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Keywords Co-occurrence Analysis of Research on Sustainable Enterprise and Sustainable Organisation

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Abstract

Purpose: The aim of the paper is to identify and explore leading thematic areas within the research field related to a sustainable enterprise/organisation. The following research questions are asked to achieve the aim of the study: (1) What are the leading areas/topics of scientific inquiry in the research field? (2) What is the research status in the leading research areas/topics? (3) What are the most up-to-date (emerging) topics in the field?

Design/methodology/approach: Analysis of keywords co-occurrence is the bibliometric method used to map the research field. The methodology of systematic literature review is applied in order to conduct the analysis of research status in the identified leading thematic areas within the research field.

Findings: The study identifies and discusses seven streams of research associated with the concept of a sustainable enterprise i.e. (1) sustainable development and sustainable enterprise idea, (2) sustainability, (3) strategic management and functional areas management, (4) human and organisational context, (5) sustainable manufacturing, (6) industrial context and (7) environmental management. Moreover, emerging, 'hot' topics attracting a growing attention of the research community in recent years are enumerated, which include such issues as: (1) the concept of the sustainable, smart and sensing enterprise, (2) sustainable enterprise resource planning and allocation, (3) building competitive advantage in a sustainable enterprise, (4) managing sales in a sustainable enterprise,

(5) managing sustainable supply chains, and (6) developing sustainable enterprise excellence.
Research and practical limitations/implications: Mapping of the research field and identifying emerging topics provides guidelines for further studies, which can be considered as valuable contribution to the theory and research development. However, due to the theoretical character of the study its practical implications are rather limited.
Originality/value: As a bibliometric study, the paper generates the added value mainly from the point of view of the theory development. Its originality derives from a very limited number of studies which use the methodology of keywords analysis to map the research field and identify leading topics within it.
Paper type: review paper.

Keywords: sustainable enterprise, sustainable organisation, keywords co-occurrence analysis, bibliometrics.

1. Introduction

Dual meaning of the adjective 'sustainable' seems to be the core of the concepts of a sustainable enterprise and a sustainable organisation. According to the online Cambridge dictionary (accessed on 23 January 2019), 'sustainable' means: (1) being "able to continue over a period of time"; and (2) "causing little or no damage to the environment and therefore able to continue for a long time". This dualism in understanding of the idea of a sustainable enterprise/organisation is highlighted by Sudolska and Lis (2018, pp. 121, 127). On the one hand, in the seminal paper by Teece (2007), the focus is given to sustainable i.e. long lasting competitive advantage and enterprise performance. On the other hand, "[a] sustainable enterprise is one that contributes to sustainable development by delivering simultaneously economic, social, and environmental benefits – the so called triple bottom line" (Hart and Milstein, 2003, p. 56).

In spite of a growing attention of the ranks of scholars (Sudolska and Lis, 2018), the research field dealing with the issues of a sustainable enterprise/organisation seems to lack a thorough bibliometric description of encompassed themes. As of 23 January 2019, the following query was accomplished in Scopus database:

> Searched for Topic (Title, Keywords, Abstracts): ('sustainable organi?ation' OR 'sustainable enterprise') AND ('keyword analysis' OR

'co-occurrence analysis' OR 'bibliometric' or 'bibliometrics'). Subject area: unlimited. Time span: unlimited.

There were found only two records indicating the use of a keywords analysis for mapping the research field related to the concepts of a sustainable enterprise or a sustainable organisation. However, both of them are centred on narrow aspects rather than mapping the whole research field. The study by Kim, Khan, Wood and Mahmood (2016) is focused on employee engagement in sustainable organisations. Almeida Dos Santos, Vieira Neto and Farias Filho (2016) use bibliometric methodology to explore the issue of eco-efficiency. The same query applied in Web of Science Core Collection retrieved no results. Extending the search beyond the two aforementioned high quality bibliometric databases brings the study by Sudolska and Lis (2017), which makes an attempt to map the research field with keywords analysis. However, this paper has some limitations, which provide reasoning for the replication of the study. First of all, the analysis was conducted manually without support of any software used for bibliometric research. Secondly, the paper lacks the co-occurrence analysis of high-frequency keywords. In consequence clustering of keywords, accomplished manually by the authors, is flawed with a relatively high level of subjectivity. All this hampered the objectivity of the study, which was made explicit by the authors in the conclusion section.

Therefore, making an attempt to fill the identified gap, the aim of this paper is to replicate the aforementioned study in order to identify and explore leading thematic areas within the research field related to a sustainable enterprise/organisation. Moreover, the emerging topics in the field will be mapped. The following research questions are asked to achieve the aim of the study: (1) What are the leading areas/topics of scientific inquiry in the research field? (2) What is the research status in the leading research areas/topics? (3) What are the most up-to-date (emerging) topics in the field?

The paper consists of four parts. First of all, the method of study including data sampling processes, and methods, techniques and instruments of research is presented. Secondly, co-occurrence analysis and clustering of high-frequency keywords are conducted. Thirdly, research status in identified leading areas is analysed. Finally, the most up-to-date (emerging) themes in the field are enumerated and explored.

2. Method of study

2.1. Data sampling

Scopus was used a source of bibliometric data for the research sampling process. The following query was applied:

> Searched for Topic (Title, Keywords, Abstracts): ('sustainable organi?ation' OR 'sustainable enterprise'). Subject area: unlimited. Time span: unlimited.

Truncation technique was applied in order to include into the research sample the publications written in both British and American standards of English. As a result of the data sampling process 561 records were retrieved. The earliest work dates back to 1989, however the majority of publications was issued after 2005. Almost all the papers comprising the research sample (545; 97%) were written in English. The majority of them (371) are journal papers. Remaining source types are: conference proceedings (85), books (65), books series (33) and trade publications (7). The research output is distributed among 23 subject areas. The most numerous of them are: Business, Management and Accounting (255 items), Social Sciences (163), Engineering (114), Environmental Science (113), Computer Science (86), Economics, Econometrics and Finance (73).

2.2. Applied methods, techniques and tools

Analysis of keywords co-occurrence was the bibliometric method used to map the research field. The process of creating keywords networks and clustering keywords was supported with the use of the VOSviewer application, developed by the Centre for Science and Technology Studies of the University of Leiden, the Netherlands (Van Eck and Waltman, 2009).

The methodology of systematic literature review (Czakon, 2011) was applied in order to conduct the analysis of research status in the identified leading thematic areas within the research field. Qualitative literature survey aimed at exploring the contribution to respective thematic areas made by the leading publications. The papers were assigned to the systematic literature review due to their focus on the topic (preference was given to publications including phrases 'sustainable enterprise' or 'sustainable organisation' in their titles) as well as impact on the research field development (measured by the number of received citations).

3. Identification of leading research areas

The papers comprising the research sample provide 2978 keywords. The most often cited expressions are: 'sustainable development' (160), 'sustainability' (120), 'sustainable enterprise' (81), 'industry' (34), 'societies and institutions' (31), 'competition' (26), 'manufacture' (24), 'innovation' (23), 'human resource management' (22), and 'leadership' (22). The number of high-frequency keywords recommended for further analysis was calculated with the use of the relevant formula (Donohue, 1974; cited after: Guo, Chen, Long, Lu and Long, 2017, p. 7). According to the aforementioned calculations, the co-occurrence should include 67 high-frequency keywords with the minimum number of occurrences equal to 6. However, in the sample there are 82 keywords meeting this threshold. In consequence, the number of high-frequency keywords in the co-occurrence network (Figure 1) was extended to 82. In the map, the size of nodes manifests the frequency of keyword's occurrence, while lines show relationships among keywords.

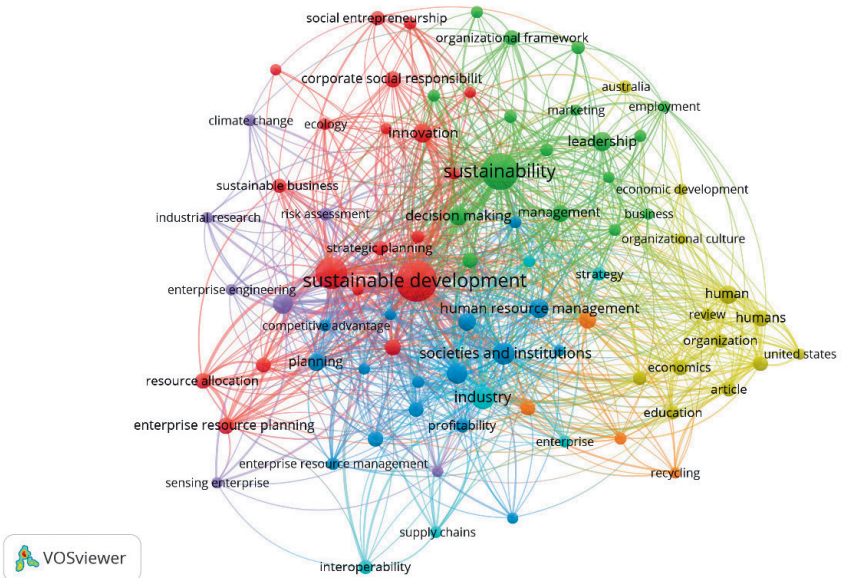

Figure 1. Co-occurrence network of high-frequency keywords

Source: own study based on data retrieved from Scopus database as of 23 January 2019 and analysed with the use of VOSviewer.

With the use of the method of co-occurrence analysis, identified high-frequency keywords can be categorized into 7 clusters corresponding with the areas of research interest in the field. Cluster analysis of high-frequency keywords is presented in Table 1.

Table 1. Clusters of high-frequency keywords related to a sustainable enterprise/organisation

Symbol	Items [N]	High-frequency keywords [N]	Issue
C1	19	business ethics (6), corporate social responsibility (15), ecology (7), enterprise resource planning (15), entrepreneurship (8), environment (6), environmental impact (8), information systems (14), innovation (23), project management (11), resource allocation (13), SMEs (6), social entrepreneurship (10), strategic planning (10), sustainable business (10), sustainable development (160), sustainable enterprise (81), sustainable enterprise excellence (6), sustainable enterprises (6)	Sustainable development and sustainable enterprise idea
C2	17	business (6), conceptual framework (6), corporate sustainability (8), decision making (21), employment (6), leadership (22), management (16), marketing (6), organizational change (7), organizational framework (11), social aspects (7), stakeholder (8), supply chain management (11), sustainability (120), sustainable leadership (7), sustainable organization (7), sustainable organizations (9)	Sustainability
C3	16	commerce (7), competition (26), competitive advantage (7), customer satisfaction (6), enterprise architecture (6), enterprise resource management (8), human resource management (22), information management (11), information technology (13), knowledge management (18), organizational development (6), planning (18), profitability (10), quality management (7), sales, societies and institutions (31)	Strategic management and functional areas management
C4	13	article (12), Australia (8), economic development (6), economics (13), education (9), human (20), humans (15), organization (10), organization and management (12), organizational culture (6), research (9), review (8), United States (6)	Human and organisational context
C5	7	climate change (7), developing countries (6), enterprise engineering (6), industrial research (6), manufacture (24), risk assessment (8), sensing enterprise (6)	Sustainable manufacturing

Table 1. Continued

Symbol	Items [N]	High-frequency keywords [N]	Issue
C6	7	enterprise (7), industry (34), interoperability (10), performance (7), strategy (9), supply chains (7)	Industrial context
C7	4	environmental management (16), environmental protection (7), environmental sustainability (11), recycling (6)	Environmental management

Source: own study based on data retrieved from Scopus database as of 23 January 2019 and analysed with the use of VOSviewer.

Comparing and contrasting the results of the keywords co-occurrence analysis with the findings from the study by Sudolska and Lis (2017) show some similarities in regard to clustering the research output in the field. The following categories are found in both studies: sustainability, strategic management and functional areas management, environmental management. The categorisation by Sudolska and Lis (2017) gives more attention to organisational resources and stakeholders as well as organisational learning, improvement and innovation. The actual study focuses on: sustainable development and sustainable enterprise idea, the various contexts of research on sustainable enterprise/organisation and the issue of sustainable manufacturing.

4. Research status in identified areas

Cluster 1 (marked in red in Figure 1) is centred around the nodes of ‘sustainable development’ (160 occurrences) and ‘sustainable enterprise’ (81). Within the cluster two branches can be identified. The first one is focused on corporate social responsibility, sustainable business and sustainable innovation. The second one deals with the issues of resource allocation and planning. Keywords comprising the cluster are listed in 239 publications. As a central area in the research field, Cluster 1 includes the top most often cited core-references. Among the top 10 core references, three approaches (streams) may be recognized with the focus on: antecedents of the sustainable enterprise, the processes of the company transformation towards the sustainable enterprise and contextual case studies. Teece (2007) in his seminal paper discusses the nature and micro-foundations (elements) of dynamic capabilities

used for improving sustainable enterprise performance. Jabbour and Santos (2008) analyse the central role of human resource management for developing a sustainable enterprise. Jabbour and De Sousa Jabbour (2016) consider possibility to combine the ideas of 'green HRM' and 'green SCM' in search for synergy in building sustainable enterprises. Lozano (2008) explores two approaches for building a sustainability-oriented enterprise i.e. the concepts of a collaborative enterprise and a sustainable enterprise. Shrivastava and Kennelly (2013) introduce the idea of the place-based enterprise assuming that such an enterprise embedded in a local context may be more effective in responding to expectations of various categories of stakeholders. Espinoza and Porter (2011) consider the potential of the Viable Systems Model and the Complex Adaptive Systems to develop sustainability of an enterprise. Keijzers (2002) studies the process of shift from environment-friendly operations to the concept of a sustainable enterprise. Zollo, Cennamo and Neumann (2013) investigate the process of a company evolution towards a sustainable enterprise, focusing their attention on understanding the know-how. Weerawardena, McDonald and Mort (2010) examine the implementation of the concept of a sustainable organisation in the context of non-profit organisations. Seidel, Recker and Vom Brocke (2013) analyse the case study of sustainable practices implemented by a software solutions provider and discuss the potential of information systems to support the efforts of becoming a sustainable enterprise.

Cluster 2 (marked in green in Figure 1) is centred around the issue of 'sustainability' (120 occurrences). The leading aspects comprising the cluster are: 'decision making', 'leadership' , 'management' and 'sustainable organisation(s)'. The keywords categorized under the umbrella of Cluster 2 come from 184 publications. Cluster 2 shares the majority of core references with Cluster 1 including the works of: Teece (2007), Lozano (2008), Jabbour and De Sousa Jabbour (2016), Zollo et al. (2013), and Shrivastava and Kennelly (2013). In addition, Hart and Dowell (2011) include the review of the sustainable enterprise literature in their study revisiting the concept of natural-resource-based view. Remaining core references in Cluster 2 attract the attention to the implementation of sustainability ideas. Kerr (2006) analyses developing strategies, policies and management systems for implementing the ideas of the sustainable organisation and supporting them leadership strategies in the context of SMEs. Rehman, Chang, Batool and Wah (2016) consider possibilities to reduce the amount of big data collected

at the customer end to create additional value in sustainable enterprises. Chofreh, Goni, Shaharoun, Ismail and Klemeš (2014) propose the implementation of Sustainable Enterprise Resource Planning systems to support decision making processes and deal with integration problems in the context of sustainable organisations. Baldwin, Allen, Winder and Ridgeway (2005) focus on the implementation of the idea of sustainable industrial development and discuss new technologies and practices in the sustainable manufacturing context.

Cluster 3 (marked in dark blue in Figure 1) relates to the issues of strategic management and functional areas management. There is not any dominant node within it. The top important keywords within its structure are: 'competition', 'planning', 'societies and institutions', 'human resource management' and 'knowledge management'. Cluster 3 comprises keywords from 123 publications. The cluster shares some core references with Clusters 1 and 2 e.g. Teece (2007), Seidel et al. (2013), Jabbour and Santos (2008), Lozano (2008), Jabbour and De Sousa Jabbour (2016), Rehman et al. (2016). Edgeman and Eskilden (2014) combine the concepts of business excellence and the sustainable enterprise and develop the model of sustainable enterprise excellence. Seidel, Recker and Vom Brocke (2012) discuss challenges and perspectives for 'green business process management' and its contributions to make an enterprise more sustainable. Baumgartner and Rauter (2017) establish the links between strategic management and the sustainable development idea and they study the process, content and context of corporate strategy to include the aspects of managing corporate sustainability.

Cluster 4 (marked in yellow in Figure 1), consisting of 13 items and referring to 69 publications, seems to be distanced from the core of the research field. In contrast to Clusters 1–3, there is not a dominant node within it. However, keywords 'human' and 'humans' combined together show some potential to become a central point of the cluster. Similar potential may be observed in combining keywords 'organization' and 'organization and management'. Therefore, Cluster 4 is labelled as 'human and organisational context' of research related to a sustainable enterprise/organisation. Considering core references, Cluster 4 share very few of them with other clusters (e.g. Chofreh et al., 2014; Badri Ahmadi, Kusi-Sarpong and Rezaei, 2017). Other core references are focused on the studies embedded in various organisational context e.g. the health care industry and non-governmental organisations. Nelson,

Batalden, Mohr and Plume (1998) discuss the challenges of the health care industry and provide recommendations concerning building sustainable enterprises in this context. Building a sustainable health care system is the topic of interest of the paper by Coiera and Hovenga (2007). Yoshida and Sandall (2013) analyse burnout and work factors among midwives in the UK to improve "sustainable organisation of midwifery care". Sarros, Cooper and Santora (2011) study leadership vision, organisational culture and support for innovations and use their findings to provide recommendations for building sustainable enterprises in not-for-profit sector.

Cluster 5 (marked in violet in Figure 1) consists of 7 keywords included in 50 publications. It occupies a frontier position in the map of the research field. On the one hand, any centrality within it can be hardly observed. In fact, 'manufacturing' cited 24 times is the only distinctive keyword with the cluster. Therefore, we labelled the cluster as 'Sustainable manufacturing'. On the other hand, the elements of the cluster show relationships with Clusters 1, 2 and 3. In consequence, some of core references are shared, too (e.g. Teece, 2007; Baldwin et al., 2005). Other important contributions are made among others by: Weichhart, Molina, Chen, Whitman and Vernadat (2016), Badri Ahmadi et al. (2017), and Gunasekaran, Jabbour and Jabbour (2014). Weichhart et al. (2016) propose to apply the concept of 'sensing, smart, and sustainable enterprise systems' and they discuss challenges for developing such enterprises. Badri Ahmadi et al. (2017) propose the framework for social sustainability in supply chains to be applied in manufacturing companies. Gunasekaran et al. (2014) make an introduction to the special issue of the *International Journal of Sustainable Development and World Ecology* focused on managing organisations for sustainable development in developing economies.

Cluster 6 (marked in light blue in Figure 1) comprises 7 keywords mentioned in 56 publications. 'Industry' with 34 occurrences is found to be the central of point of the cluster. The core references co-shared with other clusters include the works of: Hart and Dowell (2011), Weichhart et al. (2016), and Baumgartner and Rauter (2017). Moreover, Ducq, Chen and Doumeingst (2012) discuss the application of the systems theory for managing interoperability of enterprises and developing sustainable interoperability. Cretan, Coutinho, Bratu, Jardim-Goncalves (2012) propose a negotiation-based framework for rebuilding and strengthening interoperability links between companies

in the highly competitive environment. Shrivastava, Ivanaj and Persson (2013), combining the perspectives of business practice and academia, recommend the transdisciplinary approach to understanding and building sustainable enterprises.

Cluster 7 (marked in orange in Figure 1), comprising only 4 items and referring to 31 publications, is focused on the issues of environmental management. It shows relationships with three central clusters in the field and shares some core references with them (e.g. Seidel et al., 2013; Jabbour and Santos, 2008; Seidel et al., 2012). Remaining top most cited publications are centred around environmental issues. Sanchez and Leakey (1997) study the challenges for land use in Africa to make small farms into sustainable enterprises. Jabbour (2015) presents the findings from the quantitative study conducted among Brazilian companies which proves that environmental training is strongly positively related with environmental management maturity. Sweet, Roome and Sweet (2003) study different decision making styles while solving problems related to environmental management. Recycling emerges to be an important stream within this research area. For instance, Fisher, Kingsbury and Headley (2004) focus on economic, social responsibility and environmental aspects of recycling plastics from electrical and electronic equipment. Fan (2005) discusses the issues related to managing and performance of the waste recycling fund in Taiwan.

5. Emerging research topics

The emerging topics of scientific inquiry within the research field dealing with the issues related to a sustainable enterprise/organisation were identified with the use of VOSviewer application. The findings from the analysis are presented in Figure 2.

The analysis indicates the following keywords representing 'hot' topics attracting a growing attention of the research community in recent years: 'sensing enterprise', 'resource allocation', 'competitive advantage', 'sales', 'supply chain management', and 'sustainable enterprise excellence'.

The concept/framework of the S^3 (Sustainable, Smart and Sensing) enterprise is one of the emerging streams of research in the field. The sustainable component of the concept means the enterprise ability to last for a long period of time and respond to the challenges of the triple

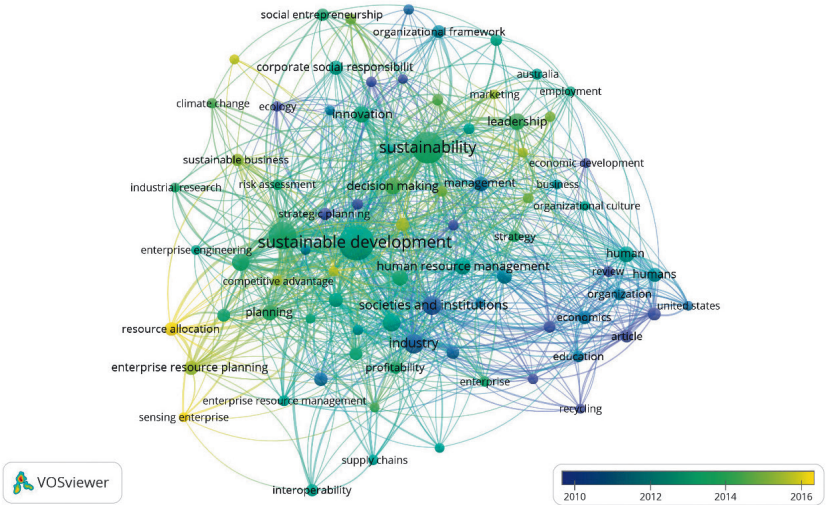

Figure 2. Emerging topics in research on a sustainable enterprise/organisation

Source: own study based on data retrieved from Scopus database as of 23 January 2019 and analysed with the use of VOSviewer.

bottom line. Being smart refers to making right decisions. The sensing component manifests being aware of the context of enterprise operations. Among emerging publications, Guerrini, de Sousa and Yamanari (2018) study goals, business principles and processes in S^3 enterprises. Challenges for such enterprises are discussed among others by Weichhart et al. (2016). Chavarria-Barrientos, Chen, Funes, Molina, Vernadat (2017) propose an operating system for S^3 enterprises. Chavarria-Barrientos, Batres, Perez, Wright and Molina (2016) develop methodology for designing and implementing S^3 manufacturing systems. Miranda, Pérez-Rodríguez, Borja, Wright and Molina (2017) analyse the case study of S^3 product development in a microfactory. Mauricio-Moreno, Miranda, Chavarria, Ramirez-Cadena and Molina (2015) propose the Sustainable x Smart x Sensing (S^3) – Reference Framework to be used by manufacturing SMEs in developing countries.

Allocating resources tends to be one of the most crucial aspects of research on sustainability. Sustainable enterprise resource planning (S-ERP) is a key issue explored in recent year in related literature. There is proposed the S-ERP master plan (Chofreh, Goni, Ismail, Shaharoun, Klemeš and Zeinalnezhad, 2016) consisting of: a roadmap (Chofreh,

Goni and Klemeš, 2016a, 2016b, 2017b, 2018b), a framework (Chofreh, Goni and Klemeš, 2017a, 2018c, 2018d), and guidelines (Chofreh, Goni and Klemeš, 2018a). Using smart technologies for sustainable enterprise resource management is another topic worth mentioning (Sastry, Gowda, Newton and Gopakumar, 2016).

The issue of competitive advantage of sustainable enterprises is the next emerging stream of research. Wang (2012) explores new trends in 'sustainable design centred manufacturing'. Leon (2012) merges the concepts of a knowledge based organisation and a sustainable organisation and explores strategic determinants of developing sustainable knowledge based organisations. Palekhova (2016) discusses the potential of public accountability regarding sustainable development to support the company competitiveness in the Ukrainian context. Bakam Fotso, Edoun and Mbohwa (2018) analyse IT systems, business process reengineering and humans as the enablers of organisational performance.

As highlighted by Izvercian, Ivascu and Potra (2014), sustainable enterprise management encompasses various areas, including among others sales. In this case, sales should be considered in a wide context referring not only to selling goods, but also providing services both in business and public sectors. Huang, Liu and Lin (2011), focusing on Taiwan public administration, study the potential of CRM and the Internet business model to support the relationships with stakeholders in sustainable organisations. Santos and Isaias (2016) study using after-sales and CRM as techniques to differentiate from competitors. Armoni, Nadra, Suarta and Widia (2017) analyse pricing techniques used by small and medium enterprises in the tourism industry. Moreover, the works by Rehman et al. (2016) and Lo, Liou, Wang and Tsai (2018) contribute to the research stream focusing on sales in the context of a sustainable enterprise.

Supply chain management is another issue attracting the attention of researchers focusing their research interest on the issues of a sustainable enterprise. Aarabi, Mat Saman, Khoei, Wong, Beheshti and Zakuan (2011) propose the model of information systems for sustainable supply chain management. Jabbour and De Sousa Jabbour (2016) consider combining the ideas of 'green' human resources management and 'green' supply chain management while searching for synergy to build up sustainable enterprises. Nakano (2013) contributes to the *Handbook of Sustainable Engineering* with explaining the ideas of sustainable

supply chains, sustainable enterprises and sustainable manufacturing. Discussion is supported with analysis of the case of Japan. Rehman et al. (2016) consider possibilities to reduce the amount of big data collected at the customer end to create additional value in sustainable enterprises. Badri Ahmadi et al. (2017) propose the framework for social sustainability in supply chains to be applied in manufacturing companies. Mani, Delgado, Hazen and Patel (2017) analyse the potential of using big data analytics to identify and reduce social risks in supply chain management. Lin, Hung and Hu (2018) present and assess the model used to support decisions on selecting suppliers in the aerospace industry. Er Kara and Firat (2018) analyse the case of a company operating in the heavy machinery industry to study the methodology of clustering based on suppliers' risk profiles in the process of selection of best suppliers. A model for selecting 'green' vendors and allocating orders is also proposed by Lo et al. (2018).

Edgeman (2013) integrates the concepts of business excellence and sustainability into the construct of sustainable enterprise excellence and develops the tool for assessing its maturity. Carayannis, Grigoroudis, Sindakis and Walter (2014) analyse business model innovation as an antecedent of excellence and resilience of an sustainable enterprise. Edgeman and Williams (2014) develop and introduce the model of sustainable enterprise excellence, resilience, robustness and resplendence (SEER). Edgeman and Wu (2016) study the role of supply chain efficiency for sustainable enterprise excellence, resilience and robustness.

6. Conclusions

Summing up, the study has identified and discussed seven streams of research associated with the concept of a sustainable enterprise i.e. (1) sustainable development and sustainable enterprise idea, (2) sustainability, (3) strategic management and functional areas management, (4) human and organisational context, (5) sustainable manufacturing, (6) industrial context and (7) environmental management. Moreover, emerging, 'hot' topics attracting a growing attention of the research community in recent years have been enumerated, which include such issues as: (1) the concept of the sustainable, smart and sensing enterprise, (2) sustainable enterprise resource planning and allocation, (3) building competitive advantage in a sustainable enterprise, (4) managing sales in

a sustainable enterprise, (5) managing sustainable supply chains, and (6) developing sustainable enterprise excellence.

The paper has replicated, with the use of more advanced methodology, and extended the research by Sudolska and Lis (2017). As a bibliometric study, the paper generates the added value mainly from the point of view of the theory development. Through mapping the research field and identifying emerging topics it provides guidelines for further studies, which can be considered as valuable contribution to the theory and research development. Its originality derives from a very limited number of studies which use the methodology of keywords analysis to map the research field and identify leading topics within it.

References

Aarabi, M., Mat Saman, M.Z., Khoei, M.R., Wong, K.Y., Beheshti, H.M., Zakuan, N. (2011), "Conceptual Model for Information Systems of Sustainable Chain Management", *IEEE International Conference on Industrial Engineering and Engineering Management*, art. 6117927, pp. 303–307.

Almeida Dos Santos, A., Vieira Neto, J., Farias Filho, J.R. (2016), "Three Decades in Development the Eco-efficiency: A Bibliometric Study the Activity in Search Literature Scientific Indexed in Scopus Base", *Espacios*, Vol. 37, No. 1, p. 20.

Armoni, N.L.E., Nadra, N.M, Suarta, I.K., Widia, I.W. (2017), "Preferred Pricing Technique Used in Tourism Small and Medium Enterprises in Badung, Bali, Indonesia", *Journal of Physics: Conference Series*, Vol. 953, Issue 1, art 012110.

Badri Ahmadi, H., Kusi-Sarpong, S., Rezaei, J. (2017), "Assessing the Social Sustainability of Supply Chains Using Best Worst Method", *Resources, Conservation and Recycling*, Vol. 126, pp. 99–106.

Bakam Fotso, G., Edoun, E.I., Mbohwa, C. (2018), "Business Enablers and Organisational Performance: Challenges and Opportunities", *ICIEB 18 Proceedings of the 2018 Conference on Internet and e-Business*, pp. 94–98.

Baldwin, J.S., Allen, P.M., Winder, B., Ridgeway, K. (2005), "Modelling Manufacturing Evolution: Thoughts on Sustainable Industrial Development", *Journal of Cleaner Production*, Vol. 13, Issue 9, pp. 887–902.

Baumgartner, R.J., Rauter, R. (2017), "Strategic Perspectives of Corporate Sustainability Management to Develop a Sustainable Organization", *Journal of Cleaner Production*, Vol. 140, pp. 81–92.

Carayannis, E.G., Grigoroudis, E., Sindakis, S., Walter, C. (2014), "Business Model Innovation as Antecedent of Sustainable Enterprise Excellence and Resilience", *Journal of Knowledge Economy*, Vol. 5, Issue 3, pp. 440–463.

Chavarria-Barrientos, D., Chen, D., Funes, R., Molina, A., Vernadat, F. (2017), "An Enterprise Operating System for the Sensing, Smart and Sustainable Enterprise", *IFAC Papers On Line*, Vol. 50, pp. 13052–13058.

Chavarria-Barrientos, D., Batres, R., Perez, R., Wright, P.K., Molina, A. (2016), "A Step Towards Customized Product Realization: Methodology for Sensing, Smart and

Sustainable Enterprises", *IFIP Advances in Information and Communication Technology*, Vol. 480, pp. 327–339.
Chofreh, A.G., Goni, F.A., Shaharoun, A.M., Ismail, S., Klemeš, J.J. (2014), "Sustainable Enterprise Resource Planning: Imperatives and Research Directions", *Journal of Cleaner Production*, Vol. 71, pp. 139–147.
Chofreh, A.G., Goni, F.A., Ismail, S., Shaharoun, A.M., Klemeš, J.J., Zeinalnezhad, M. (2016), "A Master Plan for the Implementation of Sustainable Enterprise Resource Planning Systems (Part I): Concept and Methodology", *Journal of Cleaner Production*, Vol. 136, pp. 176–182.
Chofreh, A.G., Goni, F.A., Klemeš, J.J. (2016a), "A Master Plan for the Implementation of Sustainable Enterprise Resource Planning Systems (Part III): Evaluation of a Roadmap", *Chemical Engineering Transactions*, Vol. 52, pp. 1099–1104.
Chofreh, A.G., Goni, F.A., Klemeš, J.J. (2016b), "A Master Plan for the Implementation of Sustainable Enterprise Resource Planning Systems (Part II): Development of a Roadmap", *Chemical Engineering Transactions*, Vol. 52, pp. 1105–1110.
Chofreh, A.G., Goni, F.A., Klemeš, J.J. (2017a), "Development of a Framework for the Implementation of Sustainable Enterprise Resource Planning", *Chemical Engineering Transactions*, Vol. 61, pp. 1543–1548.
Chofreh, A.G., Goni, F.A., Klemeš, J.J. (2017b), "Development of a Roadmap for Sustainable Enterprise Resource Planning Systems Implementation (Part II)", *Journal of Cleaner Production*, Vol. 166, pp. 425–437.
Chofreh, A.G., Goni, F.A., Klemeš, J.J. (2018a), "Steps Towards the Implementation of Sustainable Enterprise Resource Planning Systems", *Journal of Cleaner Production*, Vol. 70, pp. 283–288.
Chofreh, A.G., Goni, F.A., Klemeš, J.J. (2018b), "A Roadmap for Sustainable Enterprise Resource Planning Systems Implementation (Part III)", *Journal of Cleaner Production*, Vol. 174, pp. 1325–1337.
Chofreh, A.G., Goni, F.A., Klemeš, J.J. (2018c), "Evaluation of a Framework for Sustainable Enterprise Resource Planning Systems Implementation", *Journal of Cleaner Production*, Vol. 190, pp. 778–786.
Chofreh, A.G., Goni, F.A., Klemeš, J.J. (2018d), "Sustainable Enterprise Resource Planning Systems Implementation: A Framework Development", *Journal of Cleaner Production*, Vol. 198, pp. 1345–1354.
Coiera, E., Hovenga, E.J. (2007), "Building a Sustainable Health System", *Yearbook of Medical Informatics*, pp. 11–18.
Cretan, A., Coutinho, C., Bratu, B., Jardim-Goncalves, R. (2012), "NEGOSEIO: A Framework for Negotiations Toward Sustainable Enterprise Interoperability", *Annual Reviews in Control*, Vol. 36, Issue 2, pp. 291–299.
Czakon, W. (2011), "Metodyka systematycznego przeglądu literatury", *Przegląd Organizacji*, No. 3, pp. 57–61.
Ducq, Y., Chen, D., Doumeingst, G. (2012), "A Contribution of Systems Theory to Sustainable Enterprise Interoperability Science Base", *Computers in Industry*, Vol. 63, Issue 8, pp. 844–857.
Donohue, J.C. (1974), *Understanding Scientific Literature: A Bibliometric Approach*, MIT Press, Cambridge.
Edgeman, R. (2013), "Sustainable Enterprise Excellence: Towards a Framework for Holistic Data-Analytics", *Corporate Governance*, Vol. 13, Issue 5, pp. 527–540.

Edgeman, R., Eskilden, J. (2014), "Modelling and Assessing Sustainable Enterprise Excellence", *Business Strategy and the Environment*, Vol. 23, Issue 3, pp. 173–187.

Edgeman, R., Williams, J.A. (2014), "Enterprise Self-Assessment Analytics for Sustainability, Resilience and Robustness", *TQM Journal*, Vol. 26, Issue 4, pp. 368–381.

Edgeman, R., Wu, Z. (2016), "Supply Chain Criticality in Sustainable and Resilient Enterprises", *Journal of Modelling in Management*, Vol. 11, Issue 4, pp. 869–888.

Er Kara, M., Firat, S.O. (2018), "Supplier Risk Assessment Based on Best-Worst Method and k-means Clustering: A Case Study", *Sustainability*, Vol. 10, Issue 4, art. 1066.

Espinoza, A., Porter, T. (2011), "Sustainability, Complexity and Learning: Insights from Complex Systems Approaches", *Learning Organization*, Vol. 18, Issue 1, pp. 54–72.

Fan, K.-S. (2005), "Management and Performance of Taiwan's Waste Recycling Fund", *Journal of the Air and Waste Management Association*, Vol. 55, Issue 5, pp. 574–582.

Fisher, M., Kingsbury, T., Headley, L. (2004), "Sustainable Electrical and Electronic Plastics Recycling", *Proceedings of the 2004 IPEE International Symposium on Electronics and the Environment*, Scottsdale, AZ.

Guerrini, F.M., de Sousa, T.B., Yamanari, J.S. (2018), "Sensing, Smart and Sustainable S^3 Enterprises: Principles, Goals and Rules", *IFIP Advances in Information and Communication Technology*, Vol. 534, pp. 147–155.

Gunasekaran, A., Jabbour, C.J.C., Jabbour, A.B.L.D.S (2014), "Managing Organizations for Sustainable Development in Emerging Countries: An Introduction", *International Journal of Sustainable Development and World Ecology*, Vol. 21, Issue 3, pp. 195–197.

Guo, D., Chen, H., Long, R., Lu, H., Long, Q. (2017), "A Co-Word Analysis of Organizational Constraints for Maintaining Sustainability", *Sustainability*, Vol. 9, Issue 10, art. 1928.

Hart, S.L., Dowell, G. (2011), "A Natural-Resource-Based View of the Firm: Fifteen Years After", *Journal of Management*, Vol. 37, Issue 5, pp. 1464–1479.

Hart, S.L., Milstein, M.B. (2003), "Creating Sustainable Value", *Academy of Management Executive*, Vol. 17, No. 2, pp. 56–69.

Huang, S.-Y., Liu, H.-Y., Lin, Y.-C. (2011), "Addressing the Position in a Customer-Focused Internet Business Model: The Diversity between Central Agencies and Local Agencies in Taiwan's e-government", *Proceedings of the 5th International Conference on New Trends in Information Science and Service Science*, Vol. 2, pp. 334–339.

Izvercian, M., Ivascu, L., Potra, S. (2014), "Enterprise Sustainability Management: An Emergent Approach and Research Imperatives", *Proceedings of the 24th International Business Information Management Association Conference – Crafting Global Competitive Economies: 2020 Vision Strategic Planning and Smart Implementation*, pp. 440–449.

Jabbour, C.J.C. (2015), "Environmental Training and Environmental Management Maturity of Brazilian Companies with ISO 14,001: Empirical Evidence", *Journal of Cleaner Production*, Vol. 96, pp. 331–338.

Jabbour, C.J.C, Santos, F.C.A. (2008), "The Central Role of Human Resource

Management in the Search for Sustainable Organizations", *International Journal of Human Resource Management*, Vol. 19, Issue 12, pp. 2133–2154.
Jabbour, C.J.C, De Sousa Jabbour, A.B.L. (2016), "Green Human Resource Management" and Green Supply Chain Management: Linking Two Emerging Agendas", *Journal of Cleaner Production*, Vol. 112, pp. 1824–1833.
Keijzers, G. (2002), "The Transition to the Sustainable Enterprise", *Journal of Cleaner Production*, Vol. 10, Issue 4, pp. 349–359.
Kerr, I.R. (2006), "Leadership Strategies for Sustainable SME Operations", *Business Strategy and Environment*, Vol. 15, Issue 1, pp. 30–39.
Kim, W., Khan, G.F., Wood, J., Mahmood, M.T. (2016), "Employee Engagement for Sustainable Organizations: Keyword Analysis Using Social Network Analysis and Burst Detection Approach, *Sustainability*, Vol. 8, Issue 7, art. 631.
Leon, R.-D. (2012), "Strategic Factors for Developing Sustainable Knowledge Based Organizations", *Proceedings of the European Conference on Knowledge Management*, Vol. 1, pp. 618–625.
Lin, C., Hung, K.-P., Hu, S.-H. (2018), "A Decision Making Model for Evaluating and Selecting Suppliers for the Sustainable Operation and Development of Enterprises in the Aerospace Industry", *Sustainability*, Vol. 10, Issue 3, art. 735.
Lo, H.-W., Liou, J.J.H., Wang, H.S., Tsai, Y.-S. (2018), "An Integrated Model for Solving Problems in Green Supplier Selection and Order Allocation", *Journal of Cleaner Production*, Vol. 190, pp. 339–352.
Lozano, R. (2008), "Developing Collaborative and Sustainable Organizations", *Journal of Cleaner Production*, Vol. 16, Issue 4, pp. 499–509.
Mani, V., Delgado, C., Hazen, B.T, Patel, P. (2017), "Mitigating Supply Chain Risk Via Sustainability Using Big Data Analytics: Evidence from Manufacturing Supply Chain", *Sustainability*, Vol. 9, Issue 4, art. 608.
Mauricio-Moreno, H., Miranda, J., Chavarria, D., Ramirez-Cadena, M., Molina, A. (2015), "Design S3-RF (Sustainable x Smart x Sensing – Reference Framework) for the Future Manufacturing Enterprise", *IFAC Papers on Line*, Vol. 28, Issue 3, pp. 58–63.
Miranda J., Pérez-Rodríguez, R., Borja, V., Wright, P.K., Molina, A. (2017), "Integrated Product, Process and Manufacturing System Development Reference Model to Develop Cyber-Physical Production Systems – The Sensing, Smart and Sustainable Microfactory Case Study, *IFAC Papers on Line*, Vol. 50, pp. 13065–13071.
Nakano, M. (2013), "Supply Chain Management for Sustainability", in: Kauffman, J., Lee, K.-M. (Eds.), *Handbook of Sustainable Engineering*, Springer, Dordrecht, pp. 427–450.
Nelson, E.C., Batalden, P.B., Mohr, J.J., Plume, S.K. (1998), "Building a Quality Future", *Frontiers of Health Services Management*, Vol. 15, Issue 1, pp. 3–32.
Palekhova, L. (2016), "Achieving the Competitiveness Through Public Accountability on Sustainable Development", *Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu*, Issue 2, pp. 162–167.
Rehman, M.H.U., Chang, V., Batool, A., Wah, T.Y. (2016), "Big Data Reduction Framework for Value Creation in Sustainable Enterprises", *International Journal of Information Management*, Vol. 36, Issue 6, pp. 917–928.
Sanchez, P.A., Leakey, R.R.B. (1997), "Land Use Transformation in Africa: Three

Determinants for Balancing Food Security with Natural Resource Utilization", *European Journal of Agronomy*, Vol. 7, Issue 1–3, pp. 15–23.

Santos, C., Isaias, P. (2016), "After-sales and CRM: Their Role as a Differentiation Strategy for Clients", in: Kommers, P., Abraham, A.P., Roth, J. (Eds.), *2016 Multi Conference on Computer Science and Information Systems*, International Association for Development of the Information Society, pp. 66–72.

Sarros, J.C., Cooper, B.K., Santora, J.C. (2011), "Leadership Vision, Organizational Culture, and Support for Innovation in not-for-profit and for-profit Organizations", *Leadership and Organization Development Journal*, Vol. 32, Issue 3, pp. 291–309.

Sastry, G., Gowda, R.R., Newton, A., Gopakumar (2016), "Smart Technologies for Sustainable Enterprise Resource Management: An Illustration of Progress and Prospects", *Proceedings of the International Symposium on Technology and Society*, pp. 71–75.

Seidel, S., Recker, J., Vom Brocke, J. (2012), "Green Business Process Management", in: Vom Brocke, J., Seidel, S., Recker, J. (Eds.), *Green Business Process Management: Towards the Sustainable Enterprise*, Springer, Heidelberg, pp. 3–13.

Seidel, S., Recker, J., Vom Brocke, J. (2013), "Sensmaking and Sustainable Practicing: Functional Affordances of Information Systems in Green Transformations", *MIS Quarterly*, Vol. 37, Issue 4, pp. 1275–1299.

Shrivastava, P., Kennelly, J.J. (2013), "Sustainability and Place-Based Enterprise", *Organization and Environment*, Vol. 26, Issue 1, pp. 83–101.

Shrivastava, P., Ivanaj, S., Persson, S. (2013), "Transdisciplinary Study of Sustainable Enterprise", *Business Strategy and the Environment*, Vol. 22, Issue 4, pp. 230–244.

Sudolska, A., Lis, A. (2017), "Sustainable Enterprise and Sustainable Organisation: Mapping the Research Field with Keywords Analysis", *Journal of Corporate Responsibility and Leadership*, Vol. 4, Issue 3, pp. 155–168.

Sudolska, A., Lis, A. (2018), "Research Profiling on a Sustainable Enterprise and a Sustainable Organization", *Zeszyty Naukowe Politechniki Śląskiej: Organizacja i Zarządzanie*, Vol. 127, Issue 3, pp. 263–272.

Sweet, S., Roome, N., Sweet, P. (2003), "Corporate Environmental Management and Sustainable Enterprise: The Influence of Information Processing and Decision Styles", *Business Strategy and the Environment*, Vol. 12, Issue 4, pp. 265–277.

Teece, D.J. (2007), "Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance", *Strategic Management Journal*, Vol. 28, Issue 13, pp. 1319–1350.

Van Eck, N.J., Waltman, L. (2009), "Software Survey: VOSviewer, a Computer Program for Bibliometric Mapping", *Scientometrics*, Vol. 84, Issue 2, pp. 523–538.

Wang, S.-H. (2012), "Trends in Sustainable Design Centered Manufacturing", *Advanced Materials Research*, Vol. 579, pp. 494–500.

Weerawardena, J., McDonald, R.E., Mort, G.S. (2010), "Sustainability of Nonprofit Organizations: An Empirical Investigation", *Journal of World Business*, Vol. 45, Issue 4, pp. 346–356.

Weichhart, G., Molina, A., Chen, D., Whitman, L.E., Vernadat, F. (2016), "Challenges and Current Developments for Sensing, Smart and Sustainable Enterprise Systems", *Computers in Industry*, Vol. 79, pp. 34–46.

Yoshida, Y., Sandall, J. (2013), "Occupational Burnout and Work Factors in

Community and Hospital Midwives: A Survey Analysis", *Midwifery*, Vol. 29, Issue 8, pp. 921–926.
Zollo, M., Cennamo, C., Neumann, K. (2013), "Beyond What and Why: Understanding Organizational Evolution Towards Sustainable Enterprise Models", *Organization and Environment*, Vol. 26, Issue 3, pp. 241–259.