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CNI. THE STRENGTH OF THE BRAZILIAN INDUSTRY

CIRCULAR ECONOMY

OPPORTUNITIES AND CHALLENGES FOR THE BRAZILIAN INDUSTRY

Brasília
2018

Circular Economy

OPPORTUNITIES AND CHALLENGES FOR THE BRAZILIAN INDUSTRY

NATIONAL CONFEDERATION OF INDUSTRY - CNI

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INTRODUCTION

Sustainability management has been gaining space in the strategic agenda of enterprises. Long-term thinking is fundamental to overcome the current crisis, contributing to economic health and the development of Brazil.

As warned by several international agencies, the demand for consumer goods has been putting pressure on natural resource reserves. According to this reasoning, it would be impossible to ensure, to the entire world population, the same standard of living enjoyed by developed countries with the natural resources available on our planet.

It is therefore necessary to devise innovative forms of production and consumption that take into account the need to include those at the base of the pyramid of our global society in the formal market and to meet an increasing demand for a better quality of life.

For a country such as Brazil, which has one of the world's cleanest energy matrices, exploring new business models in line with the provisions of international agreements and which at the same time foster development, is only natural.

With this in mind, we have edited this document, entitled “Circular Economy: opportunities and challenges for the Brazilian industry”. We present the concept of circular economy, which considers all that has been learned over the last decades and looks for alternatives that can add more value to natural resources. This perspective is aligned with the interests of industries, and more over with the development of Brazil.

Good reading.

Robson Braga de Andrade

President of the Brazilian National Confederation of Industry (CNI)

EXECUTIVE SUMMARY

The linear economic model of production-consumption-disposal is close to exhaustion. Over the past thirty years, despite all the technological advances and increased productivity of processes that made it possible for them to extract 40% more economic value from raw materials, demand has increased by 150% over the same period (UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION - UNIDO, 2013).

One of the ways to address this problem is by adopting a circular economic model that links economic growth to a cycle of continuous positive development that preserves and improves our natural capital, optimizes resource production, and minimizes systemic risks through the management of finite inventories and renewable flows. (ELLEN MACARTHUR FOUNDATION, 2017).

The main objective of this publication is to provide readers with a better understanding of what the circular economy is all about, of the opportunities and challenges it entails, and of how business models that generate new values and ensure greater competitiveness to Brazilian industry can be implemented. The study reviews the limits of the currently adopted linear development models, opportunities

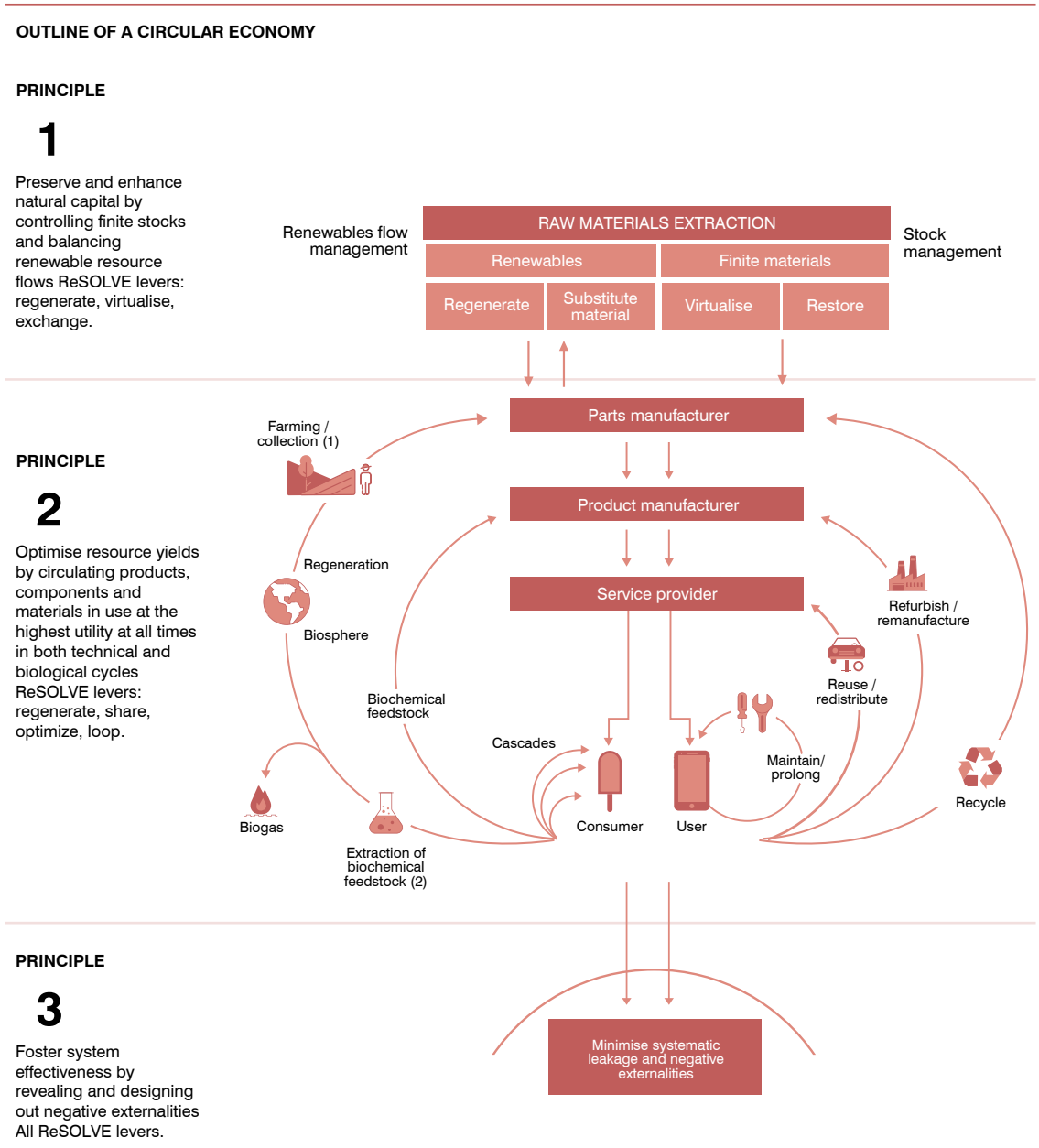
afforded by the circular economy, and the transition from a world based on linear models to one focused on circular models.

The concept of circular economy has its origin in several schools and lines of thought that laid the foundation for the debate on sustainable development, such as: Industrial Ecology, Life Cycle Management, Performance Economics, among others. It is a known fact that economic activities in a circular economy generate and recover value for products and services and preserve it in the long term and for all parties involved in the economic system.

The first step in the transition from a linear to a circular logic is to analyze opportunities for innovation in business models that make it possible for better processes, products, and services to be created and for their value proposition to be expanded by capturing lost values not perceived by all stakeholders.

Figure 1 below summarizes circular principles and processes in two cycles: the biological and the technological cycle. These cycles add value to the linear economic logic, which is represented by the center of the diagram.

FIGURE 1 - DIAGRAM OF THE FLOWS OF MATERIALS AND PRINCIPLES IN THE CIRCULAR ECONOMY

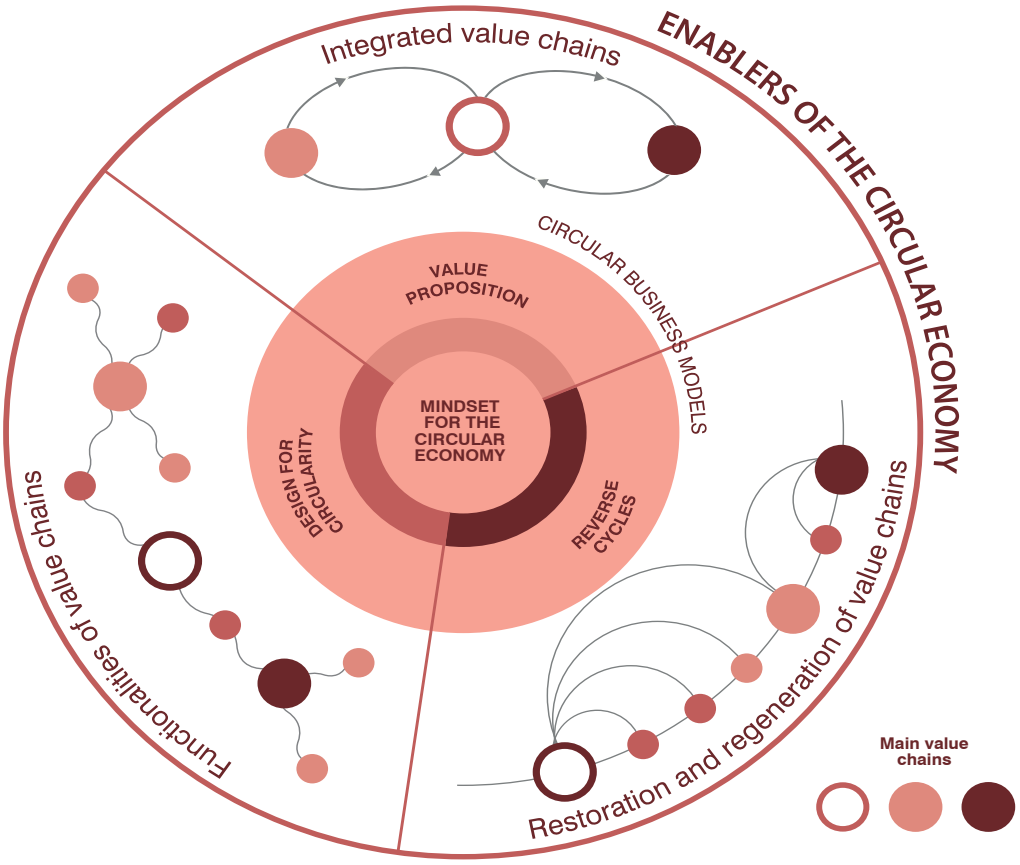


Source: Adapted from Ellen MacArthur Foundation (2013).

This publication also provides examples and case studies from Brazil about innovations in circular business models, such as: Products as services; Sharing; Extended product life; Circular inputs; Resource recovery and Virtualization, which are being adopted in several segments of the economy.

It has been concluded that the Circular Economy is already providing many opportunities for the Brazilian economy and industry by adding and recovering value in more resilient and sustainable ways. But for the Circular Economy to be scaled up and realize its potential in full, enabling conditions must be created to facilitate this transition by, for example, providing better quality education, adopting specific public policies, establishing an infrastructure focused on circularity, and promoting innovative technologies. Figure 2 shows the framework of the Circular Business System.

FIGURE 2 - ENABLERS OF THE CIRCULAR BUSINESS SYSTEM



Source: Prepared by the authors (2018).

This way, Brazil will be able to explore its strategic differentials in a circular economic model to become a benchmark in the world in promoting innovation and generating economic, environmental, and social values in the 21st century.

1. BACKGROUND

The linear economic model of production-consumption-disposal is close to exhaustion. Over the past thirty years, despite the technological advances and increased productivity of processes that made it possible for them to extract 40% more economic value from raw materials, demand has increased by 150% over the same period (UNIDO, 2013). Moreover, this model has proved to be ineffective to address the main challenges facing contemporary society, which include: reducing poverty and social inequalities and addressing climate change, water scarcity, loss of biodiversity, and the exhaustion of natural resources. From the standpoint of business, it is a model solely based on cost reduction and on a short-term approach that does not give priority to generating differential values in the market, such as more durable and better-quality services and products [1].

To achieve economic development combining prosperity with sustainability, we need to move away from a scarcity-based, short-term, and process-focused economy toward a value-based, long-term economy with a systemic view.

1. In this paper, product refers to a good, although the Brazilian Association of Technical Standards (ABNT) considers goods and services as products.

One way of doing this is through an economy that dissociates economic growth from the consumption of resources and generation of negative environmental and social externalities. We need to begin to associate economic growth with a model that promotes the regeneration and restoration of natural capital and generates positive social and economic impacts.

One of the ways to address this problem is by adopting a circular economic model that links economic growth to a cycle of continuous positive development that preserves and improves our natural capital, optimizes resource production, and minimizes systemic risks through the management of finite inventories and renewable flows. (ELLEN MACARTHUR FOUNDATION, 2017).

This transition has been occurring gradually as a result of the adoption of new business models and of current technological trends such as digitization, the notion of products as services, sharing, and connectivity, which promote, among other things, greater access to information, value chain integration, and new partnerships.

These developments have been affording an opportunity to promote the biggest systemic change in the current economic model since the industrial revolution. More than a necessity, the circular economy brings innovative solutions to industry, governments, and society.

Since the year 2000, growth in demand for primary goods and the rise in international commodity prices[2] helped boost the economy of commodity-exporting countries such as Brazil. However, price volatility significantly weakens economies dependent on commodity exports.

Despite being ranked 8th in the ranking of the world's largest economies (INTERNATIONAL MONETARY FUND - IMF, 2017), with a Gross Domestic Product (GDP) of R$ 6.3 trillion in 2016 and a per capita GDP of R$ 30,407 (BRAZILIAN INSTITUTE FOR GEOGRAPHY AND STATISTICS -

2. Between 2000 and 2008, commodity prices rose at a rate of 13.4% a year, and in the period marked by the highest increase (between 2004 and 2008) the rate was 21% a year (DE NEGRI; CAVALCANTE, 2014)

IBGE, 2016), the Brazilian economy, which competes internationally, can and needs to incorporate these solutions.

In Brazil, the industrial sector has been experiencing a significant decrease in its relative share of GDP. In the 1980s, industry accounted for 45% of GDP; currently, it accounts for approximately 21% and the share of manufacturing industry decreased from 34% to 11% over the same period (services, on the other hand, accounted for 73.3% of GDP in 2016 [IBGE, 2016]).

This scenario of a decreasing share of industry in the economy has also been observed in other countries. However, in some of them, such as in the United Kingdom, this decrease has been strategically reconciled with an increase in the contribution of traditionally industrial companies to other sectors in an integrated way. British manufacturing industry, for example, has been reinventing itself in recent years: besides carrying out manufacturing activities, it is becoming a provider of high-quality services. A classic example of this change is that of Rolls-Royce, which over the last ten years has gone from being just a turbine supplier to becoming a full-fledged aviation company, ensuring the availability and continued operation of turbines. As a result, maintenance-related services account for more than half of its revenue currently (Exame CEO, 2017b).

Opportunities of this kind to boost the economy and add value to products can be developed in Brazil, which stands out for having one of the key conditions for the circular economy: the potential to generate renewable energy. First-, second-, and third-generation solar, wind and biomass energy generation, tide energy generation, and other energy generation alternatives open up new windows of opportunity with the circular economy.

Although this study was not meant to quantify the benefits of a transition to the circular economy, Brazil will benefit from adding value to commodities; from increasing the supply of jobs; from promoting practices associated with maintenance services; from creating more structured economic activities related to reverse cycles, such as recycling (recovery of materials), remanufacturing (recovery of products) and strengthening of chains; from promoting new business with innovative

solutions that increase the competitiveness and penetration of the domestic industry in domestic and global markets. However, for this to happen, government, corporations, universities, and society as a whole need to change their current mental models. Following this change, new businesses, new value chains, and new enabling conditions (such as public policies and technologies) need to be developed for setting up a circular business system.

1.1 ORIGIN OF THE CIRCULAR ECONOMY

The Circular Economy can be seen as a proposal for an economic model that integrates several schools and lines of thought, such as: Industrial Ecology, Life Cycle Engineering, Life Cycle Management, Performance Economics, among others.

Industrial Ecology involves two main integrated action and research lines: one that seeks solutions based on ecological phenomena (a line similar to that of Biomimetics, which seeks solutions inspired by nature), and another one that seeks to strike a balance between natural systems and those built by humans with the aim of avoiding negative environmental impacts. The International Society for Industrial Ecology and the Journal of Industrial Ecology are the venues for meetings and dissemination of this line of thinking currently.

Life Cycle Engineering (LCE) and Life Cycle Management (LCM), which are terms coined by the International Academy of Production Engineering (CIRP) and by the United Nations Environment Program (UNEP), respectively, refer to engineering and management approaches designed to identify the impacts of the life cycle of products and come up with solutions to reduce the negative impacts of that cycle from the product development phase to the end of a product's life cycle.

Performance Economics is an initiative by Walter Stahel and the main contributions of this line of thought include mainly the idea of a function-based economy where services are emphasized instead of the sales of physical products only.

In addition to these, lines related to closed loop and generation of positive impacts in the life cycle of products, such as Cradle to Cradle, Collaborative and Shared Economics, according to which products and services can be used by more than one customer, along with the current trends of the Digital Age, contributed to structuring the current proposal of the Circular Economy.

Ghisellini, Cialani and Ugiati (2016) indicate that the concept of the circular economy was introduced by Pearce & Turner (1989), based on Boulding (1966), according to whom the idea of the economy as a circular system was already seen as a prerequisite for maintaining human life on Earth, the contemporary proposal of Circular Economy is the result of an integration of several areas, as described here. However, the main feature of the latter lies in the incorporation of the Circular Economy into the economic mainstream not as the "savior" of the planet and of the human species, but as the "savior" of the economy itself, with positive consequences for the planet and humankind.

For the world of business, the topic gained worldwide repercussion mainly due to the launch of the report "Towards the Circular Economy: Accelerating the scale-up across global supply chains" during the World Economic Forum held in 2014, which was drawn up by that forum jointly with the Ellen MacArthur Foundation.

As a dynamic, contemporary, evolving, and practice-based concept, economic activities in a circular economy generate and recover values of products and services that are preserved in the long term and for all parties involved in the economic system.

The transition to a circular economy model is based on innovation and systemic effectiveness is the main driver of its positive impacts, through which not only efficiency and effectiveness are sought, but also positive consequences for the parties involved in the system.

Thus, special mention should be made of the great differential of the Circular Economy in proposing the expansion of the central element of the linear economy - from Production to System - and, as a result, in expanding, diversifying, and ensuring greater longevity for value creation, proposition, and capture. For this purpose, it is meant, in an

intentional and integrated fashion, to restore physical resources and regenerate the functions of natural and anthropic systems, creating greater economic and social opportunities, with consequent positive consequences for sustainability.

To achieve these objectives, three principles are considered in the circular economy (ELLEN MACARTHUR FOUNDATION, 2014):

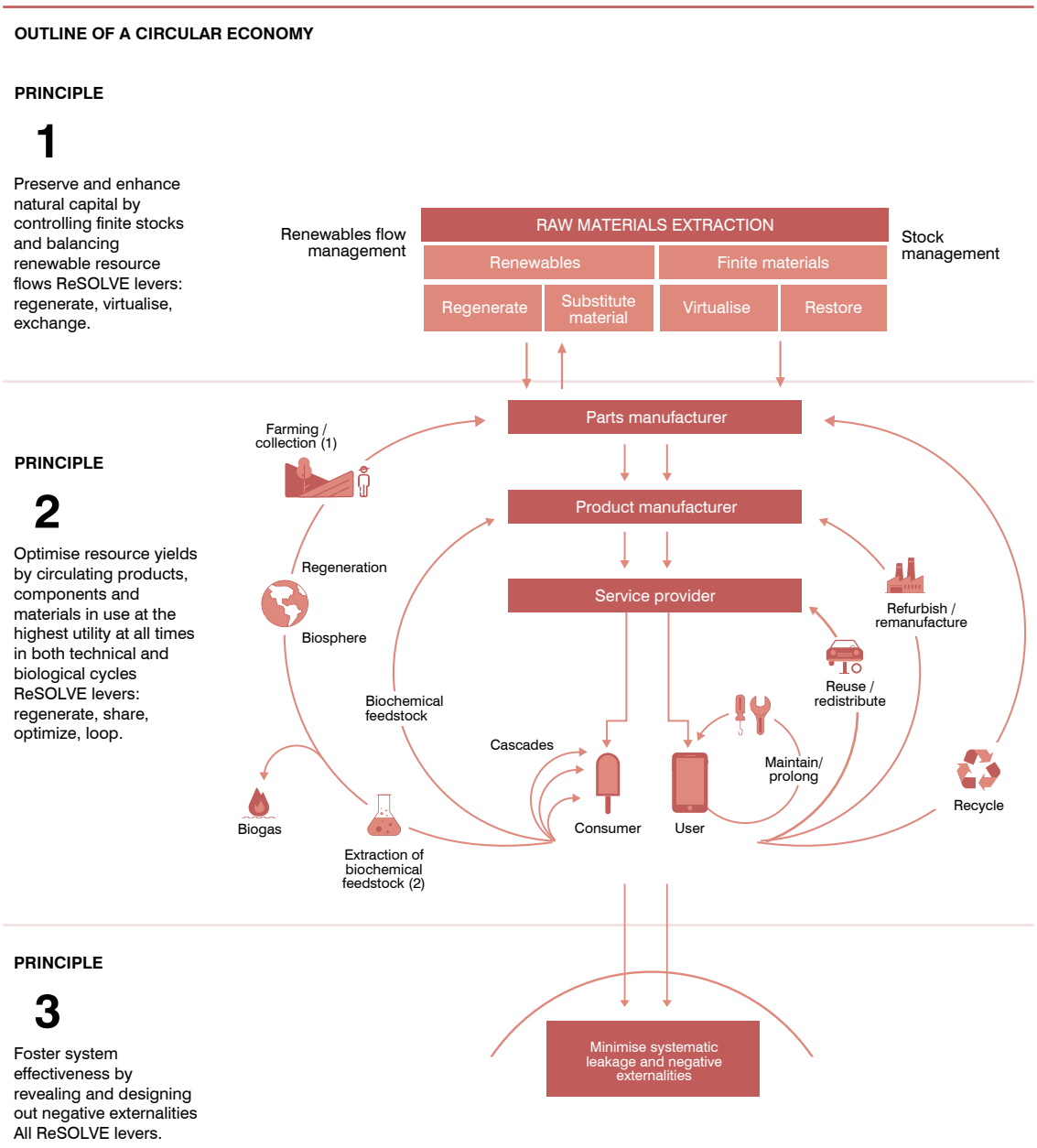
1. Preserving and improving the natural capital base by restoring and regenerating natural resources;

2. Maximizing the yield of resources, whose main results are less wastage and greater circularity of resources;

3. Stimulating the effectiveness of the system, generating positive impacts for all stakeholders.

Although the flows of materials related to activities of the primary, secondary, tertiary, and natural sectors are integrated, the diagram representing the circularity of the physical flows (Figure 3) shows opportunities for reverse cycles, which return after use, in biological (agriculture-forest-natural) contexts, on the left side, and in technical (industrial) contexts, on the right side. On the biological side, some reverse flows related to renewables and cascade utilization are presented, but regeneration will only be actually achieved if a territorial and landscape management approach is adopted, integrating economic activities into ecosystems within the so-called "biological cycle." In the technical cycle, opportunities are presented to recover the value of products through sharing, maintenance, reuse, remanufacturing, and recycling.

FIGURE 3 - DIAGRAM OF THE FLOWS OF MATERIALS AND PRINCIPLES IN THE CIRCULAR ECONOMY



Source: Adapted from Ellen MacArthur Foundation (2013).

1.2 MOTIVATIONS FOR TRANSITIONING TO THE CIRCULAR ECONOMY

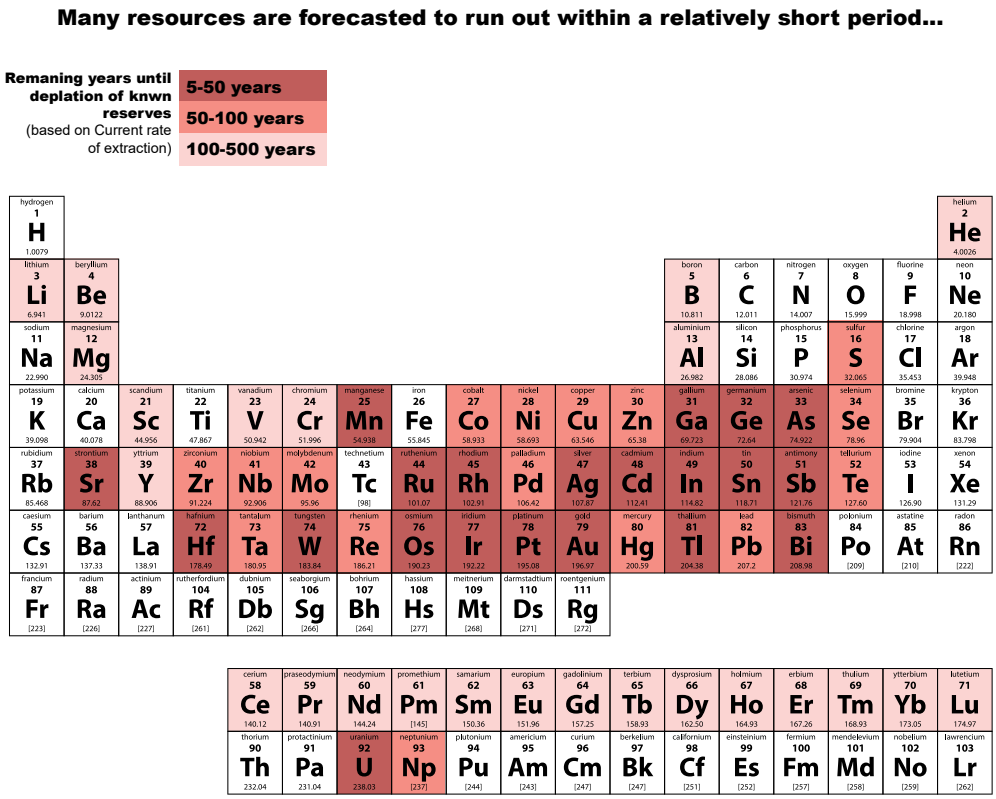
Some motivators for transitioning from a linear to a circular economy will be presented in this section:

- Limits of the linear model;
- Cost reduction and greater value generation;
- New investment sources
- Increased resilience and collaboration
- Job creation
- Legal and regulatory compliance

1.2.1 LIMITS OF THE LINEAR MODEL

Resource scarcity indicates that linear models of doing business are getting closer and closer to exhaustion (ELLEN MACARTHUR FOUNDATION, 2013). Some important elements tend to exhaust themselves in a relatively short period of time (Figure 4).

FIGURE 4 - PERIODIC TABLE



Source: Clarck4 (2014? *apud* ELLEN MACARTHUR FOUNDATION 2014)[3].

See the risk of exhaustion of mineral resources over the next 50 years in Table 1, with current production and consumption patterns.

3. Professor James Clark, Green Chemistry, The University of York.

TABLE 1 - EXHAUSTION PERIOD OF 60 ELEMENTS IN YEARS AFTER 2050

Very scarce (RGE exhausted before 2050		Scarce (RGE Exhaustion time <100 years after 2050)		Moderately scarce (RGE exhaustion time between 100 and 1,000 years after 2050)		Not scarce (RGE exhaustion time> 1000 years after 2050)	
Antimony	-10	Gold	10	Arsenic	400	Aluminum	20,000
		Molybdenum	50	Bismuth	200	Barium	1,000
		Rhenium	80	Boron	200	Beryllium	200.000
		Zinc	50	Cadmium	500	Cobalt	2000
				Chromium	200	Gallium	1,000,000
				Copper	100	Germanium	200,000
				Iron	300	Indium	10,000
				Lead	300	Lithium	9,000
				Nickel	300	Magnesium	30,000
				Silver	200	Manganese	2,000
				Tin	200	Mercury	400,000
				Tungsten	300	Niobium	2,000
						Metals of the platinum group	1,000
						Rare earth metals	20,000
						Selenium	300,000
						Strontium	10,000
						Tantalum	20,000
						Thallium	1,000,000
						Titanium	10,000
						Uranium	2,000
						Vanadium	20,000
						Zirconium	2,000

Source: Henckens et al. (2016).

1.2.2 COST REDUCTION AND GREATER VALUE GENERATION

Competitiveness gains with the circular economy materialize through cost reductions and, mainly, greater value generation. The main opportunities for reducing costs include: better use of materials, waste reutilization, greater effectiveness in production systems, and use of a product as a service, among others.

Estimates for Europe show that practices associated with the circular economy can lead to reductions in mobility costs ranging from 60 to 80

percent as a result of systems and solutions that use renewable energy. In the food industry, practices that reduce wastage can potentially generate savings of 25-50%. Practices that promote the reutilization of materials can reduce built areas by 25-35% (ELLEN MACARTHUR FOUNDATION, 2015).

In addition, values preserved for longer periods or recovered through reuse, remanufacturing, extended product life, new services, among others, afford competitive opportunities and differentials in the market.

In India, it is estimated that the circular economy has the potential to generate US$624 billion per year by 2050 (ELLEN MACARTHUR FOUNDATION, 2016a); in Europe, this potential can be as high as 320 billion euros by 2025 (ELLEN MACARTHUR FOUNDATION, 2015).

In Brazil, several opportunities already identified in the industrial sector can be explored with new business models, design, recovery of materials, apart from the existing informal economy. These opportunities include exploring the potential of the electronics industry through the recovery of materials and new services; of the construction industry by reducing the amount of waste generated; of the textile industry by using new materials and circular value chains; of the plastic industry, with great reduction and recovery opportunities, as well as new materials (See case mentioned in this study; ELLEN MACARTHUR FOUNDATION, 2016b, 2017).

Therefore, the circular economy allows for market differentiation, access to new markets or niches not yet exploited, and access to new sources for capturing revenues from new types of products or services. Value can therefore by captured in multiple product cycles, among other opportunities, such as increased customer interaction and retention and brand loyalty. (THE BRITISH STANDARDS INSTITUTION - BSI, 2017).

Companies with a long-term vision and focused on innovation and value generation, as promoted by the circular economy, have a better economic performance than others. These benefits lead to average gains of 36%, with a 47 percent increase in revenues and 81 percent higher profit margins (BARTON; MANYICA; WILLIAMSON, 2017).

1.2.3 NEW INVESTMENT SOURCES

The circular economy can also attract investments to the Brazilian industry. In 2017, for example, 750,000 euros were invested in the ERA-MIN2 consortium with a focus on the circular economy, where several countries invest in developing resources and technological innovation for mineral processing (FUNDING AUTHORITY FOR STUDIES AND PROJECTS - FINEP, 2017).

Internationally, specific funding is already available for the transition to the circular economy, such as from the European Investment Bank (EIB), through the European Fund for Strategic Investments (EFSI). Over the past five years, the EIB has co-financed projects worth 2.4 billion euros that had positive impacts on sustainable and economic development, competitiveness, and employment (EIB, 2017).

1.2.4 INCREASED RESILIENCE AND COLLABORATION

The circular economy can also contribute to the resilience of economic systems by keeping materials in the system for longer periods through reverse cycles, reducing dependence on the availability of raw materials and the vulnerability caused by fluctuations in commodity prices. With respect to biological cycles, it creates favorable conditions for preserving and restoring nutrients to regenerate natural capital, apart from reducing negative externalities such as climate change (BSI, 2017).

Another major feature of the circular economy is the collaboration it makes possible between actors within and between the technical and biological cycles involved. This allows for win-win solutions to be developed, adding value to both chains. Success cases of collaboration have been recorded, such as the case of Green Eletron, a company that manages reverse logistics for ABINEE (Brazilian Association of the Electrical and Electronics Industry), in which the reverse logistics framework is shared among its members, giving rise to opportunities for new circular businesses at a lower cost than that of individual solutions.

1.2.5 JOB CREATION

The shift toward a more effective use of resources, especially through reuse and recycling of materials and extended product life, will result in a change in the relationship between goods and services in any economy. This is undoubtedly one of the main reasons for job gains. An economy that favors these practices is, by definition, more labor-intensive than one based on the philosophy of disposal, that is, on linear resource flows. Taking care of what has been produced already through repairs, maintenance, upgrading, and remanufacturing, for example, requires more labor as compared to a linear economy (WIKKMAN; SKANBERG, 2016).

As a result of greater effectiveness in the use of resources by circular economic activities, it was seen that jobs in five European countries increased by about 1.2 million in areas related to renewable energy and material and energy use efficiency (WIJKKMAN; SKANBERG, 2016).

According to data from IBGE's Continuous National Household Sampling Survey (PNAD), services in Brazil already accounted for more than two-thirds (67.7%) of the employed population in 2016. This figure can be even higher in a circular economy, strategically and integrated into other sectors.

1.2.6 LEGAL AND REGULATORY COMPLIANCE

The transition to the circular economy will make it possible for Brazilian industry to be ahead in terms of domestic and international laws and regulations, playing a collaborative role in building public policies designed to facilitate systemic changes.

As a result of adopting a new business model focused on innovation and capture of new values that involve, for example, reuse, remanufacturing, and recycling, Brazilian industry will reap legal benefits, such as compliance with the National Policy on Solid Waste and sectoral agreements entered into in various value chains, such as in those of consumer electrical and electronic products, plastics, textiles, etc.

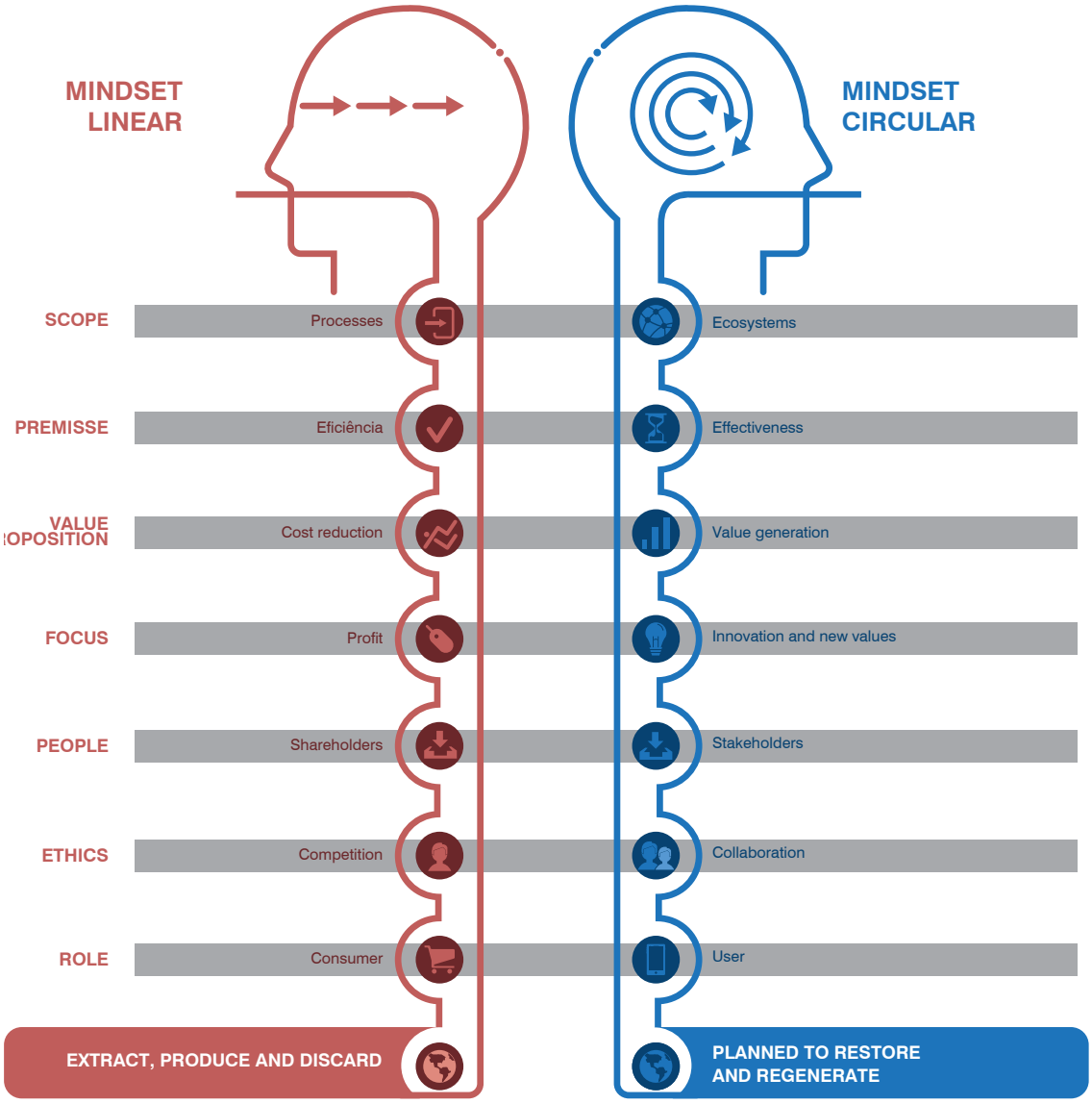
In addition, its activities will be in line with international laws, such as those of the European Union, including the Integrated Product Policy (2001/180), the European Directive on Waste Electrical and Electronic Equipment (2012/19/EU), and the Action Plan for the Circular Economy (2002/95/EC), making it possible for Brazilian products to enter international markets.

In addition to the legal issue, there are standards that include the Circular Economy directly and indirectly, such as BS 8001:2017: Framework for implementing the principles of the circular economy in organizations (BSI, 2017) and NBR ISO 14001:2015 which includes a life cycle perspective among the requirements set for guidelines on how to use the Environmental Management System (BRAZILIAN ASSOCIATION OF TECHNICAL STANDARDS - ABNT, 2015).

2. CIRCULAR ECONOMY APPLIED TO BUSINESS

The transition from linear to circular models is associated with innovations in the business system designed to ensure greater systemic effectiveness and bring about positive impacts in a world in the process of shifting from a linear to a circular one (Figure 5).

FIGURE 5 - THE TRANSITION FROM A LINEAR TO A CIRCULAR WORLD



Source: Prepared by the authors (2018).

This transition requires changes in mindsets in relation to the following elements:

- Scope: a broader vision is required beyond improvements in process efficiency, as well as seeking gains considering the systems that the business is linked to;

- Premise: doing more with less (efficiency) is not enough to reap the benefits of a circular economy, as the consequences of the activities (effectiveness) must be considered as well;

- Value proposition: a value proposition focused on cost reduction is a typical strategy of the linear economy marked by limitations and by generating negative externalities; in a circular economy, a value proposition considers value added in resources and focuses on maintaining them at the highest level of usefulness and for longer periods;

- Focus: profit is important for any business, but in a circular economy it is achieved through innovation and generation of new values;

- People: people other than shareholders must be considered; other stakeholders in the business, such as society, customers, and suppliers, who play a key role in a circular economy, as they add value and quality to products, are included in reverse chains, and have important information for designing innovative and circular products;

- Ethics: collaboration is more important than competition in a circular economy, as competition gives priority to one business to the detriment of others;

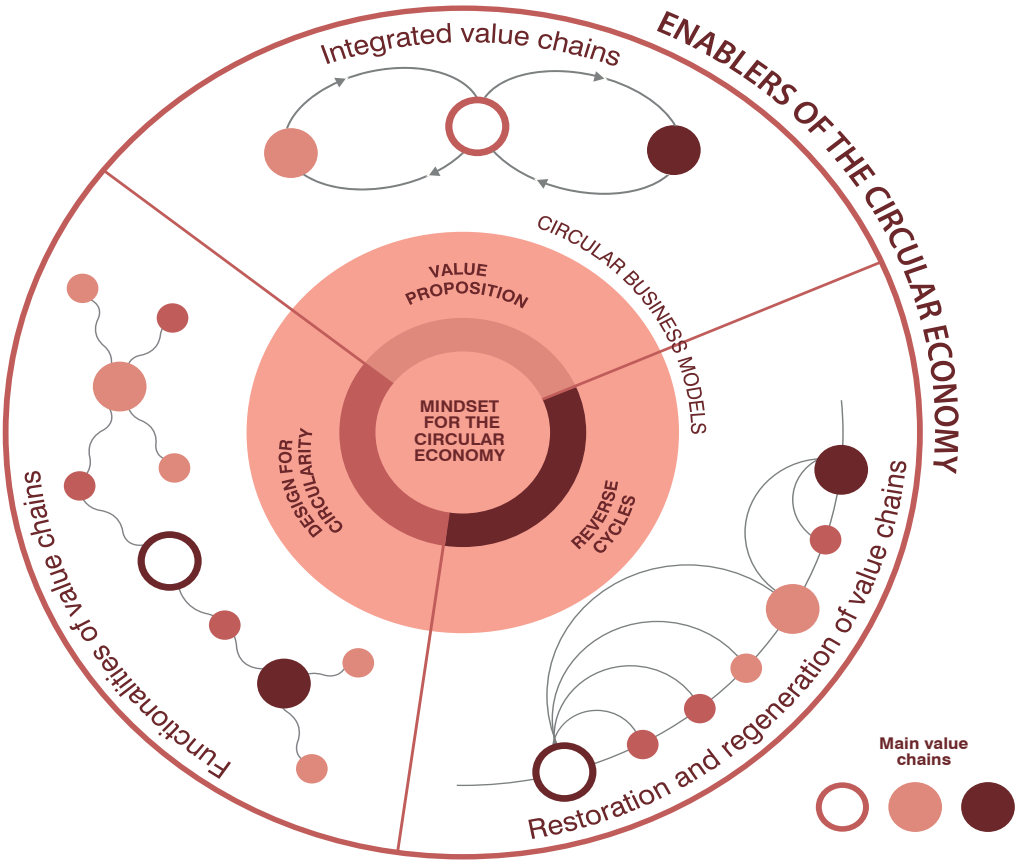
- Function: in a circular economy, experience and access to the necessary function is more important than owning a product, and this makes it possible for companies to develop closer relations with their customers and increases customer loyalty.

For this transition to be possible, innovations must occur at various scales of the business system (Figure 6). The key element is changing mindsets or mental models to incorporate the elements of the circular world shown in figure 5, which represent the great cultural change that is required for this purpose.

This transformation must entail innovations in business models, especially in value propositions, design, and reverse cycles, which lead to the integration, functionality, restoration, and regeneration of value

chains. The transition of the entire business system to circularity is supported by enablers of the circular economy, such as public policies, education, and technologies. Figure 6 shows this system and it is one of the unprecedented contributions from the authors of this publication to the knowledge basis required for understanding and building the circular economy.

FIGURE 6 - ENABLERS OF THE CIRCULAR BUSINESS SYSTEM



Source: Prepared by the authors (2018).

2.1 CIRCULAR BUSINESS MODELS

A business model comprises the activities performed by an organization that determine how it creates, delivers, and captures value.

Transitioning to a circular business model is a strategic decision that has an impact not only on the organization's activities, but also on its value chain. Understanding the value chain enables a company to understand or even redefine its role in relation to other organizations.

The first step in this transition consists in analyzing innovation opportunities in the current business model that make it possible for better processes, products, and services to be created and for the value proposition to be expanded by capturing lost and unnoticed values for all stakeholders. Some key factors that should be considered include leadership, organizational maturity, culture, management, governance, types of products or services, and market.

Among business models that include elements of the Circular Economy, the following ones stand out:

- Products as services;
- Sharing;
- Circular inputs;
- Resource recovery;
- Extended product life;
- Virtualization.

2.1.1 PRODUCTS AS SERVICES

In this type of business model, the value proposition is focused on the roles and services[4] provided through the use of products. It can be steered to integrate services into the sale of products and even to preserve the ownership of a product by organizing and offering functions. This means that services can be offered together with products by means of a lease contract or through the offer of solutions.

4. In this report, the term "product" refers only to a physical good and Products as Services is synonymous with the Product Service System. Servitization can be interpreted as the way to turn product sales into service provision.

Product durability, reusability, and sharing become direct drivers of revenues and cost reductions in the business model. It becomes more interesting for an organization to extend the life of a physical artifact and return a product at the end of its useful life, with reverse logistics, so that it can offer it to other customers, and this process becomes an intrinsic element of its business. Therefore, these factors become decisive for ensuring greater profitability to the business and also result in closer relations with customers, who start to give preference to quality rather than to quantity and to the formation of circular systems, with lower resource consumption and a focus on performance.

This business model is attractive to companies whose product operation costs are high and which enjoy a competency advantage to provide support to and maintain customers (see the Philips Lighting case).

LIGHTING AS A SERVICE[5]

Philips Lighting began its journey into the circular innovation of its business model at least 5 years ago, when it began to design the supply of lighting products as a service, migrating from its previously prevailing model of selling light bulbs for lighting to a new model. In Brazil, this innovation was introduced two years ago, starting with the training and structuring of project and sales teams and the development of partners who used to be suppliers. Today, Philips Lighting Brasil already has six projects implemented in Brazil, which account for 20% of its total revenues.

By offering products with a service, Philips Lighting changed its value proposition and began to deliver much more than quality lighting products, as it now offers complete solutions that include: more energy-efficient projects whose size is tailored to customers' needs; sensors that regulate lighting according to the light available in the environment, improving lighting efficiency, reducing the costs of using lamps by 70-80%, and extending their useful life. In addition, the company installs and maintains lighting systems, provides remote operation and monitoring, and manages the end of the useful life of products or new product cycles at the end of their cycle of use by customers.

5. Information provided by Philips Lighting Brasil.

Philips Lighting's new business model generates additional value to its own business from the physical assets it installs and whose ownership is retained by the company through a wide range of services. In addition, this approach allows for the generation of economic value to be to dissociated from the consumption of products. At the same time, it creates additional long-term value for various stakeholders and places the company in a leading position in terms of innovation in the industry in which it operates.

2.1.2 SHARING

In this type of business model, the aim is to improve the efficiency of the utilization of resources already used for manufacturing a product by extending its use. Shared use, access, and ownership is one of the solutions for this purpose. It is possible to identify two specific cases of business models falling under this category: non-monetized sharing and monetized sharing.

1. Non-monetized sharing models are those in which there is no financial transaction and whose existence depends on the participation and generosity of the members of a community (customer-to-customer) to share goods and services (see the case of Tem Açúcar). Its benefits for users include reducing the need for ownership and storage of goods.

2. Monetized sharing models are those in which a transactional financial arrangement of some kind is made between users or organizations. Examples of shared platform include: rental of private parking spaces, shared ownership of products, spatial and logistic sharing (see the car sharing cases).

CREATING INTERCONNECTIONS TO STIMULATE COLLABORATION AND SHARING[6]

Believing that access is more important than ownership, the Tem Açúcar [do you have any sugar?] platform is intended to encourage a culture of sharing among neighbors at the local level. Exchanges take place in a non-monetized fashion, that is, on the basis of lending between users.

Launched in late 2014, the application was an immediate success, as it had attracted 30,000 users in just one month in operation. Today, there are 150,000 people sharing objects of all kinds in more than 10,000 neighborhoods in all Brazilian states. Half of the requested objects are found and 25% of them are made available within half an hour. This lending model has helped users save a total of R$7.8 million - an estimate based on the average price of each object transacted since the platform was launched.

Focused on financial sustainability, the startup is now developing business models designed to monetize the service provided by the platform - although transactions between users will, in principle, continue to be non-monetized transactions. One of ideas of the Tem Açúcar platform is to offer any kind of group - a college or a gated community, for example - the opportunity to create a private community for users to share objects with specific people.

SHARING CARS IN BRAZIL[7]

Launched in late 2016, the Vamo (alternative vehicles for mobility) project is intended to promote sustainable urban mobility through an electric car sharing network in the city of Fortaleza. As a partnership between the Fortaleza city hall and the company Serttel, the project has 10 stations where users can find electric cars and, using an application, request its service.

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6. Information provided by ArcelorMittal.
7. Information provided by Tem Açúcar.
Information obtained at www.vamofortaleza.com; Strategic Workshop – Circular Economy (IEA/USP).

Another similar initiative is that of the LDS Group, which launched a car sharing service in the city of São Paulo called Urbano LDSharing in 2017. The system used for offering the service is "free-floating" - cars are distributed in predefined areas in the city and can be used spontaneously, as well as the service offered by Vamo. The focus of the service is on short trips, for which customers pay per hour.

The project was developed in partnership with a French company (Vulog) that is a provider of car-sharing technology. All cars are equipped with hardware that provides information on the position of the vehicles, on their speed, and on how users are driving them.

The initial fleet has 60 cars, 15 of which are electric cars. But the goal for 2018 is to expand the fleet to 300 vehicles, 50% of which will be electric cars. According to the company's CEO, Leonardo Domingos, the initial goal was to have an all-electric fleet. However, the few models of electric vehicles available in Brazil combined with the lack of a recharge network and legislation for imports or production of such vehicles make it difficult to implement an electric car-sharing model as has already been done in many European countries.

To overcome these barriers, the company is looking for partners to invest up to R$25 million, which would make it possible to implement a network of vehicles with four cars per square kilometer.

2.1.3 CIRCULAR INPUTS

Business models that use inputs that can be or were restored, such as recycled, renewable, reconditioned, remanufactured or uncontaminated materials are known as circular input models. Circular inputs can occur both in the biological cycle and in the technical cycle, and one of its success factors is related to the use of pure inputs, i.e. inputs that are used without being combined with any other inputs and which, therefore, facilitate their reutilization (see the case of ArcelorMittal).

Using non-toxic inputs enables their safe return to the biosphere at the end of their useful life to become a nutrient for regenerating natural capital in the biological cycle (see the CBPAK case).

In the technical cycle, the purity of inputs is also fundamental to make recycling and, consequently, the use of recycled materials possible (see the Ahlma case). In addition to materials, recovered components can be used as circular inputs according to a company's capacity to disassemble, collect, and recover these assets.

Therefore, this business model has the potential to increase the longevity of value chains and reduce dependence on finite resources, making businesses more resilient.

STEEL WITH A CARBON NEUTRAL FOOTPRINT[8]

ArcelorMittal is the world's largest steel producer, operating in more than 60 countries. In Brazil, the company supplies steel to the automobile, home appliance, civil construction and agribusiness industries, among others.

Because of its infinite capacity to be transformed into products of equal or higher quality, steel is the most recyclable material in the world. Despite its success story, ArcelorMittal recognizes that steel production requires intensive use of natural resources and the need for incremental and disruptive changes to reduce demand for finite natural resources. The circular economy strategy includes increasing use of natural capital in processes, increased efficiency in the use of resources and restoration of co-products through upcycling processes.

In its journey toward circularity, the differential of ArcelorMittal Brasil is that it has a subsidiary called ArcelorMittal BioFlorestas. With an area of 100,000 hectares of planted eucalyptus forests and 20,000 hectares of preserved natural areas, the company is the link between the steel chain and a regenerative economy in the biological cycle. Using charcoal as a bioreductor in the process makes it possible for the company to produce steel with neutral carbon balance in its industrial units with charcoal blast furnaces. Because the company uses regenerative farming methods, carbon sequestration is significant during the processes of planting and growing eucalyptus forests.

8. Information provided by ArcelorMittal.

All the forests of ArcelorMittal are certified by the Forest Stewardship Council, which is a key requirement in a market with a bad track record of production under labor conditions comparable to slavery and of illegal logging. The company also promotes integration and multiple use of planted eucalyptus forests, generating income and contributing to improving social conditions in communities through beekeeping and fish farming programs.

REGENERATIVE PACKAGING WITH A POSITIVE CARBON FOOTPRINT[9]

Established in 2002, CBPak offers an alternative to single-use packaging made of plastic or styrofoam, innovating both in terms of how raw materials are used and of the value proposition of the business. CBPAK uses cassava starch as raw material for its products, making it possible for 100% of them to be compostable.

In addition to innovating in the use of natural and renewable materials, CBPak operates a service model where the company retains ownership of the packaging and takes care of the reverse logistics operation to make sure it is focused on composting through commercial partners in locations close to where the products are used.

In addition to consuming 62 times less water than a plastic cup, a drinking glass produced by CBPAK absorbs 3.74g of greenhouse gases, while a plastic cup generates 16.69g of such gases. In addition, the drinking glasses produced by CBpak do not take up space in landfills and make soil regeneration possible - 1 million composted drinking cups made of cassava starch regenerate 100m³ of soil.

9. Information provided by CBPak.

PROMOTING A PARADIGM SHIFT IN THE FASHION INDUSTRY[10]

Established in 2017, Ahlma adopts a business model that combines the recovery of resources with the offer of products as a service. Approximately 80% of the raw materials used in its products come from secondary sources (waste from the textile chain) and the remaining 20% consist in a mixture of recycled fibers and a small amount of virgin raw materials with cotton certified by the Better Cotton Initiative (BCI). Such decisions significantly reduce the cost of inputs and the need for primary raw materials, but they also allow for value to be captured from materials that would otherwise be disposed of.

The company has set up a concept store where it markets a subscription model for clothing instead of selling its ownership. Additionally, customers can pay for a washing service in eco-efficient machines available in the store using exclusively natural and biodegradable products and repair or customize their clothing.

2.1.4 RESOURCE RECOVERY

The main objective of this business model is to recover the value and function of products, components, and materials, including reverse cycle activities such as remanufacturing and closed and open loop recycling. Models like this reduce the demand for natural capital and the wastage of components (see the ANRAP case) and materials (see the case of Lojas Renner). In addition, cascade use of materials and by-products recovers value for what used to be disposed of.

Operationalizing reverse cycles and channeling materials and by-products to the next transformation and value-adding stage is of paramount importance, since they make it possible for resources to be recovered either in the cycle itself or in other cycles (see the case of Rede Asta). In chains involving end consumers, customers play a key role in returning used or unwanted products, making it easier to recover value.

10. Information provided by AHLMA.

EXTENDING THE LIFE OF AUTO PARTS BY MEANS OF REMANUFACTURING[11]

The National Association of Auto Parts Remanufacturers (ANRAP) plays a key role in structuring and disseminating the practice of remanufacturing in Brazil, which is an important for extending the useful life of products - transforming a product at the end of its useful life into another product with the characteristics of a new one.

The remanufacturing process includes several steps: disassembly, cleaning, evaluation of parts, replacement of damaged parts and reassembly of the product. According to ABNT's standard 15296, only the original manufacturer can carry out remanufacturing processes, thus guaranteeing the quality of remanufactured products - ANRAP has a seal of origin currently.

Products remanufactured by members of ANRAP, which include companies such as EATON, WABCO, BorgWarner, and Cummins, among others, cost 40-60% less on average than manufactured parts, apart from reducing consumption of virgin raw materials.

Growing at an average rate of 10% a year, the parts remanufacturing sector in Brazil recovers more than 2,600 tons of resources, including aluminum and iron, and has a share of 6% in the post-sales sector, a percentage that is likely to rise to 20% by 2020.

RESPONSIBLE AND CIRCULAR FASHION[12]

The company Lojas Renner is adopting the fundamentals of the circular economy in its productive chain and in the way it develops its products. Recovering waste from its fabric cutting process, which was previously disposed of in landfills or sold as low value-added products, the company implemented reverse-cycle processes with its suppliers.

11. Information obtained at http://www.anrap.org.br/noticias/raio-x-do-setor-de-remanufatura/.
12. Information provided by Lojas Renner.

Its pilot scale project was carried out in partnership with suppliers, the LCM Inovação e Sustentabilidade consulting company and the Foundation for Research Development and Industrial Improvement - FIPAI, which supports the São Carlos Campus of the University of São Paulo - USP. For this purpose, it was necessary to identify and engage partners in the development of prototypes of knitted fabrics and jeans produced with recycled yarns, in addition to structuring and ensuring the economic and technical feasibility of the entire reverse chain.

In addition to collections made from recycled fabric, which in the first nine months of the project have already recovered 220 tons of waste fabric that were used to produce hundreds of items for children's and men's clothing collections already being sold in its stores, Lojas Renner has been collaborating toward developing projects designed to improve processes and new technologies with its suppliers from the standpoint of the circular economy with the aim of reducing losses at origin.

Based on this project, the company intends to expand the program by stepping up resource recovery using design methodologies focused on the circular economy and engaging more suppliers and customers in manufacturing more responsible and circular fashion products.

USING NETWORK CAPACITY TO SCALE UP VALUE RECOVERY[13]

Rede Asta is an example of a multi-sectoral business model that combines circularity, social and gender inclusion, and collaboration. With a network of 63 groups of women artisans spread across 10 states in Brazil, Rede Asta transforms post-industrial waste into art. Its handmade products are often sold to the companies that supply the waste that Rede Asta uses as raw material.

The Rio de Janeiro company also operates a virtual platform accessible to the Brazilian artisans through which training is provided in both

13. Information provided by Rede Asta.

entrepreneurship and reuse of materials, stimulating positive economic activities in low-income Brazilian communities. Operating on the basis of projects, Rede Asta has already produced computer cases and pouches from 1,000 bags of cement, as well as 4,000 backpacks and ecobags from banners, armchair upholstery, and uniforms.

With a revenue of R$1.35 million in 2016, the results of its innovations are significant. Rede Asta promotes social inclusion by offering new opportunities for women who used to work in the informal market with little visibility, contributing to turn artisans into entrepreneurs with an average income increase of 24%. Moreover, Rede Asta is aware of the value of materials and uses creativity to turn them into new products (more than 80% of its products are made from recycled material), in addition to promoting fair and transparent economic relations in the whole chain.

2.1.5 EXTENDED PRODUCT LIFE

The central purpose of this business model is to increase the useful life of a product, resulting in greater value in the use of resources and components and greater value delivered to customers and users for longer periods.

This type of business model offers many possibilities, since it is not restricted to the organization's products and can be used to extend the life of other companies' products (see the case of eStoks).

In addition to recovering the value of products, components, and materials, as already seen in the previous model, extended product life generates additional revenues from services such as maintenance, since the products remain available to users for longer periods. This business model is appropriate for most capital-intensive business-to-business companies, as is the case of those operating in the industrial machinery and equipment industry, and for business-to-customer companies, where new product versions typically deliver performance benefits to customers.

RECOVERING THE VALUE OF DEFECTIVE CONSUMER ELECTRICAL AND ELECTRONIC PRODUCTS BEFORE SALE[14]

EStoks has identified a business opportunity for extending the useful life of defective consumer electrical and electronic products, with a focus on Brazil's northeast region. By collecting these pre-consumer products from the retail network or from partner producers - Philips, Britânia, Philco, Magazine Luiza, Cadence, Oster, and Arno (SEB Group) - the business model significantly reduces reverse logistics costs, as most of producers are located in the south and southeast regions.

After collecting the products, the company applies its own algorithm to evaluate their status and quality and selects the best strategy to keep them at their highest level of usefulness and value upon returning them to the market. Of all the returned products, 55% are refurbished, 25% are repaired to be sold in eStoks' own stores at more affordable prices, and the remaining 20%, which cannot be recovered, are dismantled and its components reused.

The partners of EStoks get a financial gain six times higher than those afforded by standard disposal solutions, as instead of automatically opting for recycling, eStoks preserves the value of the products by giving priority to recovering and repairing them or, if this is not possible, to disassembling them to reuse their components.

2.1.6 VIRTUALIZATION

Traditionally, physical assets are the primary means for delivering value to customers. With the development of the processing capabilities of electronic components, cloud computing, and artificial intelligence networks, many services and activities that used to be performed and delivered physically can now be delivered digitally.

Through virtualization, physical infrastructure and assets can be replaced with digital services and, consequently, value can be delivered through virtual means. This type of business model offers opportunities

14. Information provided by eStoks.

for dematerialization in relation to physical products, reducing the use of natural resources and promoting adjustments to current trends related to the digital world, thus increasing the value perceived by customers (see examples such as those of Netflix, Spotify and MyWays).

Netflix: provider of media and video streaming services that has virtually replaced video stores. In 2013, Netflix expanded its activities and began to produce films and series and to provide online distribution services. In October 2017, Netflix had 109.25 million subscribers in 190 countries (ALEXA, 2017).

Spotify: music, podcast, and video broadcasting company that was officially launched on October 7, 2008. It provides content protected by digital rights management of record companies and media companies. Basic features are free with advertisements or limitations, while additional features such as enhanced streaming quality and music downloads are offered via paid subscriptions. Spotify provides access to more than 30 million songs. In June 2017, it had more than 140 million monthly active users and more than 60 million paying subscribers.

MyWays: developed by DHL, which offers delivery services for products purchased online. Through an application, any person can make deliveries at flexible times and earn extra income. Without increasing the delivery fleet, the service offered by the application is intended to connect demand to the provision of logistics services.

2.2 ELEMENTS OF CIRCULAR BUSINESS MODELS

Among the main activities and processes contemplated in business models for the transition to the circular economy, this section will focus on design for circularity, reverse cycles, and value proposition.

2.2.1 DESIGN FOR CIRCULARITY

Achieving the circular economy must be one of the goals of the design process, also known as the Product and Service Development Process,

as this is the process through which the main decisions related to the product/service life cycle are made. In this process, zooming out/zooming in from the outset of a project is fundamental for ensuring systemic effectiveness with positive impacts and for maximizing the value proposition.

To achieve this goal, companies must understand the needs and desires of society to translate them not only into product requirements, but also service requirements and other added values.

Therefore, the design team must be interdisciplinary, adopt a systemic approach and creativity techniques to anticipate the testing of ideas, concepts and solutions, and establish a channel of communication with its users and partners.

Adopting the Design Thinking approach is useful in this process, as it is mainly focused on human values and stimulates empathy between the design team and the needs of stakeholders in the project. This allows for innovative value propositions with high capacity to bring about positive impacts within circular chains and business models to be generated. Some requirements and strategies can help achieve these goals:

- Projects designed to promote greater durability, robustness, easy maintenance, multiple cycles, modularity, easy disassembly, use of unmixed non-toxic materials, use of recycled materials, whether recyclable or renewable, transformation of waste into inputs, life-cycle closure, among others;

- Human Centered Design, which can be useful to engage users and other stakeholders in the design process;

- Biomimetics, whose objective is to promote design approaches based on inspiration and learning with nature;

- Regenerative Design, which is intended to design systems without waste, where waste from one process is turned into inputs for others.

T-SHIRTS DESIGNED TO BE RECYCLED[15]

C&A has launched its first circular collection of Cradle-to-CradleTM (C2C) gold-certified t-shirts. The t-shirts, which were designed to be recycled, are part of the company's global strategy, which is structured around three pillars: Sustainable Products, Sustainable Supply Network, and Sustainable Lives. For each of the pillars, targets have been set to be achieved by 2020. The pillar of sustainable products is divided into two areas: sustainable raw materials, for which targets have been set to offer 100% cotton products made of more sustainable cotton (In Brazil today, 40% of the products are made of BCI - Better Cotton Initiative certified cotton and of organic cotton) and 67% more sustainable raw materials; and circular economy, which entails a commitment to increase the supply of products in line with this concept.

The t-shirts were developed by C&A Global in partnership with Fashion For Good[16], whose focus is on transforming the clothing sector by turning "fashion for good" into a standard, offering fashion with a positive impact.

During the design phase, it was necessary to engage the sales team and align the product strategy with the sales strategy, in addition to evaluating the performance of suppliers following the C2C criteria and promoting necessary improvements, which shows how supplier engagement was critical to the program's success - mainly because the concepts of circular economy and C2C are little known. To deal with such need, the company developed a narrative for engaging suppliers, customers, and employees.

One of the great differentials of these t-shirts is that they were produced in a way that does not generate excess waste and that they can be used as soil nutrients at the end of their useful life through composting. In addition, the t-shirts were produced using only safe and socially and environmentally responsible materials, with reuse of water and use of renewable energy in their production process.

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15. Information provided by C&A.
16. See the Good Fashion Guide, available on the Fashion for Good website, which tells the story of C&A in connection with this project. (https://fashionforgood.com/).

Currently, C&A is committed to introducing and expanding the range of products produced in line with the concepts of circular economy with the aim making use of other more sustainable raw materials.

CLOSED LOOP DESIGN[17]

Tarkett has been promoting the circular economy based on a global strategy focused on the choice of good materials, resource recovery, social well-being, and responsible use of resources. With an annual production of more than 470 million m² of flooring and lining, about 80% of its raw material was evaluated according to Cradle-to-Cradle® principles.

Tarkett develops new products with a focus on closed loop design, promoting "safe materials," resource management, pleasant spaces for people, and reuse, which requires devising post-use alternatives from the outset. The company has the capacity to recycle and reinsert 100% of the scrap generated in its manufacturing processes in its production processes. In addition, 67% of the materials used by the company contribute to the scarcity of resources – its goal is to hit the mark of 75% in 2020. To illustrate this, 65% of the PVC it uses is recycled, amounting to 100 tons per year.

Logistical costs and the lack of appropriate fiscal models to stimulate reverse logistics operations in Brazil constitute a major challenge. Tarkett is planning a marketing action aimed at encouraging resales. This action is also intended to lead installers to engage more strongly in these processes and to continue to encourage customers and consumers to recycle post-consumer products and installation leftovers. Tarkett's factories are already prepared to do so, and what's important is creating a new culture in the market and setting ambitious goals to increase recycled volumes with the support from customers, installers, and end users.

17. Information provided by Tarkett.

REDUCING WASTE GENERATION IN THE CONSTRUCTION INDUSTRY THROUGH MODULARITY[18]

Precon Engenharia innovated in developing prefabricated concrete solutions, thus reducing waste generation, which is a significant problem for the civil construction industry. Launched in 2010, the Precon Housing Solution (*Solução Habitacional Precon* - SHP) is the first innovative initiative in Brazil to use modular industrial processes inspired by the automotive sector, such as a construction method with lower use of inputs, improved working conditions, and cost reductions for the company.

SHP's approach consists in constructing buildings in modules that are assembled at the construction site. Compared to the traditional construction approach, the SHP solution results in a productivity gain of 100%, that is, it makes it possible for buildings to be built in half the time and with significantly less labor at the construction site. In addition, standardization of the modules provides gains in scale and allows for waste generation to be reduced by about 85% as compared to conventional forms of construction. Investment in productive processes has made residential units more flexible, increasing the possibility of changing blueprints and adapting them to the needs of users. Extended building life is an additional benefit afforded by the approach.

This innovation developed by Precon Engenharia allowed it to increase its turnover fivefold and today it accounts for 70% of its total turnover.

2.2.2 REVERSE CYCLES

The value chain and circular business models depend on reverse operational activities, whose configurations and strategies may vary according to the product, location, and position in the value chain in question.

18. Information provided by Precon Engenharia.

This means that there are several ways of recovering products with different levels of reuse, such as, for example:

- Remanufacturing: intended to recover products with the same quality and warranty of a new product;
- Reconditioning: consists in simple operations for repairing a product with the aim of adjusting it to new needs;
- Maintenance: activities intended to extend the life of a product;
- Recycling: activities designed to recover materials.

These strategies make up and depend on reverse cycle operations, where products take a path opposite to that of manufacturing and delivery to the consumer market. Reverse cycles can be comprised of maintenance, reverse logistics, disassembly, reprocessing, assembly, and redistribution stages.

In the circular economy diagram (Figure 1), it should be stressed that the more internal the circle, the more valuable the strategy, since it preserves most of the value of the products. In addition, the longer the product is used as a result of extending its life or of a greater amount of possible cycles, the higher the value of the product.

Another important feature of reverse cycles is the possibility they afford for combining different strategies according to the materials, components, and products in question. For example, reverse cycling can be applied to electronic equipment and different strategies can be defined for its detachable parts based on an analysis of the quality characteristics of the product and its components - thus combining remanufacturing of the equipment with maintenance of certain components, reconditioning, and disposal of other components for recycling (see the eStoks case study). In the case of biological nutrients, thought can be given to using the materials in multiple applications throughout their quality decay process, with cascade use, before returning the material safely to the biosphere to regenerate natural capital.

As seen above, product requirements designed to make such strategies feasible must be defined in the initial design steps and aligned with business models to capture the value of multiple cycles generated from materials, components, and products within the circular value chain.

SECTORAL COLLABORATION TOWARD CIRCULARITY[19]

Green Eletron, a company established in April 2016 by ABINEE, was set up for the purpose of managing reverse logistics for the electrical/electronic industry. It consists of 13 associated companies, including the largest mobile phone and computer equipment manufacturers that support the operations of the reverse logistics model, which already relies on 11 of 22 collection points scheduled to be implemented in the metropolitan region of São Paulo.

Through the "Green Disposal" program, the electrical and electronic products collected are sent to the partner operators GM&C and Sinctronics, which are in charge of sorting, dismantling, and recycling them. In addition to managing the reverse logistics system, Green Eletron also operates as a communication channel with government and other stakeholders. Because it centralizes the management and operation of the reverse logistics system, necessary investments are shared among its member companies, considerably reducing investment costs as compared to those required for implementing an individual system for each company.

As of next year, due to having signed a Term of Commitment with the government of São Paulo state, Green Eletron will strive to increase the volume of post-consumer products it collects by expanding the program to the entire state of São Paulo and, in the future, to Brazil at large. Meanwhile, the company has been taking action to improve its reverse logistics system by raising the awareness of consumers of the importance of returning products after the end of their useful life.

19. Information provided by Green Eletron.

2.2.3 VALUE PROPOSITION

With the adoption of circular business models, the value chain of these companies began to be organized around the logic of the circular economy. As a result, the actors involved in this chain contribute to add or recover value, setting up extended, integrated value chain models or value networks. One of the practices that can be adopted within the configuration possibilities available for integrated value chains is that of industrial symbiosis (see the case of FIEMG), according to which actions, activities, and material flows of an anchor company serve as inputs and benefit other smaller companies linked to the same value chain or to another one, where all elements benefit each other in a symbiotic way.

PROMOTING THE CIRCULAR ECONOMY THROUGH INDUSTRIAL SYMBIOSIS[20]

The Industrial Symbiosis Program of the State of Minas Gerais, which was launched by the Federation of Industries of the State of Minas Gerais (FIEMG) in 2009, already involves 760 companies in that state. Through workshops organized by FIEMG, companies learn about the potential for generating and integrating value from industrial symbiosis, share experiences, and identify opportunities for collaboration, allowing for materials previously seen as waste by an industry to be used as raw material by other industries.

Materials of different kinds have been traded since the program was launched, such as water, steam, electricity, organic materials, plastic, glass, and metals. Between 2009 and 2015, about 140,000 tons of waste that would otherwise be disposed of in landfills were recovered; 200,000 tons of virgin natural resources are no longer being used; 90,000 tons of carbon were no longer emitted, and over 13 million m³ of water were reused. In addition, recycling of materials resulted in a reduction of R$8.7 million in costs for companies participating in the program.

20. Information provided by FIEMG.

Currently, the program is seeking ways to integrate concepts and practices of the circular economy into the industrial parks of Minas Gerais state. This recently-launched project is intended to identify collective business opportunities within districts and their areas of influence, where FIEMG, in partnership with universities, will identify opportunities for the recovery and reuse of resources by participating companies and different cycles existing in the region.

The first of three stages of the program, which is being implemented in Sete Lagoas since July 2017, has been completed already, the purpose of which is to raise the awareness of decision-makers about the benefits of the Circular Economy. So far, 13 industries have joined the pilot project - FIEMG estimates that 30 companies in the city will have joined the program by the end of its second phase.

In this second stage, academia and industry work together in identifying resources. By means of visits to production units and the filling out of questionnaires, Collective Business Plans will be prepared to promote increased cooperativism between local industries and the competitiveness of the mining industry by attracting investment, generating jobs, reducing operating costs, and improving environmental quality indicators.

2.3 ENABLERS OF THE CIRCULAR ECONOMY

With the aim of moving toward circular chains and business models, it is essential to ensure conditions that can contribute to this transition directly, such as education, public policies, infrastructure, technologies.

Education: education has a key role to play not only in terms of improving technical and managerial knowledge and skills, but also of promoting changes in visions, attitudes, and values based on active and collaborative learning intended to develop new skills that are essential for building a mental model aligned with the logic of the circular economy.

Public policy: in macroeconomic terms, public policies have a role to play in stimulating reverse cycles and innovation in circular design and business models. Some possibilities could involve reducing taxation on the use of secondary resources, renewable sources, raw inputs, and labor. Good examples from the European Commission are available, such as the European Union's action plan, which includes measures that contemplate product design, production processes, consumption, waste management, secondary raw materials, water reuse, among others, and determine how advances toward the circular economy will be monitored[21] (EUROPEAN COMISSION, 2015).

Infrastructure: development of a set of elements that make it possible for circular economy activities to be carried out, such as a framework for reverse logistics and basic sanitation.

Technologies and innovation: currently, these elements play a key role in promoting changes in the industrial world and society, with emphasis on the Internet, Industrial Automation, Artificial Intelligence, culminating in the Revolution 4.0 in industry at large. Technology enables disruptive innovations in, for example, business models, value chain management, and operational solutions such as recycling. For business models, such as Virtualization and Sharing models, technology is essential because it makes it possible for value to be delivered and shared, respectively, in addition to providing access to information such as to data on the traceability of materials over multiple cycles of use.

21. In 2014, for example, the European Union implemented the zero waste program, which set the goal of recycling 70% of urban waste and 80% of packaging waste by 2030.

3. CONCLUSIONS: OPPORTUNITIES AND CHALLENGES FOR BRAZIL

Given the great challenges facing humanity currently, incrementally incorporating one-off factors into the logic of the traditional linear economic model has proved to be ineffective. Shifts that challenge the current economic model are required to bring prosperity by affording new opportunities in social and environmental terms. The Circular Economy is one of these solutions.

Innovating business systems is the path to this transition. Such innovation begins with a shift from traditional short-term mental models to long-term ones, innovations in business models and value chains, propositions for adding more value to resources, design for circularity, and reverse cycles, which are key elements for ensuring the effectiveness of this transition. Education, public policies, infrastructure, and technologies are fundamental structural conditions to facilitate this journey.

The circular economy offers a great opportunity for Brazilian industry to expand its manufacturing potential in the country, contributing to business resilience and to improving its competitiveness on a sustainable basis. For all of these reasons, the circular economy

contributes to the development of a more robust and stable economy in the long term, aligned with the current knowledge era.

Some companies have already realized this fact and are exploring the potential of the circular economy in Brazil. The following opportunities mentioned in this study should be highlighted:

- Reduced material costs for industries (Philips case);
- Regularization of informal workers and generation of new jobs and income (Rede Asta case);
- Lower use of primary resources through the recovery of resources (Lojas Renner and eStoks cases) or modular design (Precon Engenharia cases);
- Choice of safer, renewable, and non-toxic raw materials (Tarkett and C&A cases);
- Creation of diversified businesses, with multiple, more resilient strategies for maintaining value (Ahlma case);
- Strengthening of the chain and sectors (Green Eletron and FIEMG cases);
- Market differentiation (Phillips, CBPak cases);
- Greater accessibility to quality products at lower costs (Tem Açúcar case).

Because of all of these opportunities that it affords, the circular economy brings new perspectives to businesses and society, with a focus on the reality of the 21st century. For this purpose, it expands a procedural and short-term vision to foster a focus on promoting efficiency as a key objective. It promotes a systemic and long-term vision that integrates reverse cycle activities into business models and fosters effectiveness and positive impacts.

Specific challenges to be addressed include infrastructure limitations and the lack of incentives for using secondary resources in multiple cycles. In addition, a lot of value is lost when waste is disposed of inappropriately, which may be associated with a lack of awareness of the value of these resources, leading the market not to value these materials.

Therefore, in order to speed up the transition to a circular economy, Brazil must provide favorable conditions in terms of innovation for the development and growth of circular business systems. In this scenario, due to, among other factors, its biodiversity, socio-cultural diversity, culture of innovation, and entrepreneurship, Brazil has the potential to become a benchmark in terms of innovation and generation of economic, environmental, and social values in the 21st century.

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