They called the list as citation classics since they used citations count and consequently a cut-off citation cut as the inclusive criteria. In their opinion, citation classics compose "the core of the knowledge management body of knowledge" (Serenko & Dumay, 2015b).

According to Heisig (2015), there is absolutely no doubt that the knowledge management has multidisciplinary character. As a research field, it includes many topics and disciplines. Holsapple & Wu (2008) listed and described some of them: strategy, management information systems, human resource management, organisational behaviour and others. In this paper, we focus on the relation between knowledge management and innovation. The impact of innovation on knowledge management and vice versa has come with several connotations. Today's environment for organizations is intensively competitive and therefore innovation has become indispensable counterpart of knowledge management (Jiao et al., 2014; Babnik, Trunk Širca & Dermol, 2014; Natek & Lesjak, 2011; Arzenšek, Košmrlj & Trunk Širca, 2014). In the past, some prominent authors (e.g. Nonaka, 1994; Kogut & Zander, 1996; Grant, 1996) already emphasized knowledge transfer as a source for innovation. They were followed by du Plessis (2007) who clarify the role of knowledge management in innovation as an aid to addressing its complexity. She defined major roles that knowledge management plays in innovation. The role of sharing a tacit knowledge as a resource for innovation is among the most important (Babnik & Trunk Širca, 2014; Natek & Lesjak, 2013). Crook, et al. (2008) explained the procedure of knowledge management process and innovation topics. On the other hand, Durmus-Ozdemir & Abdukhoshimov (2017) explored the mediating role of innovation on the knowledge management process and performance.

The purpose of this paper is twofold. First, to investigate development of knowledge management as a scientific discipline, and second, to analyse the linkage between knowledge management and innovation. The content analysis with network analytic techniques is used to achieve the goal. In the other fields some similar methods were already applied, for instance Mariano & Walter (2015), Dermol & Čater (2013), Balkumar et al. (2014). However, this is the first attempt to construct that kind of research in the field of knowledge management related with innovation topic.

The rest of the paper consists of the following sections. Section 2 describes the methodology used in the paper, the method of collecting the data and basics of social network analysis. Section 3 shows the results with some descriptive statistics of downloaded documents on knowledge management topic and the use of network analytic techniques. Section 4 provides the discussion part, while the last section concludes.

2. Research methodology

This section provides the methods for selecting and analyzing the documents in this paper. The process was carried out in three different stages.

2.1. Collecting the dataset

Documents examined in this paper were collected from the Web of Science (WoS) platform in June, 2016. It constitutes one of the most important and complete research platforms available for searching this kind of research documents. The search for documents on the topic was conducted using a keyword "knowledge management". We initially identified and downloaded 7553 documents which were consistent with the required condition. The dataset

composed of the WoS documents include several information. Some of the most important identifiers about each document in the database are: document title, document type, publication type, publication name, authors, language used in the document, the number of cited references, cited references one-by-one, times the document was cited, year when the document was published, volume and issue (if possible) of the document, and others.

2.2. Identification of keywords

For each document, we collected its keywords that are usually provided at the initial part of the document. From the search term described in section 2.1, it is obvious that most of the documents contain the phrase "knowledge management" as one of the keywords. The final list of keywords contains 11962 items that were finally formatted to network as it is described in the section bellow.

2.3. Network analysis

Network is in general defined with actors and relations between them (Wasserman & Faust, 1993). It is obvious that in our case actors in the network are determined as keywords, and a relation as a keyword co-occurrence in the same document (Figure 1). This relation is symmetrical, i.e. if the first keyword occurs in the same paper as the second keyword than it is also true that the second keyword occurs in the same paper as the first one. Therefore, the network of keywords can be defined as undirected network. In this kind of network, on its graph a relation is displayed with undirected link or an edge. Network of keywords can be further classified as weighted network since two keywords can occur in many different documents.

Figure 1: Two keywords are linked with an edge in a network of keywords if they occur together in the same document

The program R (R Development Core Team, 2017) was used for data cleaning and editing. Descriptive and basic statistics with meta-analysis were also performed by R. One of the most often used social network analytic tool, Pajek program (Batagelj & Mrvar, 1996-2017), was applied for network analysis. In addition, CitNetExplorer (Waltman & Van Eck, 2014) which was designed for analysis of bibliometric networks was also used. To create maps of keywords based on co-occurrence network VOS methodology and software (Van Eck & Waltman, 2013) are very useful. VOS software was used to produce and display the network of keywords.

3. Results

3.1. Meta-analysis

According to Figure 2, the distribution of knowledge management documents has a growing tendency over time. The first document was published already in 1974 (Henry, 1974). From Figure 1, three phases of knowledge management referring to the WoS database can be identified. In the first phase (1974-1995), low number of documents was published each year containing "knowledge management" term in their topic. In the second phase, from 1995 to 2012, the number of documents rapidly increased. The peak is reached in 2012 achieving over 650 documents. After the year 2012 we identified the third phase when the number of documents gradually reduced to the value of 454 documents in 2015.

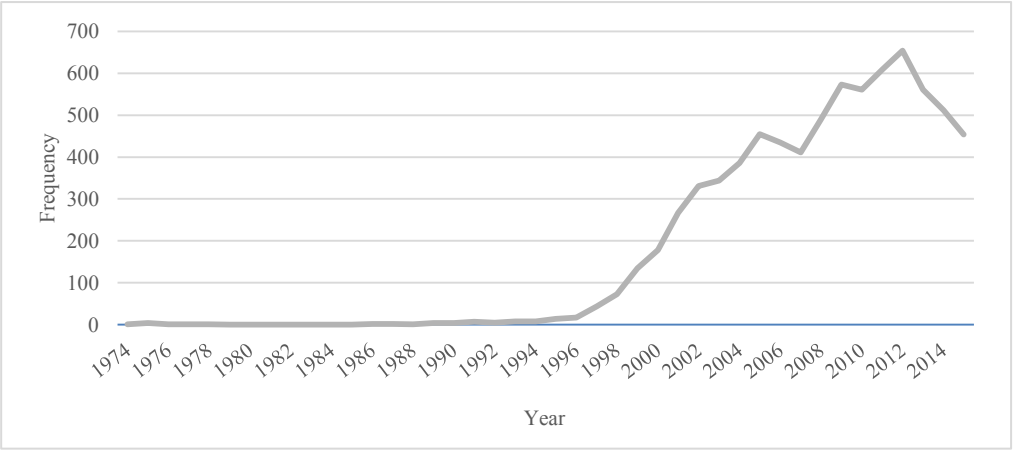

Figure 2: Appearances of articles in WoS on the knowledge management topic by their publication year

Documents on the topic of knowledge management were published in several journals (1593 journals exactly). All these journals are indexed (or they were indexed if the journal is not active any more) in the WoS database. The Journal of knowledge management (JKM) has published 318 documents in total which is the highest number of downloaded documents among all journals. JKM is published by Emerald publishing house. Emerald issues several prominent journals from this scientific field, such as: Industrial management & data systems (IMDS), Online information review (OIR), Electronic library (EL), Journal of documentation, and others. Elsevier is another publishing house with five journals represented in Table 2, followed by Palgrave, Inderscience, Wiley, Taylor & Francis and Sage, all of them publishing one journal.

Table 1. List of journals on the knowledge management with publisher, first year publication, impact factor (IF) in 2016 and document frequency

Journal title	Publisher	1st year publication	IF (2016)	Frequency
Journal of knowledge management (JKM)	Emerald	2006	2.053	318
Knowledge management research & practice (KMRP)	Palgrave	2007	1.013	218
Expert systems with applications (ESA)	Elsevier	1999	3.928	205
International journal of technology management (IJTM)	Inderscience	1999	1.036	145
Decision support systems (DSS)	Elsevier	1999	3.222	114
Journal of universal computer science (J.UCS)	Independent	2005	0.696	113
International journal of information management (IJIM)	Elsevier	1999	3.872	100
Industrial management & data systems (IMDS)	Emerald	1999	2.205	88
Journal of the American society for information science and technology (JASIST)	Wiley	1999	2.452	70
Journal of computer information systems (JCIS)	Taylor&Francis	1999	0.675	63
Knowledge-based systems (KBS)	Elsevier	1999	4.529	63
Information & management (IM)	Elsevier	2000	3.317	62
Journal of information science (JIS)	Sage	2000	1.372	60
Online information review (OIR)	Emerald	1999	1.534	52
The Electronic library (EL)	Emerald	1999	0.484	51
Journal of documentation (JD)	Emerald	1999	0.853	51

There are only seven journals that published 100 or more documents. Along with the JKM we can identify journals: KMRP, ESA, IJTM, DSS, J.UCS and IJIM. Almost one quarter of all documents on the knowledge management topic in the WoS was published by these journals.

There exists a specific research field named scientometrics which is dealing with citations among authors in specific research field. Scientometrics as a discipline is not measuring only absolute citation frequencies per observed document but rather include information which document is citing or was cited by the observed one. Serenko (2013) already dealt with this problem and Breznik (2016) was further elaborating citations among authors on the knowledge management related topic. However, we believe both papers were only initial attempts in the scientometrics field and there is still a lot of potential for this kind of research in the field of knowledge management.

The most cited document on the knowledge management topic was written and published by Alavi & Leidner (2001) in MIS Quarterly journal. The document was really well cited, receiving no less than 1767 citations. Another paper receiving over 1000 citations (1087 exactly) was written by Spender (1996). It is followed by Dyer & Nobeoka (2000) receiving no less than 941 citations. In Table 2 we can observe 15 documents on the knowledge management topic in the WoS with the highest citation frequency.

Table 2: The most cited articles on knowledge management topic listed by number of their citations

Author(s)	Journal	Year	Title	Citations received
Alavi, M. & Leidner, D. E.	MIS Quarterly	2001	Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues	1767
Spender, J. C.	Strategic Management	1996	Making knowledge the basis of a dynamic theory of the firm	1087
Dyer, J. H. & Nobeoka, K.	Strategic Management	2000	Creating and managing a high-performance knowledge-sharing network: The Toyota case	941
Hansen, M. T., Nohria, N. & Tierney, T.	Harvard Business Review	1999	What's your strategy for managing knowledge?	898
Wasko, M. M. & Faraj, S.	MIS Quarterly	2005	Why should I share? Examining social capital and knowledge contribution in electronic networks of practice	843
Studer, R., Benjamins, V. R. & Fensel, D.	Data & Knowledge Engineering	1998	Knowledge Engineering: Principles and methods	763
Carlile, P. R.	Organisation Science	2002	A pragmatic view of knowledge and boundaries: Boundary objects in new product development	682
Davenport, T. H., De Long, D. W. & Beers, M. C.	Sloan Management Review	1998	Successful knowledge management projects	664
Sanchez, R. & Mahoney, J. T.	Strategic Management	1996	Modularity, flexibility, and knowledge management in product and organization design	650
Gold, A. H., Malhotra, A. & Segars, A. H.	J of Man Inf Systems	2001	Knowledge management: An organizational capabilities perspective	612
Simonin, B. L.	Strategic Management	1999	Ambiguity and the process of knowledge transfer in strategic alliances	576
Kankanhalli, A., Tan, B. C. Y. & Wei, K. K.	MIS Quarterly	2005	Contributing knowledge to electronic knowledge repositories: An empirical investigation	541
Argote, L., McEvily, B. & Reagans, R.	Management Science	2003	Managing knowledge in organizations: An integrative framework and review of emerging themes	517
Gertler, M. S.	J of Economic Geography	2003	Tacit knowledge and the economic geography of context, or The undefinable tacitness of being (there)	514
Hedlund, G.	Strategic Management	1994	A model of knowledge management and the n-form corporation	503

The highest number of the documents in Table 2 (all of them are papers), five to be exact, were published in a journal named Strategic Management (Wiley publishing house). It is rather surprising that we cannot find the journal Strategic Management in Table 1 between the most fruitful journals on the topic. Moreover, no journal that published one top 15 articles (displayed in Table 2) can be found in Table 1.

In this study, we were also interested in the documents' keywords. Not only in descriptive way with calculating frequencies and other technical measures but rather on the co-occurrence of keywords in documents on the knowledge management topic. Network analysis turned out to be an excellent tool to achieve our goal. It is already well developed as a scientific discipline and very well supported by computer software.

3.2. Network of keywords

Network of keywords consists of 11962 actors, i.e. keywords, and 56194 links among them. Calculated density of this network accounts approximately 0.00078, therefore less than one per mill of all possible links are generated. Network of keywords can be classified as a sparse network and it is presented in VOS density view in Figure 3.

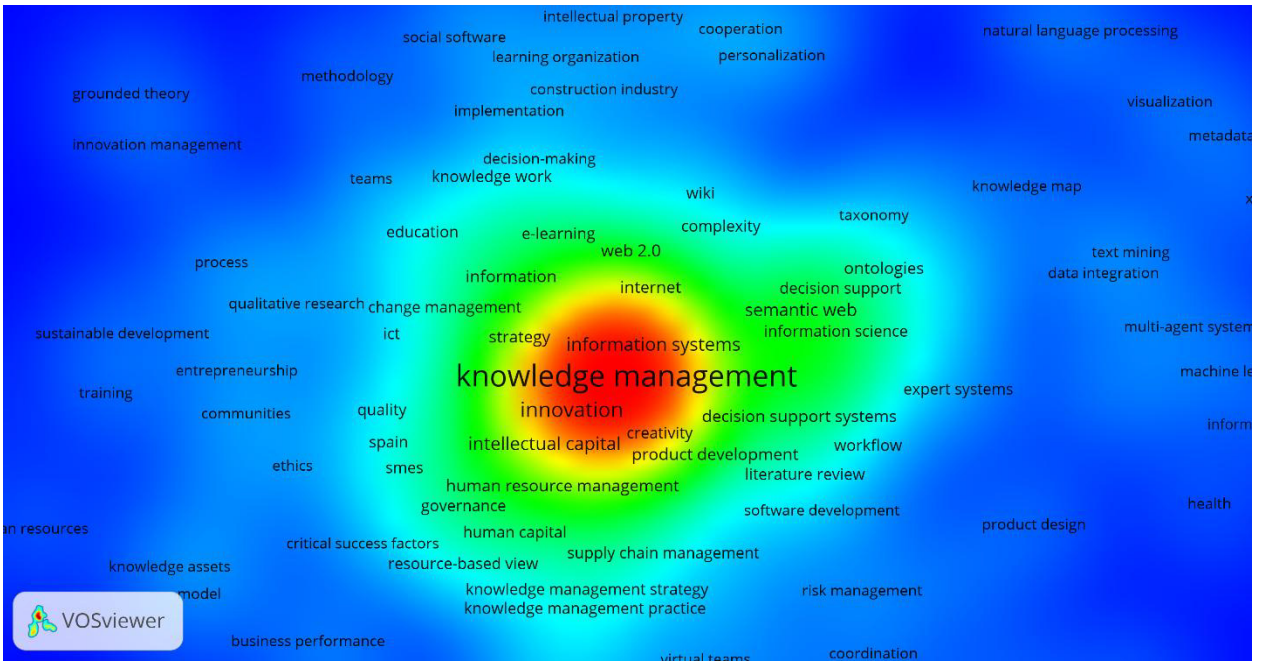

Figure 3: Network of keywords on the topic of knowledge management presented by VOSviewer

In the center of Figure 2 we can find the keyword "knowledge management". Nearby this keyword and also in the core of the network (the core is displayed by the color red), we can already identify the keyword "innovation". Other keywords in the core are: "information systems", "creativity" and "intellectual capital".

The highest degree in the network is not surprisingly with the keyword "knowledge management". It is as high as the value 6457 meaning that the keyword "knowledge management" is linked with exactly 6457 other keywords in our network (out of 11962 possible links). The next keyword on the degree list is "knowledge sharing" (with 896 links), followed by "ontology" (619) and already keyword "innovation" (594). Analyzing the strength of links, we can learn that the strongest link is between keywords "knowledge management" and "knowledge sharing" with 165 co-occurrences in documents on the knowledge management topic. It is followed by the link between "knowledge management" and "innovation" (134 co-occurrences), and "knowledge management" and "organizational learning" (105).

4. Discussion

Knowledge management as a scientific discipline developed in the nineties of previous century. Its inception was followed by the rapid growth in interest which was shown in this paper by the constant growth of documents on this topic. The peak was in 2012 and afterwards number of documents per year slowly decreased. Taking into account the characteristics of longitudinal analysis, it is premature to claim that the topic is already in its decline. However, almost exponential growth clearly came to an end. The most popular journals on the topic were revealed, most of them having the term "knowledge management" in their name. The formation of journals coincides with the development of the discipline. This also confirms our research approach by collecting the documents from the WoS database.

Our work strongly supports previous researches confirming the strong linkage between knowledge management and innovation. Network analytic procedures revealed innovation as one of the most important concepts in the core of knowledge management network structure. Other notable core concepts are creativity, information systems and intellectual capital. Around the inner core, some support concepts of the knowledge management can be found and logically explained, i.e. human capital and human resource management, decision support and information science, e-learning and web 2.0, strategy, and others. These findings are consistent with discoveries of previous authors dealing with similar problem, for instance Trunk Širca, Babnik & Breznik (2013), Donate & Guadamillas (2011), Babnik et al. (2014), Novak Trunk, Čepar & Trunk (2016) and Valaei, Nikhashemi & Javan (2017).

The following can be considered to be limitations of this paper and it can also be an invitation to further elaborate the study. First, the research is designed as cross-sectional study. Future research might use longitudinal design and analyze links among key actors over time. Second, the search term "knowledge management" can be associated with terms that are revealed in this study. Consequently, more documents will satisfy the search criteria which will allow extended research on the topic. Third, the source of document, Web of Science, can be further extended with similar databases.

5. Conclusion

The main aim of this study was twofold. Firstly, to explore the development of knowledge management topic as a scientific discipline. And secondly, to investigate the linkage between knowledge management and innovation. The study was carried out analyzing a large collection of documents obtained from the WoS database. We applied several methods from network analysis in order to reveal important compositions in the network of keywords. The content analysis with traditional network analytic techniques was used. In the other fields some similar methods were already applied, however, this is the first attempt to construct that kind of research in the field of knowledge management related with the innovation topic. Results revealed significant linkage between knowledge management and innovation in documents that were analyzed.

We should stress that network analytic procedures used in this paper offer an excellent tool for analyzing such an important topic.

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References

Davenport, T. H. (1994). Saving IT's Soul: Human Centered Information Management. *Harvard Business Review, 72*, 119-131.

Duhon, B. (1998). It's all in our heads. *Inform*, *12,* 8-13.

Serenko, A., & Dumay, J. (2015a). Citation classics published in knowledge management journals. Part I: articles and their characteristics. *Journal of Knowledge Management, 19*, 401-431.

Serenko, A., & Dumay, J. (2015b). Citation classics published in knowledge management journals. Part II: studying research trends and discovering the Google Scholar Effect. *Journal of Knowledge Management, 19*, 1335-1355.

Heisig, P. (2015). Future research in knowledge management: results from the global knowledge research study. In Bolisani, E. and Handzic, M. (EDS.), *Advances in Knowledge Management: Celebrating Twenty Years of Research and Practice*, Springer, Berlin, 151-182.

Holsapple, C. W., & Wu, J. (2008). In search of missing link. *Knowledge Management Research & Practice*, *6,* 31-40.

Jiao, H., Cui, Z. Yunxia, & Chen, J. (2014). Building Entrepreneurs' Innovativeness Through Knowledge Management: The Mediating Effect of Entrepreneurial Alertness. *Technology Analysis & Strategic Management, 26*, 501-516.

Babnik, K., Trunk Širca, N., & Dermol, V. (2014). Individuals learning in work teams: support to knowledge management initiatives and an important source of organizational learning. In: ABRUDAN, Ioan (ed.), *Challenges and innovations in management and leadership, Procedia - social and behavioral sciences, 124,* (pp. 178–185). New York: Elsevier.

Natek, S., & Lesjak, D. (2011). Integrated higher education information systems - professors' knowledge management tool. *Issues in information systems*, *12,* 80-86.

Arzenšek, A., Košmrlj, K., & Trunk Širca, N. (2014). Slovenian young researchers' motivation for knowledge transfer. *Higher education*, *68,* 185-206.

Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science, 5*, 14-37.

Grant, R. M. (1996). Toward a Knowledge-Based Theory of the Firm. *Strategic Management Journal, 17*, 109-122.

Kogut, B., & Zander, U. (1996). What Firms Do: Coordination, Identity and Learning. *Organization Science, 7*, 502-518.

du Plessis, M. (2007). The role of knowledge management in innovation. *Journal of Knowledge Management, 11*, 20-29.

Babnik, K., & Trunk Širca, N. (2014). Knowledge creation, transfer and retention: the case of intergenerational cooperation. *International journal of innovating and learning*, *15,* 349-364.

Natek, S., & Lesjak, D. (2013). Improving knowledge management by integrating HEI process and data models. *Journal of computer information systems*, *53,* 81-86.

Crook, T. R., Ketchen, D. J., Combs, J. G., & Todd, S. Y. (2008). Strategic Resources and Performance: A Meta-analysis. *Strategic Management Journal, 29*, 1141-1154.

Durmus-Ozdemir, E., & Abdukhoshimov, K. (2017). Exploring the mediating role of innovation in the effect of the knowledge management process on performance. *Technology Analysis & Strategic Management, In Press*.

Mariano, S., & Walter, C. (2015). The construct of absorptive capacity in knowledge management and intellectual capital research: content and text analysis. *Journal of Knowledge Management, 19*, 372-400.

Dermol, V., Čater, T. (2013). The influence of training and training transfer factors on organisational learning and performance. *Personnel review, 42,* 324-348.

Balkumar, K., Resmi A. T., Anbuudayasankar, S. P., Ganesh, K., Paul Silvian, S., & Gemini V. J. (2014). Effective healthcare management in India - the role of knowledge management, *Int. J. of Value Chain Management, 7*, 97-123.

Wasserman, S., Faust, K. (1994). *Social Network Analysis: Methods and Applications*. Cambridge: Cambridge University Press.

R Development Core Team. (2017). *R: A language and environment for statistical computing [Computer software manual]*. Vienna, Austria. Available from http://www.Rproject.org/

Batagelj, V., & Mrvar, A. (1996-2017). *Pajek-Program for Large Network Analysis*. Available from http://pajek.imfm.si/doku.php?id=download

Waltman, L., & Van Eck, N. (2014). *CitNetExplorer-Program for Citaion Network Analysis*. Available from http://www.citnetexplorer.nl/

Van Eck, N., & Waltman, L.(2013). *VOSViewer*. Available from http://www.vosviewer.com/

Henry, N. L. (1974). Knowledge Management: A New Concern for Public Administration. *Public Administration Review*, *34*, 189-196.

Serenko, A. (2013). Meta-analysis of scientometric research of knowledge management: discovering the identity of the discipline. *Journal of Knowledge Management, 17*, 773-812.

Breznik, K. (2016). Knowledge management with WoS network of citations, Managing innovation and diversity in knowledge society through turbulent time: proceedings of the MakeLearn and TIIM Joint International Conference, Timisoara, Romania.

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, *25*, 107-136.

Spender, J. C. (1996). Making Knowledge the Basis of a Dynamic Theory of a Firm. *Strategic Management Journal*, *17*, 45-62.

Dyer, J. H., Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal*, *21*, 345-367.

Trunk Širca, N., Babnik, K., & Breznik, K. (2013). Towards organisational performance: Understanding human resource management climate. *Industrial Management & Data Systems, 113*, 367-384.

Donate, M. J., & Guadamillas, F. (2011). Organizational factors to support knowledge management and innovation. *Journal of Knowledge Management, 15*, 890-914.

Babnik, K., Breznik, K., Dermol, V., & Trunk Širca, N. (2014). The mission statement: organisational culture perspective. *Industrial management + data systems*, *114,* 612-627.

Novak Trunk, A., Čepar, Ž., & Trunk, A. (2016). The role of expected years of schooling among life expectancy determinants. *International journal of innovating and learning*, *20,* 85-99.

Valaei N., Nikhashemi, S. R., Javan, N. (2017). Organizational factors and process capabilities in a KM strategy: toward a unified theory. *Journal of Management Development, 36*, 560-580.