

## A Brazilian perspective on remanufacturing

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### Abstract

The goal of this paper is to give further information concerning the Keynote "A Brazilian perspective on sustainable manufacturing and remanufacturing" held on the 11th CIRP Conference on Sustainable Manufacturing. Therefore, this paper contains the description of the current Brazilian situation in terms of poverty, social inequalities and violence and in contrast the country's abundance of natural resources. Thus, it is reported how this current situation is associated with sustainable development, mainly in the Brazilian industrial sector. Finally, an example of a sustainable approach to be adopted by companies within this context is given, namely remanufacturing.

### Keywords:

Brazil: Sustainability; Brazil Industry; Remanufacturing.

## 1 INTRODUCTION

Brazil is an emerging country which influence in the international trade and politics has been steadily growing since the last decades, mainly because the country offers great perspectives for sustainable development. However, the country's main drawbacks are related to weak public healthcare systems and more generally a lack of infrastructure hampers its development.

The goal of this paper is to describe the Keynote "A Brazilian perspective on sustainable manufacturing and remanufacturing" held on the 11th CIRP Conference on Sustainable Manufacturing.

An overview of the current strengths and weaknesses of Brazil is given in general terms, and associated with the opportunities of the country to use sustainable development as a main driver for the growth of its industry.

## 2 BRAZIL: A COUNTRY OF CONTRADICTIONS

### 2.1 Positive side: abundance of natural resources

Brazil has a great amount of natural resources, which highlights the importance and the responsibility of the country in the current global scenario of limited resources and growing consciousness towards the need for sustainability.

For instance, almost 50% of the national energy supply comes from renewable sources. Also, the country presents the world's largest stock of the carbon stored in forest biomass, as it has the largest area of rainforest and the second largest forestry. The forest area covers 60% of the country's territory. In addition, approximately 12% of the planet's available surface water is located in Brazil [1].

The country contains a large territory covered by natural parks, extractive reserves and indigenous lands. There are 68 units of natural parks with an extension of 38.325.615 ha (hectare) [2], 22 units of extractive reserves covering 3.407.915 ha [3] and 608 units of indigenous lands in 109.741.229 ha [4]. The indigenous lands territory represents 13% of all the Brazilian territory.

The sum of these three types of territories covers 151.474.759 ha, which is four times the extension of the Germany territory, which is 35.702.100 ha [5].

### 2.2 Negative side: poverty, social inequalities and violence

One of the Brazil most spread characteristics is its high poverty rate. 23.6% of the population lives in families with an income below the poverty line. Since Brazil has big proportions and population, this 23.6% represents between 16 and 25 million people [6].

Yet, Brazil is among the 10 countries with the highest rates of social disparity. The main reasons leading to this disproportion are [7]:

- The lack of access to education;
- Unfair fiscal policy;
- Low wages and lack of basic services, such as health, transport and public sanitation.

The large numbers associated to violence are also refraining further social integrity, mainly when it comes to the use of firearms. 70% of homicides in the country are committed with firearms. As an illustration of the last years situation, in 2010, more than 106 persons were killed by means of firearms every day [8].

These numbers are even more alarming when it comes to homicides per young people. The rate of 54.8 homicides per 100,000 young people is 137 times higher than the rates of Germany [8].

Despite the fact that Brazil is a country without territorial disputes, emancipatory movements, religious confrontations, racial or ethnic, border conflicts or terrorist acts, it is difficult to deny that the country holds a civil war. Between 2008 and 2011, a total of 206,005 died victims of homicides in Brazil, resulting in a higher casualties number than the deaths occurred during the 12 major armed conflicts that took place in world between 2004 and 2007 [8].

### 2.3 Growth of consciousness of Brazilian Society

Some recent movements and actions in Brazil have been retaining the attention of the global news stream. The most significant one occurred between April and June of 2013, when thousands of Brazilians went in the streets to demonstrate their dissatisfaction with the alarming current situation in Brazil in terms of public infrastructure management, as well as the lack of improvement measures from the government.

The trigger fuse to start the manifestation was the increase of 0.20 cents in the bus fare on public transport in the states of São Paulo and Rio de Janeiro. More than 100,000 people went on the streets and most of them were young people on age between 17 and 25 [9].

An important event is about to happen in Brazil, the World Cup on 2014. Regarding this event, example of sustainability actions can be outlined. The Environment Minister Izabella Teixeira highlighted five actions of the sustainability agenda regarding World Cup in Brazil [10]:

- Management of solid waste in the host cities;
- Expansion of the structure to receive tourists in the Parks Cup (as Foz do Iguaçu and Fernando de Noronha);
- Decrease of the emission of greenhouse gases;
- Encouraging the production of organic food;
- Grant of a Seal of Sustainability to companies and organizations.

The manifestations point out the necessity for the Brazilian government to pay attention to the social dimension, since society seems to be expecting concrete actions from the politicians. On the other side, the actions presented by the Environment Minister for World Cup shows an increasing public consciousness regarding the sustainability aspects. Another relevant point to be treated is the status of sustainability on the Brazilian industry.

## 3 SUSTAINABILITY ON BRAZILIAN INDUSTRY

Plenty of challenges and opportunities are identified when it comes to sustainability on the Brazilian industry.

### 3.1 Challenges of sustainable development on Brazilian industry

Some factors hinder the development of sustainability in the Brazilian industrial sector. These factors are described below: [1].

One important fact is the distortions within the Brazilian tax system. The unjustified diversity of taxes and frequent changes in the format of Brazilian taxation increases complexity to make changes and improvements to the current system.

High costs to access credit and interest rates can also be considered a problem since it hampers the access to long term credit for enterprises, mainly for micro and small companies.

Another factor is associated with the lack of policy instruments favoring R&D and innovation for sustainability and the lack of coordination among public and private institutions to work together, aligned with national innovation and sustainability strategies.

Instability, inadequate management and regulatory frameworks in the environmental area are also factors that hinder the development of sustainability in the Brazilian industrial sector. The focus of environmental public management is limited to licensing and permitting activities, instead of considering incentive actions to stimulate Brazilian companies on the adoption of environmental actions.

Insufficient and poor quality of infrastructure services are also challenges on sustainability adoption. The greatest lack of services is on the areas of transportation and sanitation.

Last but not least, education sector appears as a dismissed sector, especially within the public primary and secondary education system. This causes a lack of basic education and environmental awareness of the population regarding the importance of a sustainable development and also an insufficient number of skilled workers to aliment the growing human resources needs from the Brazilian economy

### 3.2 Opportunities of sustainable development on Brazilian industry

In spite of the challenges described in the session 3.1, Brazilian industry presents numerous opportunities for industrial sustainable development [1].

An opportunity is the investment on wind and solar energy. Currently, they are underutilized in Brazil. Regarding biodiversity, Brazil harbors covers about 15% of all species on the planet, however only a small portion is known. Exploiting the potential of biotechnology is presented as advancement opportunity for Brazilian industry, mainly for the pharmaceuticals sector.

An important action is the creation of incentives such as "Climate Fund", which aims to finance projects that target mitigation and adaptation of climate change and its effects.

In addition, investment in research, technological development and innovation are a source of opportunities to increase efficiency, reduce costs and develop new business.

Opportunities can also be associated to the solid waste management, which aims to stimulate the reuse of products and materials as inputs in the production system. Brazil is an international benchmark for waste recycling in activities that also contributes to social inclusion.

It is also relevant to consider that the changes required for a sustainable development pattern depends on both public and private investment, particularly in cleaner production technologies and innovative methods in business management.

Concerning innovative ways to reach sustainable actions on the business, remanufacturing is an approach that can support companies on developing actions on the three pillars of sustainability [11].

## 4 REMANUFACTURING: EXAMPLE OF SUSTAINABLE APPROACH TO BE ADOPTED BY BRAZILIAN INDUSTRY

### 4.1 Definition of remanufacturing

Some approaches are being adopted by companies for defining recovering strategies for products that reaches their end of life (EOL). Beside waste reduction, remanufacturing is the most promising strategy for enabling several product life cycles.

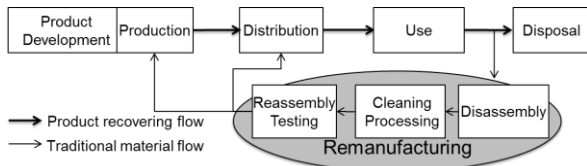


Figure 1: Traditional and reverse material flow.

The EOL product, also named core, returns to the production process and pass through steps like disassembly, cleaning, repair, inspection and assembly. The remanufactured product is characterized by having the same quality and warranty as a new one. In addition, remanufacturing process preserves part of the value added to the product during its manufacturing, allowing companies to increase resource efficiency and productivity [12].

Motivations to implement remanufacturing can be highlighted. By performing remanufacturing, companies can increase market share gain as well as contribute toward more sustainable production and consumption [13-14].

In Brazil, only few Brazilian companies are committed with the final destination of the used products they manufactured. However, this situation might change in the near future because of to the enacted National Policy on Solid Waste in 2010. The objective of this law is to stimulate Extended Producer Responsibility (EPR) [15].

#### 4.2 Remanufacturing oriented project

Aiming to stimulate the adoption of remanufacturing by companies, the project named “Networking small and medium sized enterprises for competitive remanufacturing” is being carried out by Technische Universität Berlin (Prof. Dr.-Ing. Günther Seliger) and Universidade de Sao Paulo (Prof. Dr.-Ing. Henrique Rozenfeld). This project is part of the BRAGECRIM Program - Brazilian and Germany Collaborative Research Initiative in Manufacturing.

The goal of the project is to create new potentials for competitive advantages by providing guidelines to key actors of remanufacturing networks. To reach that goal, an online guideline is being created in order to support companies on defining remanufacturing oriented business models.

#### 4.3 Guideline for remanufacturing business models

The guideline is composed of business models dimensions and templates associated with each dimension. The dimensions of the guideline are adapted from Canvas business models and its nine elements: customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partners and cost structure [16].

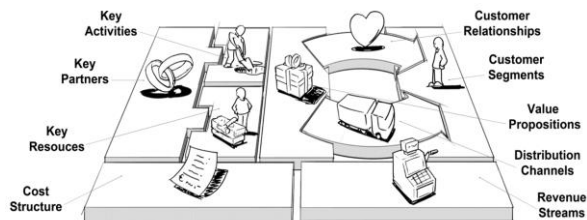


Figure 2: Canvas Business Model [16]

For each dimension, the user has inputs, tools, free outputs and attributes available to support him on the definition of the important characteristics of a specific business model dimension.

Each dimension has a template associated, which the user can download on the website and fulfill it according to options and choices he makes about his own remanufacturing business. The user can fulfill the templates following the information available on the dimensions.

Therefore, the guideline enables the design of the current or future business model based on selection of different remanufacturing attributes. In addition, new business opportunities for new entrants and improvements on current remanufacturing business can emerge.

### 5 FINAL CONSIDERATIONS

This paper described the Keynote “A Brazilian perspective on sustainable manufacturing and remanufacturing” held on the 10th CIRP Conference on Sustainable Manufacturing.

By introducing Remanufacturing as an approach to reach sustainability on industry, challenges and opportunities discussed on session 3.1 and 3.2 are implied. First of them concerns solid waste management. By making remanufacturing, enterprises need to create mechanisms to take back the product on its EOL, avoiding the increase of industrial waste and enabling a more efficient use of resources. The second point is related to technology and innovation. By adopting remanufacturing, companies may require the development of new technologies, e.g. for cleaning the product, and also the adaption or creation of new business models, which can lead to innovative business. The third point covers the social inclusion by increasing number of jobs. The development of the remanufacturing industry will demand more workforce, mainly because remanufacturing is labor oriented, with few possibilities for further automation processes.

### 6 REFERENCES

[1]CNI (Confederação Nacional da Indústria). A Indústria Brasileira no Caminho da Sustentabilidade. Brasília: CNI, 2012.  
 [2][www.icmbio.gov.br/](http://www.icmbio.gov.br/). Access on September, 2013.  
 [3]<http://www.ibama.gov.br/resex/resex.htm>. Access on September, 2013.  
 [4]<http://www.funai.gov.br/index.html>. Access on September, 2013.  
 [5][http://www.eurice.info/typo3sites/fileadmin/x\\_incs/Germany.pdf](http://www.eurice.info/typo3sites/fileadmin/x_incs/Germany.pdf). Access on September, 2013.  
 [6]<http://g1.globo.com/politica/noticia/2011/05/brasil-tem-1627-milhoes-de-pessoas-em-situacao-de-extrema-pobreza.html>. Access on September, 2013.  
 [7][http://desigualdade-social.info/mos/view/Desigualdade\\_Social\\_no\\_Brasil/](http://desigualdade-social.info/mos/view/Desigualdade_Social_no_Brasil/). Access on September, 2013.  
 [8][http://mapadaviolencia.org.br/pdf2013/mapa2013\\_homicidios\\_juventude.pdf](http://mapadaviolencia.org.br/pdf2013/mapa2013_homicidios_juventude.pdf). Access on September, 2013.  
 [9][fcnoticias.com.br](http://fcnoticias.com.br). Access on September, 2013.  
 [10]Ascom - Ministério do Esporte. <http://www.copa2014.gov.br/pt-br/noticia/ministra-do-meio-ambiente-comenta-acoes-de-sustentabilidade-na-copa-do-mundo-da-fifa-2014>. Access on September, 2013.

[11] Guidat, T., Barquet, A.P., Hamamoto, T., Zorzal dos Santos, J.A., Oliveira Gomez, J., Rozenfeld, H., Seliger, G. 2013. An analysis of industrial networks for remanufacturing in Brazil. 22nd International Conference on Production Research. Foz do Iguacu, Brazil.

[12] Giuntini, R., Gaudette, K. 2003. Remanufacturing: the next great opportunity for boosting US productivity, *Bus Horiz*, 46/6: 41-48.

[13] Barquet, A.P., Rozenfeld, H., Forcellini, F.A., 2013, An integrated approach to remanufacturing: model of a remanufacturing system, *Journal of Remanufacturing*, 3: 1–11.

[14] Amezquita, T., Hammond, R., Salazar, M., Bras, B. 1995. Characterizing the remanufacturability of engineering systems. *Proceedings of ASME Advances in Design Automation Conference*. Boston, Massachusetts.

[15] National Solid Waste Policy (Política Nacional de Resíduos Sólidos – Lei No, National Solid Waste Policy (Política Nacional de Resíduos Sólidos – Lei No. 12.305/2010). Presidência da República. Brasil. (in Portuguese).

[16] Osterwalder, A.; Pigneur, Y. 2009. *Business Model Generation*. Amsterdam: Self Published.