How Knowledge Management is Approached in Circular Economy Academic Research?

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Abstract

The main objective of the paper is to gain understanding and overview of how knowledge management practices are understood and approached in the current academic research of circular economy with the focus on business life. A systematic literature review was conducted to identify knowledge management concepts, implemented knowledge management methods, tools or models as well as the areas of knowledge management theory applications and the contexts of applications in the existing academic papers. The aim of the paper behind the main objective is not only to summarize existing evidence but also to draw attention of business practice to the role of knowledge management and complex knowledge ecosystems for meeting the circular economy challenges and overcoming the circular economy barriers.
For this paper peer-reviewed journals articles included in the Web of Science and SCOPUS databases were analysed within the systematic literature review. The main findings show that most of the current body of knowledge management theory is ignored in circular economy and circular business literature and the interest is focused mainly on knowledge sharing, knowledge acquisition and lack of knowledge while other important themes are not elaborated at all or only marginally.

Keywords – Knowledge management, Knowledge ecosystems, Circular economy, Systematic literature review

Paper type – Academic Research Paper

1 Introduction

Circular economy (also CE) is rapidly developing phenomenon which is strongly promoted by many governments worldwide and also in the European Union through different policies, legislation and regulations (Kalmykova et al, 2018) but also by supporting and supportive programmes and actions. CE is an umbrella term encompassing heterogeneous initiatives, multiple schools of thoughts and their principles belonging to the sustainability and sustainable development and sustainable growth movement (Blomsma and Brennan, 2017; Pauliuk, 2018). The „wide-angle view" of the

coverage and complexity of CE concept is reflected also in the understanding of CE given by Murray et al (2017, p. 5) who define it as a ―*general term covering all activities…*― that indirectly in the form of policies, strategies and programs or directly in a real life practice aims to ―.*reduce, reuse, and recycle materials in production, distribution, and consumption processes*". The core idea behind CE movement lies in still more urgent problematic global situation when the pursuit of the economic growth leads to serious eco-environmental degradation, to the reduction of the biosphere reproductive capacity (Merli et al, 2018) and to destruction of whole ecosystems (Winn and Pogutz, 2013) which in turn - with some delay - negatively influences also business environment (Dean and McMullen, 2007).

In the business practices the ideas and principles of CE are rather difficult to implement as the transition from the linear way of doing the business into the circular one needs specific innovative capabilities and knowledge of a network of stakeholders within and around the firms (Ritzén and Sandström, 2017; Govindan and Hasanagic, 2018). Closer collaboration with stakeholders (and with more and new stakeholders) especially from the external environment and more intensive utilization of the information technology is inevitable for provision of circular flows of products, packaging, information, finance and knowledge and to make business to become circular (Lahti et al, 2018) as the needed – and sometimes specific - skills, capabilities, knowledge and other resources often ―*reside outside of the organizational boundaries*" (Levering and Boss, 2018, p. 44).). Circular value creation and value delivery may also have different impact on the environmental ecosystems (that also can be different) (Zucchella and Previtali, 2018, in press). All these differences are connected also with the changes in knowledge ecosystems and knowledge management (also KM) – of the focal firm and of its stakeholders.

Not only new knowledge will be created with new actors and new processes, but also new patterns and new processes will emerge of how to acquire, capture, analyse, utilize, store and share the knowledge. KM plays the essential role in sustainable and competitive value creation reflected in the organisational performance in general (Schiuma et al, 2012) as well as it plays the crucial role for designing adequate and not only the circular economy promoting knowledge ecosystem (Valkokari, 2015). However, until now there is no study identifying state of the art in the literature and highlighting research gaps and areas of concern for the practice and future research in case of KM in CE.

The main objective of the paper is to gain understanding and overview of how knowledge management practices are understood and approached in the current academic research of circular economy with the focus on business life through the systematic review of literature. As the novelty accompanies circular economy concept, the research questions which guide the review are as following:

How is knowledge management conceived in circular economy theory?

What novel, specific and innovative characteristics and features of knowledge management explored, studied and published are related to circular economy and what specific knowledge, skills, competencies, capabilities are needed in CE?

The first section of the paper presents research approach, in the second results of systematic review are summarized and discussed. Finally, conclusions are drawn, and future research streams are outlined.

2 Methodology

To reach the objective, a systematic literature review was conducted. The main purpose of a systematic review is to identify the key theory-based understanding of the phenomenon of interest (Becheikh et al, 2006), to map —what" and —how" issues in the theory and also to identify gaps in current knowledge and delineate the avenues for future research (Aquilani et al, 2017). Based on Correia et al (2017) the process of the review employed for this paper consists of three broad and general phases: *1) problem formulation and question identification* (see Introduction)*; (2) literature search and conducting the review; and (3) reporting results*—(next chapter). For the review of final selected articles, the content analysis was performed.

Only peer-reviewed articles written in English were included in the search. They were obtained by querying the Web of Science and Scopus databases. These databases are commonly used for the purpose of a systematic literature review and are considered as the most comprehensive scientific databases (Aghaei Chadegani et al, 2013). No other exclusion criteria were applied e.g. for publication years and research areas. First, only the basic combination of the general terms —knowledge management" AND —circular economy" was used, but only 3 (Web of Science) and 4 (Scopus) articles were found with one overlap. Therefore, in the second search broader term of —knowledge" (instead of —knowledge management") was applied. This resulted in 152 articles in Web of Science and 159 articles in Scopus, with 132 overlapping cases.

After the inspection of titles, abstracts and keywords 47 articles entered the step of the whole text screening. The excluded articles did not correspond to the research aims as in the title, abstract or key words they mentioned either one or both keywords in other context than was needed for the review. For the inclusion/exclusion business context of the article must be presented. Full text screening of 47 articles involved evaluation of the relevancy of articles in term of the typical representative concepts and terms of KM that are relevant and connected to KM practices. Similar to the approach to understand the scope of CE also in this case the screening was realized using list of the concepts and terms based on the brief review of 20 most cited articles on —knowledge management" in Web of Science supplemented by the search results of 30 most cited articles within the period 2016 – 2019. Again, in this step – despite promising wording of the titles and abstracts – exclusion of several articles was done if KM was only touched upon, but KM was not the main area or at least one of the areas examined in the articles. The list is not exhaustive and both list and references – due to the limited extent of paper - are available on request from the author.

Thorough reading of the body of the texts lead to the further elimination, so the final list consists of 23 articles relevant to the point of interest. From the 47 articles which entered the steps before the final analysis one was not available.

3 Results

CE needs KM which would help to process, store, visualize, share, exchange amount of data and information from, to and about stakeholders, processes and products and materials involved in circular business in the efficient and effective manner. Online platforms seem to be an appropriate tool for this issue. This is confirmed for instance in the article exploring the role of institutional capacity-building through industrial symbiosis in the development of a circular economy. *(de Abreu and Ceglia, 2018). Online platforms help to* reduce uncertainties and implement a trustful business, they are an important source of information that firms could use to find business opportunities and they also promote synergies. Collaboration and data sharing tools as very helpful for harnessing knowledge-bases outside traditional knowledge areas needed for the innovative activities are mentioned in the research among waste management sector managers in Sweden (Aid et al, 2017).

Information availability and visibility is crucial for a product lifecycle management (PLM) system and product and material passports are considered to be very helpful to provide right information aiming to increase efficiency in resource management. Research done by Portillo-Barco and Charnley (2015) shows how challenging is to develop the content of a product passport (identification of data requirements and applications of sensing technologies) which would meet all requirements for data and information of the relevant stakeholders and reflect also specific condition of the environment through which product flows in cycles.

For designers and engineers in case of remanufacturing and recycling the knowledge of disassembly time is essential information for designers and engineers to make changes or adaptation into the process (and product design), however this knowledge is gained at the dismantling and de-manufacturing centres. Mandolini et al (2018) suggest and test method which enable to assess the disassembly time, estimated by using an exact disassembly sequence planning approach and a structured repository for the classification of knowledge about elementary disassembly tasks.

Tolio et al ((2017) present a broader and deeper view on different information and knowledge flow for CE in material engineering. They reviewed methods and tools as well as strategies for different CE processes in manufacturing – both theoretical and from practise and gather also information and knowledge processing-related examples.

Jiang et al (2019) proposed and tested a new hybrid method combing rough set (RS) and cased-based reasoning (CBR) for remanufacturing process planning of cores with an interactive interface. This method based on mathematical modelling helps to reuse knowledge generated from existing used parts intended for remanufacturing to facilitate process planning for the new arrival of used parts. The interface allows a user to input important information for decision making related to remanufacturing regarding part as well as failure(s) characteristics. Evaluation of the input information offers user recommendation for remanufacturing.

Network of actors (or stakeholders) represents one of the most important themes in CE. All empirical, all reviews, most of the mixed and some of the conceptual

methodology-based articles deal with issue. Barrie et al (2019) explored the position and role of the triple helix-based system intermediary as an approach to governance for tacit and explicit knowledge transfer, exchange and coordination and facilitation of shared learning in national industrial biotechnology niche network. They also developed concept of ―Totaknowledge transfer" which *―is a multiplex relational attribute formed through the combination of values from tacit and explicit knowledge transfer relational attributes facilitating shared learning*" (p. 2013). *De Abreu and Ceglia (2018)* explored the role of institutional capacity-building through industrial symbiosis. Three dimensions of the institutional capacity must but managed – knowledge and relational resources and capacity for mobilization. Formal structure of industrial symbiosis is beneficial for the development of the CE. Wang et al (2017) confirm the role of a network in industrial symbiosis by promoting relational links across organisations and governance levels. Network, purposely managed helps to increase various types of knowledge.

For a network to work effectively and efficiently collaboration is indispensable. Xiang and Yuan (2018) proposed and tested a ―Collaboration-driven mode" based on information sharing which incorporated all relevant information sharing paths and their contents among stakeholders, role and description of role of promoters in the mode and the incentive strategies for information sharing.

Facilitation of networking can be realized via ICT online tools (or the aforementioned platforms). Alvarez and Ruiz-Puente (2017) present ―SymbioSyS", a tool which helps to promote the sustainable use of resources through building of a large database that stores both more or less tacit knowledge of experiences and practices and explicit information about activities.

Leadership, role of champion and enthusiasm and collaborative experimentation within innovative activities, the role of a change agent and an industrial symbiosis promoter for knowledge generation and sharing within CE networks of actors are also stressed as the KM approaches to support transition towards CE (Brown et al, 2019; de Abreu and Ceglia, 2018).

Salvia and Quaranta (2018) present findings from their research studying the attitudes and perceptions of groups of cereal farmers regarding two projects in Basilicata (Italy) region with the aim to return the old traditional knowledge to the nowadays practice of land use and so to reduce production costs and promote soil conservation. They found that full understanding of the advantages/ disadvantages of approaches, transparency of recommendations, more confidence in trusting recommendations for practical applications from other farmers than from researchers and high involvement in the process of learning is critical for the success of transition to this CE practice. Based on the findings from the interviews and survey the authors propose the adaptation of SECI model of KM: 1. receive knowledge (the best source are those who share the same problem), 2. identify knowledge as useful, 3. understand implications of knowledge, 4. choose options to work on knowledge, 5. action the option(s), 6. evaluate results of action(s) and 7. share evaluation with others.

Bueren et al (2018) analysed four existing plant breeding orientations and based on the positive and negative feature suggested the novel approach – „a systems-based

breeding". Plant breeding is an extremely complex process with long-term impact on whole ecosystem(s). This is why transdisciplinarity of knowledge is needed to create a synergy of social and natural sciences and integration of knowledge at and from various levels – socio-economic, agro-ecological among all. The importance of transdisciplinarity for CE, especially for the transition from linear to circular economy is accented also by Marra et al (2018). The authors reviewed 1244 research publications on circular economy and revealed that existing body of knowledge for macro or policy making level, which creates necessary conditions for CE – is extremely deficient and what is missing (also for micro and meso levels) is knowledge coming from social sciences, economics and behavioural sciences and their integration. To this stream of research findings from Antonnen et al (2018) review of key industrial texts, policy reports and abstracts of the academic articles devoted to CE utilizing topic modelling methodology can be added. The aim of the review was to discover how big is "the consensus space" of three institutional spheres of Triple-Helix (industry, government and university) which constitutes an important system to accomplish systemic innovations typical for CE success. Their findings show that the consensus space is rather small, and many crucial aspects of CE functioning are missing not only in this space but also in the individual domains. They point especially to consumer behaviour (in larger social dimension view) and paradoxically also environmental dimension of sustainability (as the current interest is concentrated only on a few areas).

Mutual learning and sharing of the individual knowledge of designers designing CE products and processes is incorporated into the serious game for professionals called „In the Loop: The Critical Raw Materials Game", developed and tested by Whalen and Peck (2014). Their article is one of the several examples dealing with the changing role and capabilities of designer in CE environment. Mutual learning and increase of understanding as well as overcoming biases for human-machine interfaces is evaluated by Arnold (2018) through the application of a "structural systemic constellations" as an innovative tool which might help to integrate unconscious knowledge in a research context and should be suitable especially in complex systems that are typical in CE. Workshops are another way how to stimulate common understanding and support sharing of knowledge and generation of new knowledge (*De Abreu and Ceglia, 2018).*

With regard to consumers 3 articles pay closer attention to this stakeholder and his role in CE in case of KM. Lofthouse and Prendeville (2018) discuss the role of designers in CE who should integrate knowledge from the social sciences (especially consumption, consumer psychology, cultural studies. Also research on design needs to develop knowledge on how to design products and services for different circular business models "*by considering norms, behaviours, attitudes and the contexts of people's social live*" (p. 466).

Seminal article written by Tukker (2015) on Product Service Systems (PSS) points to challenges and problems with convincing consumers to shift from the ownership to relatively more circular business models. This may be ranked to the "know-why" and "know-what" issue from KM. In context of PSS Hobson et al (2018) discusses empirical research exploring consumers' reactions to a novel, hypothetical mobile phone. Research

examines consumers' knowledge about current mobile phone life cycles, and responses to the proposed product service system. Action-based research demonstrates also the function of a ―systems of practice" framework to discuss the potential for significant changes in phone purchase and use stemming from the increase of understanding and awareness of the complexity of phone production, distribution and recovery options.

Some articles stress role of designers and innovators for CE and also changes of their role, especially in the broadening of the scope of their work. This is reflected in new knowledge, skills and capabilities requirements. De los Rios and Charnley (2017) focus directly on designers and allege that for designer a variety of new capabilities will be needed„*from deeper knowledge of material composition to rich understanding of social behaviour*―(p. 109). *Brown et al (2019) point to both* ***hard capabilities and soft skills*** *needed for collaborative circular innovation-oriented activities of companies. Specific hard capabilities include* specific CE design strategies and product criteria that are linked to different recovery operations across whole product life cycle considering multiple life cycles as well together with the incorporation of knowledge and requirements of stakeholders in circular value network. Knowledge might be rather interdisciplinary and includes also assessment of impacts across multiple product life-cycles and not only at the individual but at the system network level. Skills to build and support collaboration with stakeholders vital for successful circular business models and to translate and communicate CE complexity into a clear future vision to be fully comprehended by stakeholders who operationalize business models belong to the most important soft skills. Barrie et al mention also an urgent need of ―transition thinking" for CE.

Specific manual and technological skills for core CE activities and more complex cognitive skills for the CE enabling activities that should be part of the educational curricula and trainings programs for the future were investigated by Burger et al (2019) in the U.S.A. environment, nevertheless with the general applicability anywhere. They stress particularly skills to collaborate to create joint value, to design for the future, to incorporate digital technology, to be able to prioritise regenerative resources, to use waste as a resource. To rethink the business models, complex problem-solving skills and resource management skills.

Tukker (2015) demonstrates that particularly result-oriented PSS requires different and specific skills (product knowledge and more dedicated and unique customer knowledge and customer and relation management skills) and also the organization. Knowledge is generated not only form relationships but also from remote monitoring and maintenance systems incorporated into the product and tracking the performance. Bottom-up knowledge sharing techniques are supportive to PSS design.

Van Schalkwyk et al (2018) reviewed literature on the metallurgical knowledge, the behaviour of technology elements and existing simulation and modelling techniques in lead metallurgy, which is considered to be a key to the CE. The authors also think about challenges of digitalization for tracking the metallurgical knowledge. The conclusions show that there are big gaps in current knowledge which make barriers for process optimisation and more efficient use of metals in CE.

Aid et al (2017) looked into the Swedish waste management sector and analysed challenges for inter organizational resource network to create circular value offer. Core competencies or in-house technical knowledge of waste management companies are identifying, developing, and implementing solutions (specifically sorting and valuation technology knowledge) for complex wastes and by-products. Advanced market and technology intelligence are perceived to be of increasing importance for companies

Barrie et al (2019) highlight specific transition thinking for the successful move from linear to circular business model.

4 Conclusions

Review manifest enormous inattention to knowledge management in CE theory in comparison to many other fields of study and this conclusion only support idea of Jabbour et al (2017, in press) that CE as a body of knowledge is in its infancy but also the statement that it ―*is an exercise in knowledge creation and application*….” (de Abreu and Ceglia, 2018, p. 106).

Paper has several limitations. For instance, conference papers should be included into the review or other databases as well.

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References

Aquilani, B., Silvestri, C., Ruggieri, A. and Gatti, C. (2017) ―A systematic literature review on total quality management critical success factors and the identification of new avenues of research―, The TQM Journal, Vol. 29, No.1) pp. 184-213.

Aghaei Chadegani, A., Salehi, H., Yunus, M., Farhadi, H., Fooladi, M., Farhadi, M. and Ale Ebrahim, N. (2013) ―A comparison between two main academic literature collections: Web of Science and Scopus databases―, Asian Social Science, Vol. 9, No. 5, pp. 18-26.

Aid, G., Eklund, M., Anderberg, S. and Baas, L. (2017) ―Expanding roles for the Swedish waste management sector in inter-organizational resource management―, Resources, Conservation and Recycling, Vol. 124, pp. 85-97.

Alvarez, R. and Ruiz-Puente, C. (2017) ―Development of the tool symbiosis to support the transition towards a circular economy based on industrial symbiosis strategies―, Waste and biomass valorization, Vol. 8, No. 5, pp. 1521-1530.

Anttonen, M., Lammi, M., Mykkänen, J. and Repo, P. (2018) ―Circular Economy in the Triple Helix of Innovation Systems―, Sustainability, Vol. 10, No. 8, No. 2646.

Arnold, M. G. (2018) ―Combining conscious and unconscious knowledge within human-machine-interfaces to foster sustainability with decision-making concerning production processes―, Journal of Cleaner Production, No. 179, pp. 581-592.

Barrie, J., Zawdie, G. and João, E. (2019) ―Assessing the role of triple helix system intermediaries in nurturing an industrial biotechnology innovation network‖, Journal of Cleaner Production, No. 214, pp. 209-223.

Becheikh, N., Landry, R. and Amara, N. (2006) ―Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003‖, Technovation, Vol. 26, No. 5-6, pp. 644-664.

Blomsma, F. and Brennan, G. (2017) ―The emergence of circular economy: A new framing around prolonging resource productivity‖, Journal of Industrial Ecology, Vol. 21, No. 3, pp. 603-614.

Brown, P., Bocken, N. and Balkenende, R. (2019) ―Why Do Companies Pursue Collaborative Circular Oriented Innovation? ‖, Sustainability, Vol. 11, No. 3, No. 635.

Burger, M., Stavropoulos, S., Ramkumar, S., Dufourmont, J. and van Oort, F. (2019) ―The heterogeneous skill-base of circular economy employment‖, Research Policy, Vol. 48, No. 1, pp. 248-261.

Centobelli, P., Cerchione, R. and Esposito, E. (2017) ―Knowledge management in startups: Systematic literature review and future research agenda‖, Sustainability, Vol. 9, No. 3, No. 361.

Correia, E., Carvalho, H., Azevedo, S. and Govindan, K. (2017) ―Maturity models in supply chain sustainability: A systematic literature review‖, Sustainability, Vol. 9, No.), No. 64.

de Abreu, M. C. S. and Ceglia, D. (2018) ―On the implementation of a circular economy: The role of institutional capacity-building through industrial symbiosis‖, Resources, Conservation and Recycling, No.138, pp. 99-109.

Dean, T. J. and McMullen, J. S. (2007) ―Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action‖, Journal of Business Venturing, Vol. 22, No.1, pp. 50-76.

De los Rios, I. C. and Charnley, F. J. (2017) ―Skills and capabilities for a sustainable and circular economy: The changing role of design‖, Journal of Cleaner Production, No.160, pp. 109-122.

Govindan, K. and Hasanagic, M. (2018) ―A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective‖, International Journal of Production Research, Vol. 56, No. 1-2, pp. 278-311.

Hobson, K., Lynch, N., Lilley, D. and Smalley, G. (2018) ―Systems of practice and the Circular Economy: Transforming mobile phone product service systems‖, Environmental innovation and societal transitions, No. 26, pp. 147-157.

Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Sarkis, J. and Godinho Filho, M., (2017 in press) ―Unlocking the circular economy through new business models based on large-scale data: An integrative framework and research agenda‖, Technological Forecasting and Social Change.

Jiang, Z., Jiang, Y., Wang, Y., Zhang, H., Cao, H. and Tian, G. (2019) ―A hybrid approach of rough set and case-based reasoning to remanufacturing process planning‖, Journal of Intelligent Manufacturing, Vol. 30, No. 1, pp. 19-32.

Kalmykova, Y., Sadagopan, M. and Rosado, L., (2018) ―Circular economy–From review of theories and practices to development of implementation tools‖, Resources, Conservation and Recycling, No. 135, pp. 190-201.

Lahti, T., Wincent, J. and Parida, V., (2018) ―A Definition and Theoretical Review of the Circular Economy, Value Creation, and Sustainable Business Models: Where Are We Now and Where Should Research Move in the Future? ‖, Sustainability, Vol. 10, No. 8, 2799, pp. 1-19.

Levering, R. and Vos, B., (2019) Organizational Drivers and Barriers to Circular Supply Chain Operations in Operations Management and Sustainability, ed. L. De Boer and P.H. Andersen, Palgrave Macmillan, Cham.

Lieder, M., Asif, F. M. and Rashid, A. (2017) ―Towards Circular Economy implementation: an agent-based simulation approach for business model changes―,Autonomous Agents and Multi-Agent Systems, Vol. 31, No. 6, pp. 1377-1402.

Lofthouse, V. and Prendeville, S. (2018) ―Human-centred design of products and services for the circular economy–a review―,The Design Journal, Vol. 21, No. 4, pp. 451-476.

Mandolini, M., Favi, C., Germani, M. and Marconi, M. (2018) ―Time-based disassembly method: how to assess the best disassembly sequence and time of target components in complex products―,The International Journal of Advanced Manufacturing Technology, Vol. 95, No. 1-4, pp. 409-430.

Marra, A., Mazzocchitti, M. and Sarra, A. (2018) ―Knowledge sharing and scientific cooperation in the design of research-based policies: The case of the circular economy―,Journal of Cleaner Production, No. 194, pp. 800-812.

Merli, R., Preziosi, M. and Acampora, A. (2018) ―How do scholars approach the circular economy? A systematic literature review―,Journal of Cleaner Production, No. 178, pp. 703-722.

Murray, A., Skene, K. and Haynes, K. (2017) ―The circular economy: An interdisciplinary exploration of the concept and application in a global context―,Journal of Business Ethics, Vol. 140, No. 3, pp. 369-380.

Pauliuk, S. (2018) ―Critical appraisal of the circular economy standard BS 8001: 2017 and a dashboard of quantitative system indicators for its implementation in organizations―,Resources, Conservation and Recycling, No. 129, pp. 81-92.

Portillo-Barco, C. and Charnley, F. (2015) ―Data requirements and assessment of technologies enabling a product passport within products exposed to harsh environments: a case study of a high pressure nozzle guide vane―,International Journal of Product Lifecycle Management, Vol. 8, No. 3, pp. 253-282.

Ritzén, S. and Sandström, G. Ö., (2017) ―Barriers to the Circular Economy–integration of perspectives and domains―,Procedia CIRP, No. 64, pp. 7-12.

Salvia, R. and Quaranta, G. (2018) ―An Iterative Approach for Knowledge Production in the Agricultural Systems and Insights for IS Development", International Journal of Agricultural and Environmental Information Systems (IJAEIS), Vol. 9, No. 4, pp. 45-57.

Schiuma, G., Carlucci, D. and Lerro, A., (2012) "Managing knowledge processes for value creation", VINE, Vol. 42, Iss 1 pp. 4-14.

Tolio, T., Bernard, A., Colledani, M., Kara, S., Seliger, G., Duflou, J., ... and Takata, S. (2017) ―Design, management and control of demanufacturing and remanufacturing systems―,CIRP Annals, Vol. 66, No. 2, pp. 585-609.

Tukker, A. (2015) ―Product services for a resource-efficient and circular economy–a review―,Journal of Cleaner Production, No. 97, pp. 76-91.

Valkokari, K. (2015) ―Business, innovation, and knowledge ecosystems: how they differ and how to survive and thrive within them―,Technology Innovation Management Review, Vol. 5, No. 8, pp. 17-24.

van Bueren, E. T. L., Struik, P. C., van Eekeren, N. and Nuijten, E. (2018) ―Towards resilience through systems-based plant breeding. A review―,Agronomy for Sustainable Development, Vol. 38, No. 5, pp. 1-21.

Van Schalkwyk, R. F., Reuter, M. A., Gutzmer, J. and Stelter, M. (2018) ―Challenges of digitalizing the circular economy: Assessment of the state-of-the-art of metallurgical carrier metal platform for lead and its associated technology elements―,Journal of Cleaner Production, No. 186, pp. 585-601.

Wang, Q., Deutz, P. and Chen, Y. (2017) ―Building institutional capacity for industrial symbiosis development: A case study of an industrial symbiosis coordination network in China―,Journal of Cleaner Production, No. 142, pp. 1571-1582.

Whalen, K. and Peck, D. (2014) ―In the Loop–Sustainable, Circular Product Design and Critical Materials―International Journal of Automation Technology, Vol. 8, No. 5, pp. 664-676.

Winn, M. I. and Pogutz, S. (2013) ―Business, ecosystems, and biodiversity: New horizons for management research―Organization & Environment, Vol. 26, No. 2, pp. 203-229.

Xiang, P. and Yuan, T. (2019) ―A collaboration-driven mode for improving sustainable cooperation in smart industrial parks", Resources, Conservation and Recycling, No. 141, pp. 273-283.

Zucchella, A. and Previtali, P., (2018, in press) ―Circular business models for sustainable development: A ―waste is food" restorative ecosystem―, Business Strategy and the Environment, Vol. 28, No. 2, pp. 274-285.