The Role of Circular Economy in Peripheral Countries:
A Multiple Helix Approach

Jorge Julião
Católica Porto Business School, Universidade Católica Portuguesa, Portugal

Marcelo Gaspar
Escola Superior de Tecnologia, Instituto Politécnico de Castelo Branco, Portugal

Benny Tjahjono
School of Management, Cranfield University, UK

ABSTRACT150 palavras

Over the past decades, more attention has been given worldwide to sustainability issues, like the scarcity of natural resources, waste management, and climate changes. The circular Economy has been assumed as a strategy to overcome these issues, since it implies the adoption of clean production, reuse of materials, use of renewable energies, waste recycling, among others. In recognition of this, several countries, like China, Japan, German, and Netherlands, have implemented legislation in favor of circular economy, whence successful experiences were obtained. An important learned lesson emphasizes the participation of all actors (governments, regional authorities, business and non-governmental organizations) in the transaction towards a Circular Economy strategy. The purpose of this chapter is to use a Multiple Helix approach to analyze and discuss the challenges and opportunities towards a Circular Economy in peripheral countries, identifying the implications of fostering sustainable economic growth and enhancing local competitiveness by means of an integrated approach.

Keywords: Circular Economy, Sustainable Strategy, Closed Loop Systems, Multiple Helix, Peripheral Countries, Words Three-to-Eight

INTRODUCTION

Depletion of the earth's resources and sustainability issues have pushed many governments to adopt policies that aim to achieve resource-efficient economies. In this context, Circular Economy (CE) is gaining increasing attention worldwide, particularly in Europe and Asia, as a way for society to increase prosperity, while reducing dependence on natural resources and energy (MacArthur et al. 2015), and to overcome the current production and consumption model based on continuous growth and increasing resource throughput (Ghisellini et al. 2016). As such, CE may be considered a sustainable development strategy, or economic model, that attempts to conceptualize the integration and interaction of economic activity and environmental issues in a sustainable way, balancing economic, environmental, technological and social aspects. To this end, several countries, like China, Japan, Germany and the Netherlands have implemented legislation in favor of CE, whence successful experiences were obtained. An important learned lesson emphasizes the participation of all actors (governments, regional

authorities, business and non-governmental organizations) in the transaction towards a CE strategy.

In a Multiple Helix (MH) system a common ground is set between ecology, knowledge, and innovation, creating the synergies between economy, society, and democracy (Carayannis et al. 2014). Therefore, interactions amongst the different MH actors evolve from the traditional university–industry–government relations to a wider approach, where society, with its different roles and contributions, is considered, as all issues related to the supply chain of green products are influenced by these four main actors and their interrelationships (Julião et al. 2016). In such model, societal aspects are mainly discussed from a consumer's point of view, where their needs, expectations, and attitudes are addressed.

In current global context, state borders are becoming increasingly blurred and peripheral territories fight to survive using strategies and tools that best fit their aspirations and needs. Considering that globalisation is associated not only with the mobility of people or to communication at a planetary scale, but also to the growing mobility of goods, services, and commodities (Hoppe et al. 2016), there is no doubt that the widespread availability of low-cost goods at a larger scale may be considered beneficial for global population. Nonetheless, the scarcity of natural resources, waste management, and climate changes has raised increasing awareness to environmental issues and to the sustainable use and consumption of existing resources. If the differentiation of regional ecosystems is crucial to keep cultural and economic identities alive, there is no doubt that the importance of regional socio-economic systems is enhanced through the currently common tendency to regionalise the role of national and local spaces.

Recently the European Commission adopted an ambitious CE Package (EEA, 2015) with measures covering the whole life cycle from production and consumption up to the final waste management. As such, under the influence of new incentives, the role and position of regional ecosystems, as of peripheral countries, may become more relevant than ever before, boosting local companies towards green innovation and the integration of environmentally sustainable solutions in their manufacturing processes. This illustrates how governments address sustainability with both regulations and incentives empowering environmental sustainability.

Current local and global companies alike are increasingly recognizing the relations and interdependencies between economic, environmental and social dimensions (Lozano, 2013), pursuing the development of greener products through the integration of environmental sustainability issues into their business strategy (Santolaria et al. 2011). Considering that company-consumer interrelations are mainly market driven, it has also been shown that environmental thinking can stimulate green consumption, and, as a consequence, sustainable practices by the companies (Julião et al. 2016). To this end, universities perform a major role, not only with the dissemination of environmental awareness information and applied knowledge resulting from their research, but also as a credible third party concerning eco-labelling evaluation and certification, contributing this way to the empowerment of environmental sustainability.

The purpose of this chapter is to use a Multiple Helix approach to analyze and discuss the challenges and opportunities towards a Circular Economy in peripheral countries, identifying the implications of fostering sustainable economic growth and enhancing local competitiveness by means of an integrated approach.

BACKGROUND

Since the industrial revolution, which brought new manufacturing methods that enabled mass production of goods, resulting in high availability and low costs products, there has been a prevailing shift in economic policy in many countries. Nowadays, the neo-liberal economic policy that predominates in most developed countries, where economic orientations tend to be led by the market, associated with the global population growth, is pushing consumption of goods and, consequently, industrial production. These factors have been contributing to the worldwide rise of natural resources consumption and environmental deterioration. However, sustainability issues and ecological problems are not considered to be a consequence of the population growth (Holdren & Ehrlich, 1974), but of the dominant "open-ended" economic model (Gallaud & Laperche, 2016), conventionally called as the linear model, which follows a "take-make-dispose" pattern (Ness, 2008).

In the linear model, natural resources enter one end, are transformed into economic products, sold to consumers and, when no longer serve their purpose, discarded at the other end. The model focuses on the economic value of products and the efficient allocation of resources in the market (Ghisellini et al. 2016). Nevertheless, this model typically ignores the depletion of natural resources and the resultant accumulation of economic waste (George et al. 2015), threatening the stability of the economies and the integrity of natural ecosystems, that are essential for humanity's survival (Geng et al. 2012). This led to a prevalent and continuing concern that business may have been failing to address the critical issues related to the promotion of sustainable development (Murray et al. 2015), as well as a lack of balance amongst economic, environmental, technological and social aspects (Ren et al. 2013). Consequently, several approaches have been proposed towards the adoption of sustainable practices amongst companies, with a special focus on the manufacturing industry. Nonetheless, the consensus seems to be that a lot of companies continue to operate in a "take-make-dispose" model (Abdul-Rashid et al. 2008) and that governments seem unable to instigate change against the will of the corporate world, (Banerjee, 2012).

Circular Economy is emerging as a sustainable development strategy that attempts to conceptualize the integration of economic activity and environmental issues in a sustainable way (Murray et al. 2015). The CE is an industrial and social evolutionary concept that pursues holistic sustainability goals through a culture of no waste (De los Ríos & Charnley, 2015), that proposes a closed-loop of material flows in the economy, in opposition to the open-ended model (Macarthur, 2013; Su, et al. 2013). From the environmental economic perspective, CE is based on the balance principle (Kneese et al. 1970), which infers that all material flows need to be accounted for, although it will be the economic values, not the physical flows, that guide their management (Andersen, 2007). Moreover, it is restorative or regenerative by intention and design (MacArthur, 2013).

The CE is a fairly recent economic model that emerged from ideologies introduced in the past by other authors as Simmonds (1862) and Boulding (1966) and has its conceptual roots in industrial ecology (Andersen, 2007). Although its origins are difficult to trace back to one single author or date, Pearce & Turner (1990) were pioneers conceptualizing the idea of CE. CE started to be implemented in Germany, the Netherlands, China, and Japan, driven by government orientations, regulations, and legislation (Yong, 2007). Although all these countries

claim that CE contributes to economic growth and to improve competitiveness, they all adopted different definitions of CE. Germany and Japan focused mainly on the waste management as the Netherlands integrated such waste as new raw materials into their processes (Gallaud & Laperche, 2016). China, however, took a much broader and structural strategy that looked for the efficiency of all life cycle stages, namely production, distribution, and consumption. Applying such strategy to more areas besides the 3Rs (Reduce, Reuse, Recycle), like energy efficiency, conservation or land management (Su et al. 2013). Moreover, these countries applied different activities, some emphasized eco-design, life cycle for waste management, and others clean technologies and industrial ecology. After these four pioneer countries, France also addressed CE assuming a broader perspective that included several activities (Lévy, 2009). Additionally, China and Japan, which adopted framework Laws, emphasized the participation of all MH actors (e.g., governments, companies, universities, non-governmental organizations, and society) in the process. Ghisellini et al. (2016) also stress that the transition towards CE comes from the involvement of all actors of the society and their capacity to link and create suitable collaboration and exchange patterns. Considering this evolution, and some of the late definitions of CE (e.g. Lieder & Rashid, 2016; MacArthur, 2013; Murray et al. 2015), it is clear that CE is assuming a strategic role in different countries and is important to address it with multiple perspectives considering the different society actors.

CIRCULAR ECONOMY IN A MULTIPLE HELIX PERSPECTIVE

Circular Economy attempts to harmonize the ambitions of both environmental conservation and economic growth, considering multiple perspectives, i.e. levels of analyses and life cycle phases. CE can be applied to an economy, sector, or individual process, and comprising the environmental impact of the entire activity system, e.g. production, design, transportation, distribution, consumption, recycling, and disposal. Although the term of CE is clearly conceptualized, there is not a CE definition that could be said that is communally accepted. Actually, one of the weaknesses of CE is the lack of a comprehensive and formal definition (Kobza & Schuster, 2016). For example, there are definitions that focus on the economic aspects (e.g. Stahel & Reday-Mulvey, 1981), the 3R principles (e.g. Yuan, Bi, & Moriguichi, 2006), and others the industrial ecology (e.g. Geng & Doberstein, 2008). Based on an extensive review and case studies analysis, the Ellen MacArthur Foundation proposes a more comprehensive definition that considers both the environmental and economic advantages simultaneously. According to the underlying foundation, CE is defined as “an industrial system that is restorative or regenerative by intention and design” (MacArthur, 2013).

Academia and Governments as precursors of Circular Economy

Although CE could be applied to different products type, like everyday consumer goods (MacArthur, 2013), and to both service and manufacturing, for the purpose of this chapter it is assumed that CE is primarily concerned with material goods (e.g. automobiles, TVs, mobile phones). Also, the service sector is not addressed, considering that it does not convert materials and so, is less affected by the circular principles. Nevertheless, it is assumed a broad perspective analysis, considering the effect of CE at micro- (e.g. company or consumer level), meso- (e.g. eco-industrial parks) and macro-level (e.g. nations, regions, provinces and cities) (Su et al. 2013).

In response to the challenges of resource scarcity and environmental impact, both governments and academia are the main promoters for the public awareness, making them major precursors of CE. From their extensive review, Lieder & Rashid (2016) concluded that the acceptance of CE concept and its implementation desire is growing. According to Giutini & Gaudette (2003), CE has caught the attention of governments, researchers, and NGOs as a plausible road towards sustainability. However, this desire needs to be materialized, i.e. implemented by manufacturing companies. One might argue that a transaction from a linear to a circular model may be perceived by industry as a constraint to the business process rather an opportunity for sustainable business and growth. Although this might be the case of most companies, there are exceptions. Companies like Michelin, Renault, Caterpillar and Ricoh have successfully applied the CE concept (MacArthur, 2013). Moreover, according to MacArthur (2014), companies that have adopted CE principles reportedly benefits, mainly from material savings, reduced supply risks, improved customer loyalty and the development of new revenue streams. Thus, the dimension economic benefits, or competitive advantages, needs to be added to the resource scarcity and environmental impact perspective (Lieder & Rashid, 2016). Moreover, business competitiveness depends on the commercial success of products in the marketplace, which relies on the consumer's acceptance. Thus, consumer awareness of CE issues is another element to be considered when addressing CE implementation. These arguments sustain the topic of this chapter, which is analyzing CE principles in a Multiple Helix System, with the underline principle that the relationship between industry and environment is crucial for industrial business performance.

Companies and their lead-role in the Circular Economy model

Companies, particularly manufacturing enterprises, play a key role in CE since are responsible for the creation of products. Although the traditional linear economic model appears to prevail in most companies, some are leaving the model based on throughput optimization and cost efficiency and starting to implement strategies that integrate sustainability issues (MacArthur, 2013). The challenge is to identify drivers and arguments that impel the remaining companies towards CE and circular innovations, particularly, adopting cleaner production and eco-design. While cleaner production looks at the pollution, energy and efficient use of resources in the transformation processes, eco-design aims the incorporation of environmental issues into the design of product and processes.

Mainly driven by public awareness (Horbach, 2008) and regulations (Dangelico & Pujari, 2010), companies are increasing their efforts to integrate environmental sustainability issues into their products. A way of contributing to this integration is through product design. One of the principles CE is based on, is that manufactured durable products, or components, need to be designed from the start for reuse, i.e. designed in a way that optimizes disassembly and reuse. An argument that may drive companies towards circular products, raised by MacArthur (2013), is the resources price and volatility, which have been increasing in a recent past, as populations grow and raw materials become scarce. The underlying argument is that if companies manage to create products that are less raw materials dependent and have a high percentage of reuse materials, will be less expose to resources price and volatility, giving them a competitive advantage. It is important to stress that the reduction and reuse of raw materials cannot compromise the quality of the product since consumers will not accept it (Khosla & Taghian, 2005). Also, the reuse of resources implies the implementation of a policy that promotes the return to the company of products. Moreover, products are to be designed in a way that disassembly is facilitated and resources recycling is efficient. Considering only the economic

perspective, in some market economies, the prices of materials and natural resources are too low, which may inhibit the applications of some CE principle (Andersen, 2007). However, company managers need to realize that this might be the case in a short term. In a long term, the depletion of resources and environment costs will change the cost-benefit balance. Thus, companies may gain strategic competitiveness by being pioneers in adopting CE principles. Moreover, applying the reduction principle of CE to product design, companies may benefit from minimizing the input of raw materials. The gain in raw material savings may come from reducing the bill of materials, standardization, and modulation of components, simplified products and packaging, among others. If the reuse principle is introduced at the design phase, companies can also significantly reduce the need for raw materials (Castellani et al. 2015). Designing products balancing the economic, environmental and social dimensions, companies can contribute to both economic growth and sustainability.

Products manufacturing implies the input of energy (e.g. oil, gas, coal) and in most cases, originate the emission of pollutants (e.g. solid waste, gas, water waste). The energy costs for some process industries are significate, 7% to 30% of total operating costs (Brodkorb et al. 2007). Thus, energy savings promoted by CE principles can contribute significantly to industrial profitability and long-term success, especially for energy intensive processes and economies that rely heavily on imported energy. For example, energy consumption per industry output value for the main industry sectors in China has reduced 0.75 billion tons of standard coal in five years (Wu et al. 2014). Companies may also expect direct benefits from reducing the emission of pollutants and waste. One example is the reduction of waste management investments, which push companies to have transformation processes more efficient and focused on effective use of resources. Compiling with legislation and regulation will also be facilitated.

It can be argued that is impossible to have a manufacturing system that is fully circular, where both products and energy are completely reintegrated in the system in a continuous way. For example, considering the reuse and recycle of materials, only a few are fitted to consecutive recycling cycles with minimal waste (e.g. glass, metal), and many can only support a few cycles because become environmental and economically too expensive. Moreover, the inclusion of sustainable issues in the corporate strategy can be perceived by companies either as limiting their modus operandi or as an opportunity to reduce operational costs. Competitive pressure push manufacturing companies to primarily focus on economic benefits and growth, which blurs their vision. The CE-initiatives are seen as constraints to industrial activities rather an opportunity for sustainable business and growth. Although, it has been confirmed by different researchers that there is a direct correlation between the integration of environmentally sustainable solutions and the gain of competitive advantage (Chen et al. 2006; Doran & Ryan, 2014; Ellram et al. 2008; Lin et al. 2013; Saxena & Khandelwal, 2012; Wong, 2012). Moreover, according to Porter and van der Linde (1995) reducing environmental impact at lower costs could be perceived as an opportunity by companies, mainly by redesigning products, processes, and/or operation methods. As such, the relationship between industry and environment is critical for industrial business performance (Lieder & Rashid, 2016). This allows one to conclude that although CE may present different challenges and opportunities to companies, it can have an overall positive impact on their business. The challenge for manufacturing companies is to adopt the business models that aim to profit from existing resources and reduce new resources dependency. Thus, economic factors, such as cost reduction, may be seen as important drivers for companies to adopt CE principles.

Consumers as the target of Circular Economy

The commercial success of products that integrate CE principles, circular products, in the marketplace is crucial in driving companies and society towards environmental sustainability (Hall and Clark, 2003). However, the majority of consumers may still relatively unaware of CE concept and principles. Nevertheless, due to regulations, scientific publications and public discussions, the awareness of sustainable issues has been increasing. As a result, the demand for circular products shows signs of increasing, but according to Mintel report (Mintel Group, 2009), only a few consumers consider sustainability factors in major purchases. Moreover, many conceptualisations of the CE seem to exclude large parts of the social dimension (Geissdoerfer et al, 2017), in particular consumers. However, consumers may have a great contribution to the implementation of CE principles, since they are the ones purchasing products and influencing governments.

Consumers tend to select products based on the perceived value for money according to its price and quality ratio (Mandese, 1991). As discussed by Witjes & Lozano (2016) quality criteria may include other non-pecuniary criteria (Parikka-Alhola, 2008), as environment criteria (Rietbergen & Blok, 2013). But this value needs to be communicated to consumers in an efficient way. In general, miscommunicated and not environmental concerned consumers are typically reluctant to search for information (Gleim et al. 2013; Zhao et al. 2014) and view circular products as less effective than conventional products (Lin and Chang 2012). On the other hand, consumers that demonstrate sustainability concerns seem to be satisfied with their quality (Ritter et al. 2014). Thus, increasing sustainability consumer awareness may have a direct effect on the development of circular products.

It has been also argued that developing products which excels in environmental terms while remaining economically and technically competitive, is a significant challenge (Pujari, 2006), as in most instances it implies making trade-offs. From the business perspective, it seems to prevail the idea that producing circular products increases costs and affects efficiency, which needs to be reflected in higher prices. From the consumer perspective, circular products need to demonstrate at least a comparable quality to the conventional products (Lin et al. 2013), since the perceived quality directly affects the intent to purchase (Tseng and Hung, 2013). Moreover, consumers that are more sensitive to sustainable issues tend to accept more easily higher prices of circular products (Laroche et al. 2001), but the higher prices must be related to the benefits that consumers will gain when using or consume these products (Tomasin et al. 2013). On the other hand, consumer that are not aware of sustainability issues, are unwilling to pay a premium price for circular products offering the same quality as conventional products, because price sensitivity is related to the perception of value added and this value is often only evident in the long-term (Drozdenko et al. 2011). Thus, increasing sustainability consumer awareness may also increase circular products demand, driving new business models and a manufacturing shift from convention to circular products.

Although consumers have information about environmental advantages of CE and gains associated with well-being and health, have little knowledge and experience with products that integrate CE principles, which increases their doubts regarding their specifications, claims and added value, and reduces purchase intention. Therefore, product information needs to be efficiently transmitted to consumers. Environmental labeling is an effective way of communicating to customers the specific benefits and characteristics of the product and the claim, which can be displayed by using symbols or messages (D'Souza et al. 2006). For

example, consumers tend to value products with certificate information more highly, like a seal of quality, since they are willing to pay more for these products (Cason and Gangadharan, 2002). Thus, the acceptance of circular products by consumers may be enhanced if sustainability claims are communicated efficiently, which will promote the manufacturing of products that integrate CE.

CIRCULAR ECONOMY IN PERIPHERAL COUNTRIES: A MODEL FROM EUROPE TO THE WORLD

In a global context, as state borders are becoming increasingly blurred, the differentiation in regional ecosystems is crucial to keep cultural and economic identities alive. The importance of regional socio-economic systems is enhanced through the common tendency nowadays to regionalise the role of national and local spaces, not only in Europe but globally (Castells, 2010). As such, under the influence of new forms of globalization throughout the world, the role and position of regional ecosystems become more relevant than ever before. Nowadays regions are no longer treated as mere territorial or historical units, but they aspire to adopt the role of a functionally alternative structure of national governance (Szajnowska-Wysocka, 2009). Hence, converting local ecosystems into pragmatic identities of the region can be translated into economic acts and marketing attractiveness for investors, creating new dynamics in the region, as well as for local resources and products.

Recently the European Commission adopted an ambitious CE Package (EU, 2015) with measures covering the whole life cycle from production and consumption up to the final waste management. As such, under the influence of new incentives, the role and position of regional ecosystems, as of peripheral countries, may become more relevant than ever before, boosting local companies towards green innovation and the integration of environmentally sustainable solutions in their manufacturing processes. This illustrates how governments address sustainability with both regulations and incentives empowering environmental sustainability.

REFERENCES

Abdul-Rashid, S. H., Evans, S., & Longhurst, P. (2008). A comparison of four sustainable manufacturing strategies. *International Journal of Sustainable Engineering*, *1*(1), 214–229.

Andersen, M. S. (2007). An introductory note on the environmental economics of the circular economy. *Sustainability Science*, *2*(1), 133–140.

Banerjee, S. B. (2012). A climate for change? Critical reflections on the Durban United Nations climate change conference. *Organization Studies*, *33*(12), 1761–1786.

Boulding, K. (1966). The Economics of the Coming Spaceship Earth. In H. E. Jarrett (Ed.), *Environmental Quality in a Growing Economy* (pp. 3–14). RFF Press.

Brodkorb, M., Moore, I., de Souza, J., & Petela, E. (2007). Energy management: Consider supply and demand. *Chemical Engineering*, *114*(6), 42–49.

Carayannis, E. G., Sindakis, S., & Walter, C. (2014). Business Model Innovation as Lever of Organizational Sustainability. *Journal of Technology Transfer*, *40*(1), 85–104.

Cason, T. N., & Gangadharan, L. (2002). Environmental Labeling and Incomplete Consumer Information in Laboratory Markets. *Journal of Environmental Economics and Management*, *43*(1), 113–134.

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), 373–382.

Castells, M. (2010). *The Information Age: Economy, Society and Culture, vol. 2 - The Power of Identity*. (Blackwell Publishers Ltd, Ed.) (2nd ed.).

Chen, Y.-S., Lai, S.-B., & Wen, C.-T. (2006). The Influence of Green Innovation Performance on Corporate Advantage in Taiwan. *Journal of Business Ethics*, *67*(4), 331–339.

D'Souza, C., Taghian, M., Lamb, P., & Peretiatkos, R. (2006). Green products and corporate strategy: an empirical investigation. *Society and Business Review*, *1*(2), 144–157.

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming Green Product Innovation: Why and How Companies Integrate Environmental Sustainability. *Journal of Business Ethics*, *95*(3), 471–486.

De los Ríos, I. C., & Charnley, F. J. (2015). Skills and Capabilities for a Sustainable and Circular Economy: the Changing Role of Design. *Cleaner Production Journal*, (November 2015), 24.

Doran, J., & Ryan, G. (2014). Eco-Innovation – does additional engagement lead to additional rewards? *International Journal of Social Economics*, *41*(11), 1110–1130.

Drozdenko, R., Jensen, M., & Coelho, D. (2011). Pricing of green products: premiums paid, consumer characteristics and incentives. *International Journal of Business, Marketing and Decision Sciences*, *4*(1), 106–116.

EEA. (2015). *Closing the loop - An EU action plan for the Circular Economy*. European Environment Agency. Retrieved from http://www.eea.europa.eu/policy-documents/com-2015-0614-final#tab-related-indicators

Ellram, L. M., Tate, W., & Carter, C. R. (2008). Applying 3DCE to environmentally responsible manufacturing practices. *Journal of Cleaner Production*, *16*(15), 1620–1631.

Gallaud, D., & Laperche, B. (2016). *Circular Economy, Industrial Ecology, and shorter supply chains* (Vol. 4). Wiley.

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – a new sustainability paradigm? *Journal of Cleaner Production*, *143*(under review), 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048

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), 231–239. https://doi.org/10.3843/SusDev.15.3

Geng, Y., Fu, J., Sarkis, J., & Xue, B. (2012). Towards a national circular economy indicator system in China: an evaluation and critical analysis. *Journal of Cleaner Production*, *23*(11), 216–224.

George, D. A. R., Lin, B. C.-A., & Chen, Y. (2015). A circular economy model of economic growth. *Environmental Modelling and Software*, *73*, 60–63.

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, *114*, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007

Giutini, R., & Gaudette, K. (2003). Remanufacturing: The Next Great Opportunity for Boosting US Productivity. *Business Horizons*, *46*(6), 41–48.

Gleim, M. R., Smith, J. S., Andrews, D., & Cronin, J. J. (2013). Against the Green: A Multi-method Examination of the Barriers to Green Consumption. *Journal of Retailing*, *89*(1), 44–61.

Hall, J., & Clark, W. (2003). Special Issue: Environmental innovation. *Journal of Cleaner Production*, *11*(4), 343–346.

Holdren, J. P., & Ehrlich, P. R. (1974). Human Population and the Global Environment: Population growth, rising per capita material consumption, and disruptive technologies have made civilization a global ecological force. *American Scientist*, *62*(3), 282–292.

Hopper, T., Lassou, P., & Soobaroyen, T. (2016). Globalisation, accounting and developing countries. *Critical Perspectives on Accounting*, 1–24.

Horbach, J. (2008). Determinants of environmental innovation - New evidence from German panel data sources.

Research Policy, *37*(1), 163–173.

Julião, J., Gaspar, M., & Tjahjono, B. (2016). Key Factors on Green Product Development: Influence of Multiple Elements. In M. Peris-Ortiz, J. J. Ferreira, L. Farinha, & N. O. Fernandes (Eds.), *Multiple Helix Ecosystems for Sustainable Competitiveness* (pp. 75–90). Springer.

Khosla, R., & Taghian, M. (2005). Intelligent consumer purchase intention prediction system for green products. In *Knowledge-Based Intelligent Information and Engineering Systems* (pp. 752–757). Springer-Verlag Berlin Heidelberg.

Kneese, A. V, Ayre, R. U., & D'Arge, R. C. (1970). *Economics and the environment: a materials balance approach*. New York, USA: Routledge.

Kobza, N., & Schuster, A. (2016). Building a responsible Europe - the value of circular economy. *IFAC-PapersOnLine*, *49*(29), 111–116. Retrieved from http://dx.doi.org/10.1016/j.ifacol.2016.11.067

Laroche, M., Bergeron, J., & Barbaro-Forleo, G. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*.

Lévy, J.-C. (2009). *Économie circulaire: l'urgence écologique: monde en transe, Chine en transit*. Paris, France: Presses de l'École nationale des ponts et chaussées.

Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: A comprehensive review in context of manufacturing industry. *Journal of Cleaner Production*, *115*, 36–51. https://doi.org/10.1016/j.jclepro.2015.12.042

Lin, R.-J., Tan, K.-H., & Geng, Y. (2013). Market demand, green product innovation, and firm performance: evidence from Vietnam motorcycle industry. *Journal of Cleaner Production*, *40*, 101–107.

Lin, Y., & Chang, C. A. (2012). Doubie Standard: the role of environmental consciousness in green product usage. *Journal of Marketing*, *76*(5), 125–134.

Lozano, R. (2013). Sustainability inter-linkages in reporting vindicated: A study of European companies. *Journal of Cleaner Production*, *51*, 57–65. https://doi.org/10.1016/j.jclepro.2013.01.039

MacArthur, E. (2013). *Towards the circular economy: Opportunities for the consumer goods sector*.

MacArthur, E. (2014). *Towards the circular economy: Accelerating the scale-up across global supply chains*. Geneva.

MacArthur, E., Zumwinkel, K., & Stuchtey, M. R. (2015). *Growth within: a circular economy vision for a competitive Europe. Ellen MacArthur Foundation.*

Mandese, J. (1991). New study finds green confusion. *Advertising Age*, *62*(45), 1–56.

Mintel Group. (2009). Green Living - US Market Research. Retrieved from www.mintel.com/oxigen-reports

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), 369–380.

Ness, D. (2008). Sustainable urban infrastructure in China: Towards a Factor 10 improvement in resource productivity through integrated infrastructure systems. *International Journal Of Sustainable Development & World Ecology*, *15*(4), 288–301.

Parikka-Alhola, K. (2008). Promoting environmentally sound furniture by green public procurement. *Ecological Economics*, *68*(1–2), 472–485.

Pearce, D. W., & Turner, R. K. (1990). *Economics of Natural Resources and the Environment*. London, UK: Harvester.

Peris-Ortiz, M., Farinha, L., Ferreira, João, J., & Fernandes, N. O. (2016). *Multiple Helix Ecosystems for Sustainable Competitiveness - Innovation, Technology, and Knowledge management*. https://doi.org/10.1007/978-3-319-29677-7

Porter, M., & van der Linde, C. (1995). Toward a new conception of the environment competitiveness relationship. *The Journal of Economic Perspectives*, *9*(4), 97–118.

Pujari, D. (2006). Eco-innovation and new product development: Understanding the influences on market

performance. *Technovation*, *26*(1), 76–85.

Ren, J., Manzardo, A., Toniolo, S., & Scipioni, A. (2013). Sustainability of hydrogen supply chain. Part I: Identification of critical criteria and cause–effect analysis for enhancing the sustainability using DEMATEL. *International Journal of Hydrogen Energy*, *38*(33), 14159–14171.

Rietbergen, M. G., & Blok, K. (2013). Assessing the potential impact of the CO2 Performance Ladder on the reduction of carbon dioxide emissions in the Netherlands. *Journal of Cleaner Production*, *52*(1), 33–45.

Ritter, Á. M., Borchardt, M., Vaccaro, G. L. R., Pereira, G. M., & Almeida, F. (2014). Motivations for promoting the consumption of green products in an emerging country: exploring attitudes of Brazilian consumers. *Journal of Cleaner Production*.

Santolaria, M., Oliver-Sol, J., Gasol, C. M., Morales-Pinzón, T., & Rieradevall, J. (2011). Eco-design in innovation-driven companies: Perception, predictions and the main drivers of integration. the Spanish example. *Journal of Cleaner Production*, *19*(12), 1315–1323.

Saxena, R. P., & Khandelwal, P. K. (2012). Greening of industries for sustainable growth: an exploratory study on durable, non-durable and services industries. *International Journal of Social Economics*, *39*(8), 551–586.

Simmonds, P. L. (1862). *Waste products and undeveloped substances: Or, hints for enterprise in neglected fields*. (R. Hardwicke, Ed.). London, UK.

Stahel, W. R., & Reday-Mulvey, G. (1981). *Jobs for tomorrow: the potential for substituting manpower for energy*. Vantage Press.

Su, B., Heshmati, A., Geng, Y., & Yu, X. (2013). A review of the circular economy in China: Moving from rhetoric to implementation. *Journal of Cleaner Production*, *42*, 215–227.

Szajnowska-Wysocka, A. (2009). Theories of Regional and Local Development - Abridged Review. *Bulletin of Geography. Socio-Economic Series*, *12*(12), 75–90.

Tomasin, L., Pereira, G. M., Borchardt, M., & Sellitto, M. A. (2013). How can the sales of green products in the Brazilian supply chain be increased? *Journal of Cleaner Production*, *47*, 274–282.

Tseng, S. C., & Hung, S. W. (2013). A framework identifying the gaps between customers' expectations and their perceptions in green products. *Journal of Cleaner Production*, *59*, 174–184.

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*, 37–44. https://doi.org/10.1016/j.resconrec.2016.04.015

Wong, S. K.-S. (2012). The influence of green product competitiveness on the success of green product innovation. *European Journal of Innovation Management*, *15*(4), 468–490.

Wu, H. Q., Shi, Y., Xia, Q., & Zhu, W. D. (2014). Effectiveness of the policy of circular economy in China: A DEA-based analysis for the period of 11th five-year-plan. *Resources, Conservation and Recycling*, *83*, 163–175. https://doi.org/10.1016/j.resconrec.2013.10.003

Yong, R. (2007). The circular economy in China. *Journal of Material Cycles and Waste Management*, *9*(2), 121–129.

Yuan, Z., Bi, J., & Moriguichi, Y. (2006). The circular economy: A new development strategy in China. *Journal of Industrial Ecology*, *10*(1–2), 4–8.

Zhao, H., Gao, Q., Wu, Y., Wang, Y., & Zhu, X. (2014). What affects green consumer behavior in China? A case study from Qingdao. *Journal of Cleaner Production*, *63*, 143–151.