Circular economy: Barriers to change from linear to circular business model

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Abstract

This paper aims to identify barriers to changing sustainable industries from linear to circular business (circular economy - CE) models, through a literature review followed by two case studies. Several benefits in adopting circular business models can be cited, although, in practice, numerous barriers to their implementation exist, such as problems in estimating possible benefits, existing costs, knowledge requirements, policies, regulations, consumer demands for green products and lack of dissemination of the theme throughout businesses. It is important to recognize these barriers so that organizations can cope with the academy.

Keywords: Circular Economy, Sustainability, Barriers

Introduction

Circular economy is related to different topics, and the concept includes several themes, including sustainability (Homrich et al. 2017) industrial ecology (Lewandowski 2016), eco-design (Ellen MacArthur Foundation 2015), cleaner production (Geng et al. 2010), eco-innovation (Castellani et al. 2015), closed economy (Geng & Doberstein 2008), ecological loops (Haas et al. 2015) and product-service systems (Tukker 2015). CE is viewed as a condition for sustainability, namely a beneficial relation or a trade-off in the literature, like in the managing area of the studied organizations (Geissdoerfer et al. 2017).

Values behind unsustainable consumption are deeply rooted in society, but were only justified during economic development. One of the strategies applied to deal with unsustainable consumption patterns is by developing shared-use systems with lower environmental impacts. Clemente et al. (2018) points out that governmental policies display the potential to foster sustainable consumption patterns and product-service systems, such as washing centres and car sharing, although most of these systems display a rather low profile in society. It is, therefore, important to investigate factors that

facilitate the broader acceptance of such sustainable consumption alternatives (Mont 2004).

"Sustainable manufacturing practices and circular economy have recently received significant attention in academia and within industries to improve supply chain practices" (Moktadir et al. 2018 p.1366). For companies to contribute to sustainable development, they must rethink their business models (Evans et al. 2017). New incentives are required to increase the transformation speed to circular production (Linder & Williander 2017). Despite the wealth of information concerning environmental awareness and the behaviour of business economy (Liu & Bai 2014), little empirical research on business awareness and behaviour in developing circular economy is available (Liu & Bai 2014; Murray et al. 2015).

Galvão et al. (2018) identified certain barriers in the implementation of CE in businesses. According to the authors, studying these barriers can aid in CE implementation. In this context, this paper aims to identify barriers concerning the change from linear to circular business models in sustainable industries, by two case studies conducted in multinational companies headquartered in Brazil.

Theoretical Background

This section provides an overview of the two key concepts on which this research is based, Circular Business Models and Sustainability.

Circular Business Model and Barriers

No single opinion on which resource efficiency strategies and on which changes in material flow industries must adopt to incorporate a "circular" business yet exist. However, there are some common points, such as the substitution of primary material inputs for secondary products, extending average product life through projects and long-life measures, like repairs or remanufacturing, and material recycling (Bey et al. 2013).

A comprehensive knowledge on designing circular business models is required to stimulate and foster circular economy implementation (Lewandowski 2016). Thus, new incentives are necessary, in order to increase the speed of the transformation to circular economy (Schulte 2013). Although some companies display an understanding of what circular economy is, as well as a positive outlook and a relatively strong willingness to operate towards this condition, a lack of enthusiasm in adopting this model is still, unfortunately, observed (Liu & Bai 2014).

Although the concept of circular business models is becoming prominent and advancing the transition to CE (Nußholz 2017), this is not easy, and some important factors should be considered, including: (i) minimizing product waste through system designs by selecting adequate materials; (ii) understanding the "total ecosystem" of a business and ensure that this is reflected in the business model (iii) maximizing flexibility through design; (iv) using renewable energy sources and (vi) maximizing energy use (Schulte 2013).

Circular Economy is viewed as a condition for sustainability, a beneficial relation, or a trade-off (Geissdoerfer et al. 2017). Several benefits to companies adopting circular business models can be cited, however, in practice several barriers are still present, in many forms, including difficulties in assessing future benefits in relation to current costs, knowledge requirements, attraction factors and market momentum, which includes technology availability and consumer demands for green products (Rizos et al. 2016). The shift from the linear to the circular model calls for changes at several levels, including technological innovation, new business models and further collaboration among stakeholders (Witjes & Lozano, 2016). A joint support of all stakeholders is, in fact,

necessary to successfully implement large scale CE concepts (Lieder & Rashid 2016; Schulte 2013; Witjes & Lozano 2016).

Many barriers to the implementation of sustainable strategies are still in place (Bey et al. 2013). In Brazil, the social barrier is one of the main barriers for sustainability-related issues (Ceglia et al. 2016). In this case, "public agencies play a crucial role in institutional framing, from infrastructures to legal set-ups, as well as in R & D support and increasing social awareness" (Jesus & Mendonça 2018 p.85). Thus, essential future developments for CE implementation will require more extensive work in the social area (Lieder & Rashid 2016). To set the change process in motion, many players, both public and private, such as companies, authorities, citizens, and research institutions, must be involved (van Buren et al. 2016).

Galvão et al. (2018) identified several barriers regarding CE implementation in businesses, including technological, policy and regulatory, financial and economic, managerial, performance indicators, customer and social. A transition to CE would require radical transformations to the economic order, including fundamental recasting of manufacture, retail, consumption and property rights (Gregson et al. 2015).

Sustainability and the linear business model

The triple bottom line (TBL) proposed by Elkington (1997), presents three different sustainability aspects, environmental, social or economic, as well as their combinations. Thus, in order for organizations to achieve sustainable performance, their operations must incorporate TBL, decreasing the amount of materials in product design, manufacture, transportation, recycling, reuse and remanufacturing (Wu et al. 2017). Environmental and economic issues are the most frequent, and the diffusion and effective adoption of sustainable solutions is insufficient compared to real requirements (Gauthier & Gilomen 2015).

On 25 September 2015, United Nation member countries adopted an ambitious 17 Sustainable Development Goals (SDGs) aiming to 'transform the world' in the next 15 years. The plan was implemented in January 2016 (Nations 2016), and its Item 12 deals with consumption and production patterns.

Some industries are currently adopting sustainable manufacturing practices to mitigate environmental concerns, resulting in reduced waste generation and energy and material use (Moktadir et al. 2018). "In adopting more sustainable development pathways, companies should be open to new experiences, increased consciousness and agreement to share knowledge" (Ceglia et al. 2016 p. 382). In order for sustainability issues to be institutionalized, visionary leaders are required to foster sustainable business models (Stubbs & Cocklin 2008). For companies to contribute to sustainable development, they will need to rethink their business models (Bocken et al. 2014; Schaltegger et al. 2012; Hart & Dowell 2011; Stubbs & Cocklin 2008; Schulte 2013).

In a linear business model, value creation is based on a material flow, where virgin material enters the upstream value chain and the entire product value, except for the raw material value, is added up through manufacturing and behavior processes. It deal with different models, which occurs in most manufacturing industries (Vargo & Lusch 2004). In a linear business model, products are usually downgraded after only one use phase and their embedded value is lost (Velte & Steinhilper 2016).

Understanding the drivers and barriers for CE development is a relevant and timely effort. In the sustainability debate, the role of eco-innovation is relevant in the transition to circular economy (Jesus & Mendonça 2018). Sustainable "challenges call for bold innovation, and most firms continue to focus on incremental strategies such as eco-

efficiency, pollution prevention, product stewardship and corporate social responsibility" (Hart & Dowell 2011p. 1476).

Methodology

The research was carried out through a literature review followed by two case studies. A semi-structured questionnaire was applied (Chizzotti 2017) to 6 people (3 from each company). The questions were based on Global Goals, TBL and CE, points, presented in Figure 1. Before the interviews, topics related to global goals, TBJ and CE were conceptualized. Both case studies were conducted in the Brazilian units of multinational sustainability-investing companies.

Profile of companies and respondents

Case study 1 has a R & D department focused on sustainability, while case study 2 works on sustainability in new products.

Table 1 – Profile of companies

Case 1	Is a company with over 45,000 staff, belonging to the chemical industry sector, with an annual turnover of over US 14 billions It is a multinational corporation, with a sustainability department and ISO 9001 certification.
Case 2	Is a company with over 250,000 staff, belonging to the automotive industry sector, with an annual turnover of over EURO118 billions. It is multinational corporation, has no sustainability department but with ISO 14.001 certification.

The interviewees are responsible for the sustainability area or sustainability in the company.

Table 2 – Company and interviews

	Time	Analysis documents	Interviews
Case 1	1- 43' 2- 20' 3- 25'	Analysis of primary and secondary documents. It was possible to informally talk to other employees.	The 3 interviewees answered all questions without reservations. They offered to visit the factory.
Case 2	1- 20' 2- 51' 3- 27'	No analysis of primary documents was carried out, only of secondary documents.	Answered all questions without reservations, was friendly the entire time. Said that if they needed anything else, he would be available for other interviews.

Results and discussion

Not all interviewees were aware of CE. After conceptualizing the term, presenting studies and exemplifying how this concept would work in the production of one of the company's products, all interviewees agreed that the company would be more sustainable if CE were to be applied. The six respondents pointed out that the investment for the transition is high, would require radical transformations to the economic order, including in manufacturing, retail, consumption and property rights as foreseen by Gregson et al. (2015).

Even when aware that the company invests in sustainability issues, the interviewees believe that there is still a need for more investments in this regard, as discussed by Gauthier & Gilomen (2015). The interviewees showed interest in CE but still did not demonstrate a perception of value, thus leading to resistance in implementing the concept,

although Company 1 has product lines that depends of cradle to cradle other aspects of CE.

Both companies are involved in environmental and social programs. In this case, companies are motivated by the hope that this will produce improvements to their corporate image or that they will gain a competitive advantage (Hall & Wagner 2012).

Case 1

one of its strategies is an adaptation to the sustainable business model, comprising a department responsible for implementing and overseeing the three pillars of sustainability. The main suppliers also have a sustainable business model as strategy. However, according to the interviewees, "the biggest focus of the organization is to market products to help the customer be sustainable."

The company uses energy consumption and waste indicators with established targets in order to comply with ISO14000 certification.

The product design, or product declaration, seeks to create less aggressive or easier to recover products. The organization seeks to create more productive resources, "producing more with less." This seems to be a general rule in this organization, to seek continuous improvement regarding product production and engineering processes.

The interviewees were not aware of the CE concept. After an explanation, the respondent said he did not feel secure in investing in a strategy that his clients did not know about. "The financial gain by wearing the sustainability shirt is very advantageous" because of customer values.

CE products would bring benefits to company 1, as mentioned by Rizos et al (2016), because the company invests in sustainability advertising for this product line.

Case 2

This company focuses on the three pillars of sustainability in a strategy adopted over seven years ago. Since then, it has sought to reduce the negative impacts of its operations, with the implementation of programs aimed at reducing material consumption, as well as investments to reduce fluids and treat sewage before leaving the factory. Integrated sustainability management policies exist both internally and for suppliers.

When developing executive projects concerning new products, the company does so attempting to make the most of the raw material. During each project, sustainability management is implemented not only due to pressure from society and customers, but also to achieve financial savings by using fewer resources.

The organization implements a sustainable business model and enables clients to maintain legal sustainability goals. It invests in reducing negative impacts to the environment and society, emphasizing the importance of sponsoring or developing programs aiming at better use of materials, water and energy. The interviewee could not say if the matrix acts the same way. The organization incorporated all three pillars of sustainability. However, in the social sphere it is restricted to complying with legal aspects, in relation to employees. The interviewees were aware of the CE concept and added that a European subsidiary is studying these kinds of implementations in the production process. However, they are still in the initial study phase.

Part of the answer analysis (2 cases) is displayed in figure 1. When the company demonstrated concern about the topic, the circle is filled. When the company showed reasonable concerns, two circles are presented, one inside the other, and when the company has not presented initiatives, the circle is greyed out.

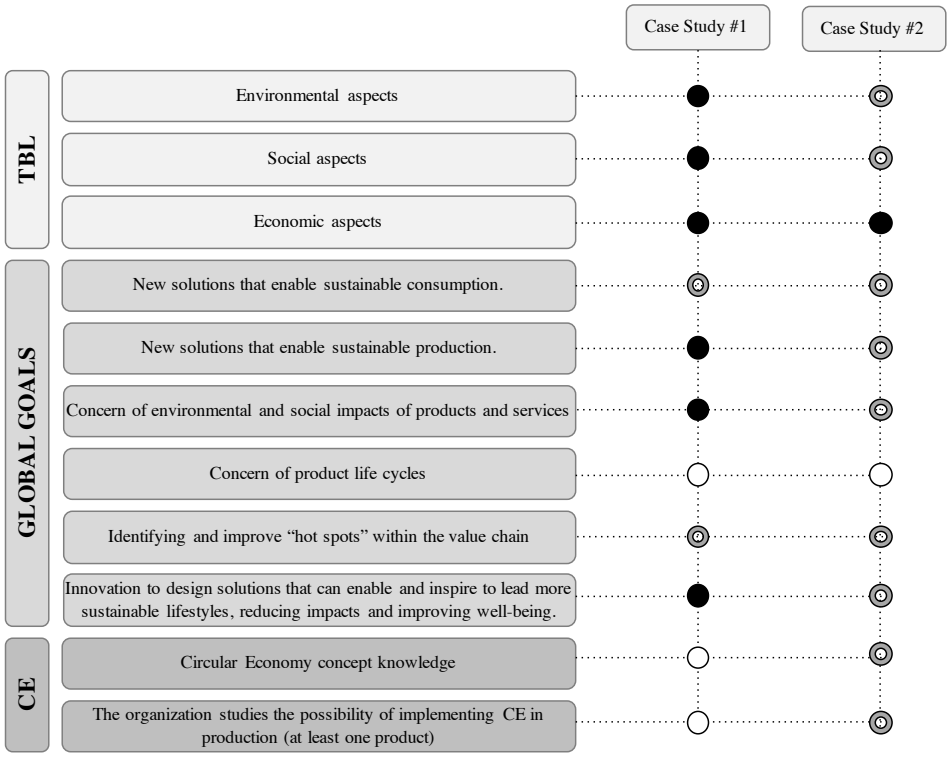

Figure 1 – Results

Through interviews, factory/industry visits and documental access, it was established that most products from both companies are produced through the linear model, as displayed in Figure 1.

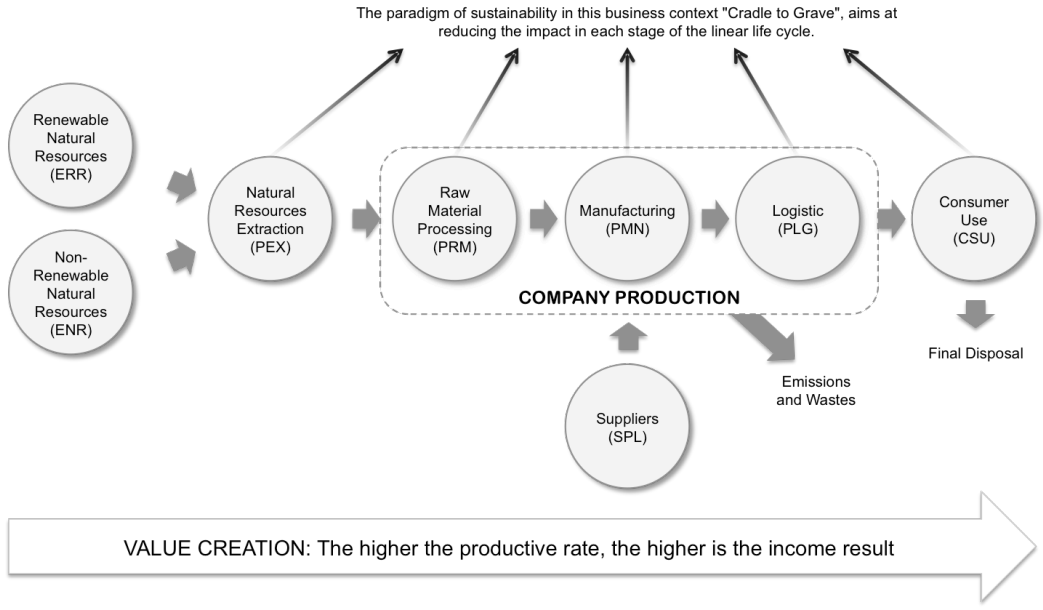

Figure 2 – Linear Process

Conclusion

This paper aimed to identify barriers to changing sustainable industries from linear to circular business models. The article also found, for the most part, CE are related to different topics. They conceptualize circular economy and bring up themes as

sustainability, industrial ecology, eco-design, cleaner production, eco-innovation, closed-loop economy and product service system.

Some respondents were unfamiliar with the term "circular economy," although they were well acquainted with the sustainability pillars of reverse logistics, eco-design and 3Rs. After conceptualizing CE, understanding the evaluated industries and accompanying certain production issues, it was concluded that organization 1 have 1 product produced according to CE. Thus, businesses should further research the subject, allowing working with improvements in some processes, changing linear production to circular production. With disclosure, clients could value and recognize the importance of CE, which is desired by the interviewees.

The main barrier expressed by the interviewees was the lack of perception of value, since CE requires several investments, including innovations focused on sustainability. This, however, is the Brazilian scenario, while, in other regions, such as Europe for example, where the theme is more widespread, the results may be different. Nonetheless, companies are increasingly focusing on certain strategies, such as eco-efficiency, pollution prevention and corporate social responsibility.

Finally, only two cases are presented herein. More cases studies are necessary to evaluate other barriers in the change from linear to circular business models.

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References

Bey, N., Hauschild, M.Z. & McAloone, T.C., 2013. Drivers and barriers for implementation of environmental strategies in manufacturing companies. *CIRP Annals - Manufacturing Technology*, 62(1), pp.43–46. Available at: http://dx.doi.org/10.1016/j.cirp.2013.03.001.

Bocken, N.M.P. et al., 2014. A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, 65, pp.42–56. Available at: http://dx.doi.org/10.1016/j.jclepro.2013.11.039.

van Buren, N. et al., 2016. Towards a circular economy: The role of Dutch logistics industries and governments. *Sustainability (Switzerland)*, 8(7), pp.1–17.

Castellani, V., Sala, S. & Mirabella, N., 2015. Beyond the Throwaway Society: A Life Cycle-Based Assessment of the Environmental Benefit of Reuse. *Integrated Environmental Assessment And Management*, 11(3), pp.373–382.

Ceglia, D., Abreu, M.C.S. de & Da Silva Filho, J.C.L., 2016. Critical elements for eco-retrofitting a conventional industrial park: Social barriers to be overcome. *Journal of Environmental Management*, 4(6), pp.31–38.

Chizzotti, A., 2017. *Pesquisa Qualitativa em Ciências Humanas e Sociais-Estudo de Caso.* E. Vozes, ed.,

Elkington, J., 1997. Cannibals with forks. *The triple bottom line of 21st century*.

Ellen MacArthur Foundation, 2015. Growth within: a circular economy vision for a competitive europe. *Ellen MacArthur Foundation*, p.100.

Evans, S. et al., 2017. Business Model Innovation for Sustainability: Towards a Uni fi ed Perspective for Creation of Sustainable Business Models.

Galvão, G., Nadae, J., Clementea, D., Chinena G., Carvalho, M., 2018. Circular Economy: Overview of Barriers. *10th CIRP Annals*.

Gauthier, C. & Gilomen, B., 2015. Business Models for Sustainability Energy Efficiency in Urban Districts. *Organization & Environment*, p.1086026615592931.

Geissdoerfer, M. et al., 2017. The Circular Economy–A new sustainability paradigm? *Journal of Cleaner Production*.

Geissdoerfer, M. et al., 2017. The Circular Economy – a new sustainability paradigm? *Journal of Cleaner Production*, 143(under review), pp.757–768. Available at: http://dx.doi.org/10.1016/j.jclepro.2016.12.048.

Geng, Y. et al., 2010. Regional initiatives on promoting cleaner production in China: a case of Liaoning. *Journal Of Cleaner Production*, 18(15), pp.1502–1508.
Geng, Y. & Doberstein, B., 2008. Developing the circular economy in China: Challenges and opportunities for achieving'leapfrog development'. *International Journal of Sustainable Development & World Ecology*, 15(April 2016), pp.231–239.
Gregson, N. et al., 2015. Interrogating the circular economy: the moral economy of resource recovery in the EU. *Economy and Society*, 44(2), pp.218–243.
Haas, W. et al., 2015. How Circular is the Global Economy?: An Assessment of Material Flows, Waste Production, and Recycling in the European Union and the World in 2005. *Journal of Industrial Ecology*, 19(5, SI), pp.765–777.
Hall, J. & Wagner, M., 2012. Integrating sustainability into firms' processes: Performance effects and the moderating role of business models and innovation. *Business Strategy and the Environment*, 21(3), pp.183–196.
Hart, S.L. & Dowell, G., 2011. Invited Editorial: A Natural-Resource-Based View of the Firm: Fifteen Years After. *Journal of Management*, 37(5), pp.1464–1479.
Homrich, A.S. et al., 2017. The Circular Economy Umbrella: Trends and Gaps on Integrating Pathways. *Cleaner Production Journal*, (November).
de Jesus, A. & Mendonça, S., 2018. Lost in Transition? Drivers and Barriers in the Eco-innovation Road to the Circular Economy. *Ecological Economics*, 145(July 2017), pp.75–89.
Lewandowski, M., 2016. Designing the Business Models for Circular Economy-Towards the Conceptual Framework. *Sustainability*, 8(1).
Lieder, M. & Rashid, A., 2016. Towards circular economy implementation: A comprehensive review in context of manufacturing industry. *Journal of Cleaner Production*, 115, pp.36–51. Available at: http://dx.doi.org/10.1016/j.jclepro.2015.12.042.
Linder, M. & Williander, M., 2017. Circular business model innovation: inherent uncertainties. *Business Strategy and the Environment*, 26(2), pp.182–196.
Liu, Y. & Bai, Y., 2014. An exploration of firms' awareness and behavior of developing circular economy: An empirical research in China. *Resources, Conservation and Recycling*, 87, pp.145–152. Available at: http://dx.doi.org/10.1016/j.resconrec.2014.04.002.
Moktadir, M.A. et al., 2018. Drivers to sustainable manufacturing practices and circular economy: A perspective of leather industries in Bangladesh. *Journal of Cleaner Production*, 174, pp.1366–1380.
Mont, O., 2004. Institutionalisation of sustainable consumption patterns based on shared use. *Ecological Economics*, 50(1–2), pp.135–153.
Murray, A., Skene, K. & Haynes, K., 2015. The Circular Economy: An Interdisciplinary Exploration of the Concept and Application in a Global Context. *Journal of Business Ethics*, 140(3), pp.369–380.
Nations, U., 2016. Responsible Consumption & Production : three planets. *Responsible Consumption & Production : Three Planets*, (R Esponsibl E Consum P T Ion & Produc T Ion: Why It Matters).
Nußholz, J.L.K., 2017. Circular business models: Defining a concept and framing an emerging research field. *Sustainability (Switzerland)*, 9(10), pp.14–17.
Rizos, V. et al., 2016. Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers. *Sustainability (Switzerland)*, 8(11).
Schaltegger, S., Lüdeke-Freund, F. & Hansen, E.G., 2012. Business cases for sustainability: The role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development*, 6(2), pp.95–119.
Schulte, U.G., 2013. New business models for a radical change in resource efficiency. *Environmental Innovation and Societal Transitions*, 9, pp.43–47.
Stubbs, W. & Cocklin, C., 2008. Conceptualizing a "Sustainability Business Model." *Organization & Environment*, 21(2), pp.103–127.
Tukker, A., 2015. Product services for a resource-efficient and circular economy - A review. *Journal of Cleaner Production*, 97(SI), pp.76–91. Available at: http://dx.doi.org/10.1016/j.jclepro.2013.11.049.
Vargo, S.L. & Lusch, R.F., 2004. Evolving to a New Dominant Logic for Marketing. *Journal of Marketing*, 68(1), pp.1–17.
Velte, C.J. & Steinhilper, R., 2016. Complexity in a Circular Economy : A Need for Rethinking Complexity Management Strategies. *World Congress on Engineering 2016*, 958, pp.0–5.
Witjes, S. & Lozano, R., 2016. Towards a more Circular Economy: Proposing a framework linking sustainable public procurement and sustainable business models. *Resources, Conservation and Recycling*, 112, pp.37–44. Available at: http://dx.doi.org/10.1016/j.resconrec.2016.04.015.
Wu, R., Geng, Y. & Liu, W., 2017. Trends of natural resource footprints in the BRIC (Brazil, Russia, India and China) countries. *Journal of Cleaner Production*.