Planned Obsolescence and Sustainability

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Abstract

Substantial increase in interest about environmental issues has occurred in the last decades with academy, industry, government, leaders and general society more concerned about sustainability. Although much research has been done on ways to provide better conditions of environment and cleaner production, little attention has been paid to the impact of the short life cycle of the current products in sustainability and also to the necessity of providing natural resources to supply goods to a human population with a growth rate never seen before. Using literature review and secondary data, the objective of this paper is to study the necessity of changing the paradigm of planned obsolescence to the one of long-lasting products and to present some suggestions on how to keep them updated under so many changes and innovation to which the products are subject in the present days. The originality and practical implications of this research is to arouse interest that global developing based on a consumption society is no longer sustainable, and a new and less consumerist society should replace the current one.

***Keywords**: sustainability, life cycle, obsolescence, consumerism, innovation*

1. Introduction

Life cycle is an issue that has received much attention in recent years due to its importance to sustainability. Manufacturers are more concerned about the environmental performance of their products due to the growth of the worldwide awareness of the environmental problems we face today (Tao et al., 2017).

Manufacturing is an important sector of the economy. In 2015 the European Union manufacturing sector was responsible for 15.81% of its economy, in Germany 22.81% and in the UK 9.76%. In 2014 the US manufacturing sector accounted for 12.33% of its economy and Japan 18.67% (Organization for Economic Co-operation and Development (OECD), 2017).Directly or indirectly, most jobs depend on manufacturing, transforming through mechanical, chemical or physical processes, substances, materials or components into new products (United States Department of Labor (DOL), 2017; Roosevelt Institute, 2011).

Raw material, water and energy scarcity, growing world population, increasing urbanization, aging society, global warming, increasing CO_2 emmissions, ecosystem at risk, power of innovation, the age of life science, and technology diffusion, among other trends, will substantially impact and will promote structural changes in almost all manufacturing sectors (European Factories of the Future Research

Association (EFFRA), 2013).

The recycling of the material that composes the products at the end of their life cycle can provide new sources of raw material to produce new products (Russell et al., 2005), providing resource conservation, reducing the pressure to find new sources of raw material and the depletion of current sources.

In order to increase sales, possibly inspired by the fashion industries that launch new models every season, some industrial sectors promote modifications in their products, sometimes minimal, to differentiate the products produced in one year from those produced in another one. At the same time, these industries design, manufacture and sale their products so that they can become non-functional or obsolete in a short period of time, reducing the product life cycle, and so forcing consumers to buy new ones very frequently. This phenomenon is referred as "planned obsolescence" (Fishman et al., 1993)

There are authors that advocate planned obsolescence seeing it as a tool to reach technological progress, boosting innovation, seeing long-lasting products as inductors of slow innovation that can lead to economy stagnation (Fishman et al., 1993). Others see its negative economic side-effect, such as pollution, increase of garbage and depletion of scarce natural resources, among others (Echegaray, 2016; Guiltinan, 2009; Cooper, 2008).

Although much research has been done on ways to provide better conditions of environment and cleaner production, little attention has attracted the interest of the academic community to the impact of the short life cycle of the current products on sustainability, and the repercussion this can cause on the necessity of supplying goods to a human population with a growth speed never seen before. The objective of this paper is to study the necessity of changing the paradigm of planned obsolescence to one of long-lasting products and present some suggestions on how to keep them updated under so many changes and innovation to which the products are subject in the present days.

2. Literature review

Here follows the literature review.

2.1 Sustainable Development and Sustainability

According to the World Commission on Environment and Development (WCED), sustainable development can be understood as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p.43). There is criticism to this definition, by focusing on economic growth as a way to reach environmental sustainability and also by eliminating poverty concerns. Lélé (1991, p. 618), suggests that sustainable development should be considered the development of "strategies that might lead to a society living in harmony with the environment and with itself".

Elkington (2004) coined the term "triple bottom line" to show the importance environmental, economic and social (or socio-cultural) issues have to support sustainability, as indicated in Fig. 1. Bansal and Desjardine (2015) understand that sustainability is the use of resources in a way they can regenerate to continue supplying the present and future generations.

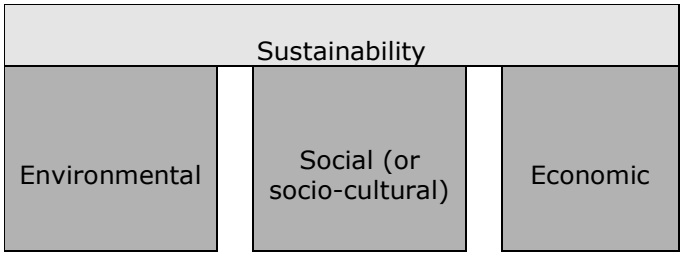

Fig. 1. The triple bottom line concept (Source: Adapted from Elkington, 2004).

There is criticism to the "triple bottom line" of Elkington, for decreasing environmental issues to externalities and social issues to background questions (James et al., 2015); instead of the three issues proposed, James et al. (2015), propose four approaches to consider sustainability: economic, politics, ecology and culture, called the "circles of sustainability".

2.2 Sustainable consumption

The Organization for Economic Co-operation and Development (OECD, 2008) states that sustainable consumption considers the ethical and social dimension of the product, the way products are produced, the effects of the production processes, including workers and resources, and their ecological impacts, considering consumers as the key driving to sustainable production, and so to a sustainable development. Sustainable production and consumption are a key role of sustainable development, which aims to achieve long-term economic growth coherent with environmental and social needs (OECD, 2008).

Linear economy is when the end of the life cycle of a product is achieved, it is disposed and considered a waste (Mathews and Tan, 2011), that is, extract, produce, consume and trash, without any concern to the pollution generated at each phase (Sauvéa et al., 2016). Circular economy, also known as "closed-loop" economy, is when the use of wastes, by-products or recycling of disposable products is used as resource of raw material to produce a new product, converting wastes of an industrial process into inputs to another process (Sauvéa et al., 2016, Mathews and Tan, 2011), when inputs of energy, water, and new raw material consumption decline and output of waste disposal requirement is reduced (Cooper, 2008, 1994). To achieve sustainable consumption it is necessary to change from a linear economy to a circular economy.

2.2 Planned obsolescence

The term "planned obsolescence" was coined by Brook Stevens in 1954, in Minneapolis, USA, during a talk at a local advertising club with the concept of "instilling in the buyer the desire to own something a little newer, a little better, a little sooner than it is necessary" (Milwaukee Art Museum (MAM), 1999).

The aim of planned obsolescence is to provoke buyers to replace their buying (Guiltinan, 2009). According to Guiltinan (2009), there are two main obsolescence mechanisms:

(a) Physical obsolescence mechanism:

- *Limited functional life design* ("*death dating*") or *Contrived durability*. The product is designed to deteriorate quickly, so each component of a product is made to last a short period of time, such as 3 years. One method of limiting durability is the use of inferior materials in critical components, such as plastic material that deteriorate easily, screws undersized that break down after a limited time, and others that compromise the use of a product (Giles, 2006; Orbach, 2004).
- *Design for limited repair*. Critical components that are subject to breakage in service are made to be so expensive to replace that it is cheaper to buy a new product. For example bearings failure in some washing machines, which is one of the most common problems, it is so costly and complicated to repair that it is worth buying a new washing machine (Poulter, 2015); or screws head that require special tools only available in the factory technical assistance, such as the ones required to fix the iPhones (Foresman, 2011).

An example of limited functional life design and limited repair is shown in Fig. 2. A broken plastic support, practically impossible to be repaired, of a vanity mirror in the sun visor of a Hyundai Tucson, vehicle with 3-years use, prevents the adjustable light from being turned on. The entire sun visor must be replaced, as the vanity mirror is not sold separately. Only available from authorized dealers, it was budgeted at almost 2% of the total car sales price in January 2017, in São Paulo, Brazil.

Fig. 2. Broken plastic support of vanity mirror in the sun visor of Hyundai Tucson, budgeted at almost 2% of the total car sales price to be replaced.

- *Design aesthetics that lead to reduced satisfaction*. Aesthetic characteristics that deteriorate over time, such as golden parts that oxidize with use.

(b) Technological obsolescence mechanism:

- *Design for fashion or style obsolescence*. Fashion thinking is applied to products, so that consumers are induced to replace their buying for a new one that has some design change. An example is when the automotive industry promotes cosmetic changes, such as new headlights and friezes in a vehicle to differentiate it from the ones produced in the previous year, but keeping the same basic technical characteristics of the vehicle (Müeller et al., 2007).
- *Design for functional enhancement through adding or upgrading product features*. New products are launched incorporating other functionalities or technological enhancement, such as cellular phones incorporating digital TV, GPS and other functionalities, or personal computer with more powerful processors, memory, etc., making it attractive to replace the old ones that did not have these new features.

3. Methodology

Based on Scopus database, we made a research on January, 30th., 2017, using as search engine the terms "planned obsolescence" AND sustainability, the first terms in quotes to reach results that have both words together and using the logical operator AND to provide both terms. We used these terms in the search field: Paper title, Abstract, Keywords, in the period from 2007 to 2017 and in all document types. It resulted in 9 documents.

Table 1
Quantity of documents found in Scopus database. Search engine: "planned obsolescence" AND sustainability.

Year	No. of Documents
2016	1
2015	1
2014	4
2013	0
2012	1
2011	1
2010	0
2009	0

2008	0
2007	1
Total	9

Table 2
Number of document type found in Scopus database.

Document Type	No.
Article	5
Conference Paper	3
Book Chapter	1

The 8 papers were used as references of this study, disregarding the book chapter for difficulty to get the book. We also used secondary data available in the World Population Policies Database of the United Nations Department of Economic and Social Affairs Population Division (DESA, 2015) of the United Nations Secretariat and in the Greendex 2014: Consumer Choice and the Environment – A Worldwide Tracking Survey – Highlights Report of National Geographic and Globescan (2014).

4. Discussion

Defenders of the idea of planned obsolescence state that it is necessary to replace buying to keep production running, but this is a paradigm that need to be changed (Çetiner and Gündoğan, 2014). It is interesting to analyze the world population presented in Fig. 1 that illustrates the population from 1950 to 2015, and the projection from 2015 to 2100 in three scenarios: high, medium and low fertility (DESA, 2015).

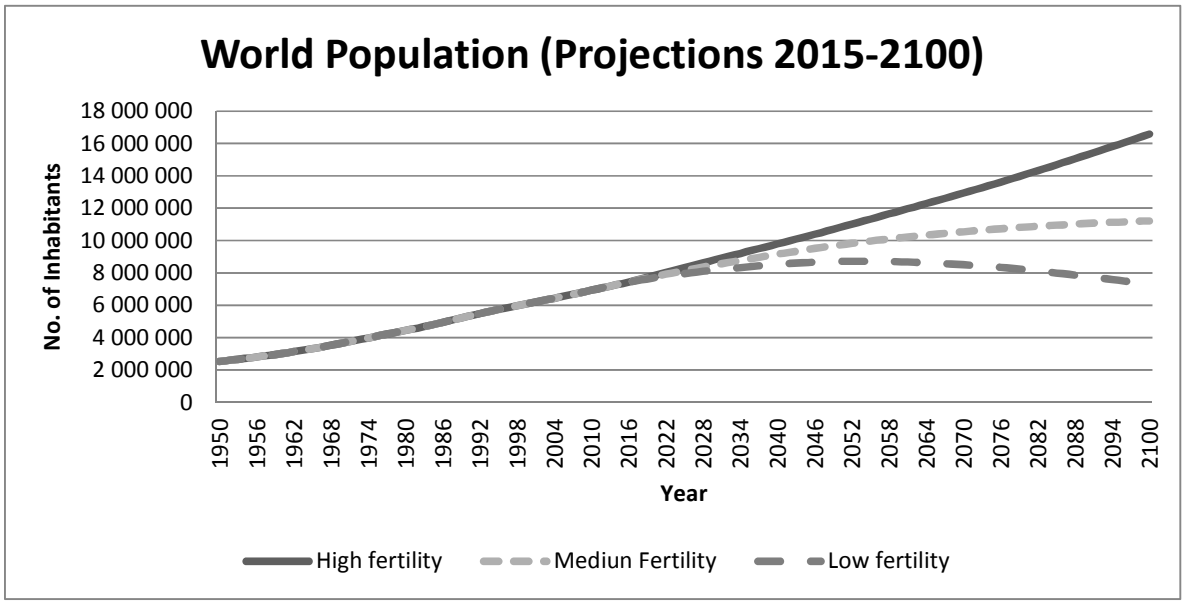

Fig. 3. World Population (Source: Adapted from DESA, 2015).

In the 1950's when the concept of "planned obsolescence" was launched (MAM, 1999), the II World War (1935 – 1945) had finished five years before, economy was experiencing a virtuous growth cycle and the world population was about 2.5 billion inhabitants. Mass production made it possible to supply world population many times if necessary, and competition among companies became fierce to keep market share until our days.

The improvement of living standards, the reduction of war among nations and modern medicine have enabled the huge growth of the world's population and increased life expectancy, expanding urbanization and advancing migration (United Nations Population Fund (UNFPA), 2017). The population has grown faster than expected; in 2011 the world's population reached the mark of 7 billion and today

it stands at more than 7.5 billion (UNFPA, 2017), or three times the world population in the 1950's.

Observing Fig. 3, the medium fertility scenario projection indicates that by the 2050's the world population will reach 10 billion, an increase of 2.5 billion inhabitants over the present year. In in almost 30 years, an increase that represents the same amount of people that inhabited Earth in the 1950's.

One central challenge to achieve a sustainable society is waste reduction (OECD, 2011), and in order to attempt to reduce it, government and society are trying to involve the producer as the responsible for the entire life cycle of their products (recycling or ecofriendly waste disposal), although little attention has been paid to produce long-lasting products and repairable appliances (Echegaray, 2016).

Fast obsolescence increases waste generated, pressuring public resources with the increase of garbage collection, costs with acquisition and maintenance of waste disposal areas, exposing population to toxic material from non-recycled products, polluting air, water and land (Echegaray, 2016; Çetiner and Gündoğan, 2014; Madden, 2014), reducing consumer experience (Lobos, 2014) and consuming excessive natural resources to produce replacement products, pressuring the commodities price, thus generating economic instability and supporting inflation (Echegaray, 2016).

In addition to the waste generated by "planned obsolescence", which leads to fast obsolescence, our generation is facing natural resources depletion. The climate change effects provoke water shortages, among others, compromising society, industrial and agriculture production, and the population growth will pressure demand for food and agricultural resources (Food and Agriculture Organization of the United Nations (FAO), 2016). Another challenge is metal scarcity, as extraction and consumption of metals has risen in the industrial economy, so the depletion of some metals is a possibility if extraction is not reduced (Henckens et al., 2014). Antimony, which is used in the electronics industry to manufacture semiconductor accessories, ammunition, lead-acid batteries, fireworks and also used to make flame retardant products (Rakshit et al., 2011) should have extraction reduced in 96%, or antimony mineral reserves will be depleted before 2050-year. Copper extraction should be reduced in 63% to become sustainable, and gold, molybdenum, boron, bismuth, zinc and rhenium should also be given high priority to reduce their primary consumption on a world scale for the same reason. It is worth notice that some of these metals do not appear in recent lists of critical raw materials of developed countries (Henckens et al., 2014).

In general, people are increasingly adopting a more sustainable consumer behavior, more concerned about the negative effects of global warming and more convinced that the cause of climate change is linked to human activity. Consumers in emerging countries show greater concern about the consumption of sustainable products, although this has not yet been translated into consumption of more environmentally friendly products (National Geographic and Globescan, 2014).

Consumers in Mexico, Brazil, India and Argentina are more concerned about sustainability cause for receiving feedback about their impact on the environment, while British, German and Swedish consumers are the least influenced. American, British, Chinese, Indian and South Korean consumers increase confidence that new technology will be created to solve the environmental problems (National Geographic and Globescan, 2014).

Some engineers and designers think that if they plan their products for manufacturing, use and obsolescence, they can be recycled after they are disposed and the resultant materials reprocessed, making them believe that they are reducing the environment impact, but this is not true. In order to minimize the environmental impact they need to extend life cycle of their products if and when possible (Lawlor, 2015).

There are ways of delaying obsolescence, such as making technologies easier to fix / upgrade, create open source software (Nyman et al., 2014), projects that simplify replacing / updating parts rather than replacing them, so that waste can be reduced and long-lasting products can continue to function, as well as many other ways that innovation in engineering and design and the creation of new technologies can provide (Lawlor, 2015).

World population growth, increase of waste generated, water shortage, natural resources scarcity and climate change, among other factors, are pressuring for a new production paradigm, as the planned obsolescence paradigm is no longer possible. Long-lasting products paradigm that can supply present and future generation is required. Scientists, engineers and designers have the challenge of designing products that can incorporate innovations and continue to function without being replaced, keeping them updated under many changes and innovation to which the products are subject in the present days. It is no longer possible to live in the twenty-first century, based on paradigms created in the twentieth century, when the conditions of life on Earth were others. Entrepreneurs, industry and academy must be made aware of the impact on sustainability of the short life cycle of the current products and start thinking in long-lasting products terms.

5. Conclusion

The planned obsolescence paradigm with the concept of inducing the buyer to replace his buying earlier than necessary, awakening the desire to buy something new that could provide better benefits was created in the 1950's, to increase sales and keep mass production functioning (Guiltinan, 2009; MAM, 1999).

There are two main obsolescence mechanisms: (a) physical obsolescence mechanism – with the objective of deteriorating the physical conditions of the buying, such as: limited functional life design ("death dating") or contrived durability; design for limited repair; and aesthetic design that leads to reduced satisfaction; (b) technological obsolescence mechanism – with the aim of making the product seem outdated, such as: design for fashion or style obsolescence and design for functional enhancement through adding or upgrading product features (Guiltinan, 2009).

Planned obsolescence generates short life cycle of the current products that impact sustainability negatively. Fast obsolescence increase waste generated, pressuring the costs with acquisition and maintenance of waste disposal areas, garbage collection, and exposing population to toxic material from non-recycled products, polluting the air, water and land (Echegaray, 2016; Çetiner and Gündoğan, 2014; Madden, 2014). Short life cycle presses new buying, demanding large quantities of natural resources, which are already being reduced by climate change, among other factors. If mineral extraction is not reduced, depletion of some metals is a possibility, as extraction and consumption of metals has risen in the industrial economy (Henckens et al., 2014).

In the 1950's we had abundant natural resources with industries able to produce huge quantity of products, but due to the limited number of consumers and the reduced world population compared to our days, industries have created mechanisms to induce consumption, generating the - consumption society - to keep industries running and also the economy.

Now, in the twenty-first century things have changed. Population has grown faster than expected, due to the modern medicine, the improvement of living standards and the reduction of war between nations, so today the world's population stands at more than 7.5 billion (UNFPA, 2017), or three time the world's population in the 1950's, when planned obsolescence paradigm was launched. The industries will have to produce each time more to supply a population that is growing in a rate never seen before, and the natural resources required are becoming scarce. Scientists, engineers and designers have the challenge of delaying obsolescence, for example, creating open source software (Nyman et al., 2014), making technologies easier to fix / update, developing projects that make it simple to replace / update parts, rather than replacing the whole product (Lawlor, 2015).

Entrepreneurs, industry and academy must be made aware of the impact on sustainability of the short life cycle products. It is no more possible trying to live in the twenty-first century, based on paradigms created in the twentieth century, when the conditions of life on Earth were others and natural resources were abundant. It is time for the industry to start paying attention to the impact of the short life cycle of the current products on sustainability, starting to think in long-lasting products terms. Consumption society as an engine for global developing is no longer sustainable and a new and less consumerist society should replace the current one.

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References

Bansal, T, Desjardine, M., 2015. Don't confuse sustainability with CSR. Ivey Business Journal. 1-3.

Çetiner, B.G., Gündoğan, M., 2014. Defying planned obsolescence: paradigm change for macro level sustainability of supply chain management systems. In: CIE44 & IMSS'14 Proceedings, Istanbul / Turkey, 809-814.

Cooper, T. 1994. Beyond recycling: The longer life option. New Economics Foundation, London.

Cooper, T., 2008. Slower consumption: Reflections on product life spans and the "Throwaway Society". Journal of Industrial Ecology. 9 (1-2), 51-67.

Echegaray, F., 2016. Consumers' reactions to product obsolescence in emerging markets: the case of Brazil. Journal of Cleaner Production. 134 (Part A), 191–203.

Elkington, J., 2004. Enter the triple bottom line. In: A. Henriques and J. Richardson, (Eds.). The Triple Bottom Line, Does it All Add Up? Assessing the Sustainability of Business and CSR. Earthscan, London, pp. 1–16.

European Factories of the Future Research Association (EFFRA), 2013. Factories of the Future: PPP: FoF 2020 Roadmap - Consultation document. 1-89.

Food and Agriculture Organization of the United Nations (FAO), 2016. The state of food and agriculture: Climate change, agriculture and food security.

Fishman, A., Gandal, N., Shy, O., 1993. Planned obsolescence as an engine of technological progress. The Journal of Industrial Economics. 41, 361-370.

Foresman, C., 2011. Apple "screwing" new iPhones out of simple DIY repair. ARS Technica. https://arstechnica.com/apple/2011/01/apple-screwing-new-iphones-out-of-simple-diy-repair/ last accessed 01 February 2017.

Giles, S., 2006. Make to Break: Technology and Obsolescence in America. Harvard University Press, USA.

Guiltinan, J., 2009. Creative destruction and destructive creations: environmental ethics and planned obsolescence. Journal of Business Ethics. 89, 19–28.

Henckens, M.L.C.M, Driessen, P.P.J., Worrell E., 2014. Metal scarcity and sustainability, analyzing the necessity to reduce the extraction of scarce metals. Resources, Conservation and Recycling. 93, 1–8.

James, P., Magee, L., Scerri, A., Steger, M., 2015. Urban sustainability in theory and practice: Circles of sustainability. Routledge, Oxon, UK.

Lawlor, R., 2015. Delaying obsolescence. Science and Engineering Ethics. 21 (2), 401-427.

Lélé, S.M., 1991. Sustainable development: A critical review. World Development. 19 (6), 607-621.

Lobos, A., 2014. Timelessness in sustainable product design. In: 9th International Conference on Design and Emotion 2014: The Colors of Care, 169-176.

Madden, S., 2014. Obsolescence in/of Digital Writing Studies. Computers and Composition. 33, 29–39.

Mathews, J.A., Tan, H., 2011. Progress toward a circular economy in China the drivers (and inhibitors) of eco-industrial initiative. Journal of Industrial Ecology. 15 (3), 435-457.

Milwaukee Art Museum (MAM), 1999. Brooks Stevens Biography. https://mam.org/collection/archives/brooks/bio.php last accessed 02 February 2017.

Müeller, D.B., Cao, J., Kongar, E., Altonji, M., Weiner, P-H, Graedel, T.E., 2007. Service lifetimes of mineral end uses. Final Report. U.S. Geological Survey, Minerals Resources External Research Program, 1-31.

National Geographic and Globescan, 2014. Greendex 2014: Consumer Choice and the Environment – A Worldwide Tracking Survey – Highlights Report. http://images.nationalgeographic.com/wpf/media-content/file/NGS_2014_Greendex_Highlights_FINAL-cb1411689730.pdf last accessed 02 February 2017.

Nyman, L., Mikkonen, T., Lindman, J., Fougère, M., 2014. Perspectives on code forking and sustainability in open source software. IFIP Advances in Information and Communication Technology, 378 AICT. 274-279.

Orbach, B.Y., 2004. The Durapolist puzzle: Monopoly power in durable-goods markets. Yale Journal on Regulation. 21 (1), 67-119.

Organization for Economic Co-operation and Development (OECD), 2008. Promoting Sustainable Consumption: Good Practices in OECD Countries. OECD, Paris.

Organization for Economic Co-operation and Development (OECD), 2011. Greening Household Behavior: the Role of Public Policy, OECD Publishing, Paris.

Organization for Economic Co-operation and Development (OECD), 2017. Value added by activity. https://data.oecd.org/natincome/value-added-by-activity.htm last accessed 30 January 2017.

Poulter, S., 2015. Washing machines 'cheaper to replace than fix': Manufacturers accused of making appliances too costly and complicated to repair. Mail One. http://www.dailymail.co.uk/news/article-3130577/Washing-machines-cheaper-replace-fix-Manufacturers-accused-making-appliances-costly-complicated-repair.html last accessed 01 February 2017.

Rakshit, S., Sarkar, D., Punamiya, P., Datta, R., 2011. Antimony sorption at gibbsite–water interface. Chemosphere. 84 (4), 480–483.

Roosevelt Institute, 2011. Six Reasons Manufacturing is Central to the Economy. http://rooseveltforward.org/six-reasons-manufacturing-central-economy/ last accessed 30 January 2017.

Russell, A., Ekvall, T., Baumann, H., 2005. Life cycle assessment – introduction and overview. Journal of Cleaner Production. 13 (13-14), 1207-1210.

Sauvéa, S., Bernard, S., Sloan, P., 2016. Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research. Environmental Development. 17, 48–56.

Tao, J., Chen, Z., Yu, S., Liu, Z., 2017. Integration of Life Cycle Assessment with computer-aided product development by a feature-based approach. Journal of Cleaner Production. 143, 1144-1164.

United Nations Department of Economic and Social Affairs (DESA), 2015. Population division. World Population Prospects: The 2015 Revision.

United Nations Population Fund (UNFPA), 2017. World population trends. http://www.unfpa.org/world-population-trends last accessed 03 February 2017.

United States Department of Labor (DOL). Bureau of Labor Statistics, 2017. Industries at a Glance – Manufacturing: NAICS 31-33. https://www.bls.gov/iag/tgs/iag31-33.htm last accessed 30 January 2017.

World Commission on Environment and Development (WCED), 1987. Our Common Future: Report of the World Commission on Environment and Development. Oxford University Press, New York.