

Circular Economy in Developing Countries: Chile and India Cases

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Abstract

Many people hold the notion that Earth is a dominant and powerful entity, equipped with infinite resources and the innate ability to heal itself. However, the reality is quite the opposite. Climate change, plastic pollution, and global warming are widely known issues, but have we truly made efforts to find effective solutions? It's not just about participating in protests, adopting an eco-friendly lifestyle, or reducing meat consumption to lower carbon emissions. Instead, what we need is the emergence of an advanced technological system on a global scale, coupled with a collective awareness from businesses, governments, and consumers.

In this article, I aim to delve into the concept of the circular economy (CE), exploring how different countries and companies have implemented it, how it can contribute to combating air pollution, and why it is crucial to reassess our familiar business patterns. There are Chile that stands for the developed country is compared with India that stands for developing country in this article based on the business concepts, political laws, and the social positioning.

1 What is a Circular Economy?

The term "circular economy" was first introduced in 1988 in the book "The Economics of Natural Resources." At its core, the concept of the circular economy revolves around creating an economic system that aims to achieve zero waste by promoting the sharing and recycling of existing materials and products for as long as possible. Since 2010, the idea of circular economy has gained significant

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traction, and it comes as no surprise. This model offers numerous benefits, such as minimizing emissions and the consumption of raw materials, creating new market opportunities, and enhancing overall resource efficiency.

The principles underlying the circular economy can be summarized into three key aspects: eliminating waste and pollution, promoting the circulation of products and materials, and actively regenerating the natural environment (1).

The traditional linear economy model, characterized by the collection of raw materials, their transformation into products, and their sale to consumers who eventually dispose of them as waste, is no longer viable without serious consideration for its ecological footprint. In contrast, the circular economy presents an alternative approach where everything operates within a closed loop. This shift towards a circular economy model leads to increased productivity, reduced resource consumption, and prolonged utilization of materials and infrastructure.

2 Circular Economy in Developed Countries

Developed countries, due to their advanced industries, face a more pronounced global waste problem. The demands and values in these countries differ from those in developing nations. Developed countries generally possess greater purchasing power, robust infrastructure, engage in international collaborations, have well-established laws that prioritize citizens' welfare, and are better equipped to implement circular economy (CE) ideas efficiently.

Several factors contribute to the growth and development of the circular economy as an economic model. These include extending the product life cycle through the principles of Reduce, Reuse, and Recycle (3R), promoting ecological balance and protection, leveraging the flow of big data, implementing supportive government policies, and influencing consumer behavior (3).

Extending Product Life Cycle Using 3R

The primary objective of the 3R concept is to transition from a linear "create-use-discard" approach to a circular "create-use-reuse" model. To effectively extend the life cycle of products, companies adopt several components of the 3R policy. Firstly, the implementation of Product-as-a-Service and reduce consumption. By shifting from individual product ownership to providing products as services, companies can minimize waste generation. Secondly, sustainable

consumption practices play a vital role in the 3R approach. This involves actively avoiding waste and reducing overall consumption, promoting a more responsible and mindful use of resources. Lastly, the establishment of efficient material handling systems is crucial for closing the loop and creating a sustainable cycle.

Ecological Balance and Protection

“Nature is cyclical” –is the core concept of the circular economy (CE). In other words, it emphasizes the efficient utilization and reuse of resources. According to Denise Lu, our current consumption patterns would require 1.7 Earths to sustainably meet our needs (5). Developed countries, in particular, leave a substantial environmental footprint, surpassing the available resources for their populations, resulting in what is known as an ecological deficit. For example, the United States accounts for 13 percent of the world’s total ecological footprint and holds the second largest deficit globally. Despite reducing its footprint by 18 percent since 2005, it still surpasses that of other developed nations by a significant margin (6). In order to achieve ecological balance, it is imperative for humanity to focus on several key concepts. These include energy and resource efficiency, which involves the systematic utilization of resources during the creation of a product to minimize wastage. Embracing renewable energy sources reduces. The global progress in adopting clean energy technologies such as solar, wind, and thermal power is evident. Effective waste management is another crucial aspect. Waste can manifest in various forms, including solid, liquid, or gas. To address this, it is essential to implement local infrastructure networks and waste to energy (WTE) methodologies that efficiently handle and process waste in an environmentally sustainable manner.

Big Data and Information Flow

Big data refers to the massive, dynamic, and continuous datasets that are often challenging to explore and evaluate because of their complexity (7). Big Data has been identified through the 7Vs framework (8), which includes volume (representing the large amount of data), velocity (referring to the high speed at which data is generated), variety (encompassing data in various forms such as text, numeric, and videos), veracity (highlighting the inherent uncertainty associated with data sources), volatility (indicating the storage capacity required), and value (emphasizing the primary objective). Through this data analysis,

companies can uncover hidden patterns and unlock the potential of circularity. Leveraging big data can support decision-making at each stage of the product life cycle and enable interventions in the development of more renewing and regenerative business models.

Cloud computing, Internet of Things, and Artificial Intelligence (AI) are pivotal components of the developed circular economy that have fueled the growth of Big Data and analytics. Cloud computing technology provides the capability to handle complex calculations required for data analysis. The Internet of Things enables the capture of valuable data that is essential for analysis and insights. Artificial Intelligence plays a significant role in predicting patterns of resource usage and evaluating waste production. AI is increasingly becoming central to accelerating and facilitating the adoption of circular economy practices.

Government Policies

Policies play a crucial role in influencing the adoption of sustainable methodologies. Strong regulations can provide clear guidance and direction for development and promote sustainability. They have the power to shape how supply chains, businesses, and energy efficiency practices operate. Effective policies create an ecosystem on a large scale, something that neither companies nor consumers can achieve individually

Consumer Behavior

Consumer behavior plays a pivotal role in shaping the adoption of sustainable practices and has significant psychological implications. It has the power to influence regulatory decisions by authorities, drive movements, and create shifts in the marketplace. Consumer behavior varies across different factors such as ethnicity, society, education, and social class. Achieving a shift in consumer behavior requires targeted efforts in promotion, education, and influencing public opinion.

3 Chile's Circular Economy Roadmap

I decided to pick Chile as an example for a developed country that is actively working towards implementing a circular economy. Firstly, Chile is in the early stages of integrating circular economy principles into its political and economic models, positioning itself as the first South American country to embrace this concept. Its territory is quite big and has the capability to produce its industrial needs domestically. Chile's economy is marked by a high degree of economic freedom, with a score of 74.4 according to The Heritage Foundation's 2022 Index. This signifies that Chile's economy ranks as the 20th freest globally.

Background

In 2021, Chile experienced a significant economic growth, with its GDP expanding by 11.7 percent, driven by robust exports of minerals, fruit, copper, and wine. Recognizing the need to address waste disposal amidst this period of rapid growth, the Chilean government took proactive measures. The Ministry of Environment (MMA), Ministry of Economy, and the Chilean Economic Development Agency (CORFO) jointly published the Roadmap for a Circular Chile by 2040 (12).

Over a span of two years, this initiative engaged more than 140 stakeholders from the private and public sectors, civil society, and other organizations. Extensive studies were conducted to map the key actors involved, and diverse committees were formed to establish goals and discuss specific initiatives. Additionally, public consultations were held to foster awareness and encourage participation among the broader population.

The roadmap itself is designed to be regularly updated every 10 years, and it sets forth seven core goals along with a detailed action plan. During the development of these goals, the roadmaps of other countries were studied to identify standard indicators that could be utilized and to assess the progress made by nations in this domain.

Those seven goals include:

- 1. Generate 100,000 new green jobs by 2030, followed by a target of 180,000 by 2040.** Currently, according to the World Bank, approximately 9 million people are employed in Chile (13). The ambitious goal of creating

such a significant number of new working opportunities signifies the country's commitment to fostering a sustainable and circular economy.

2. Reduce Municipal Solid Waste per capita The government aims to achieve a 10 percent decrease by 2030 and 25 percent reduction by 2040. As per estimates by the Ministry of Environment (MMA), approximately 16 million tons of waste being generated annually, and only a mere 2 percent of Municipal Solid Waste is currently being recycled (14).

3. Reduce total waste generation by 15 percent by 2030 and by 30 percent by 2040. It is important to recognize the significant costs associated with waste collection and transportation. Currently, waste management services in Chile are carried out by 15 companies operating throughout the country. On average, the cost of these operations amounts to approximately USD 35 per ton (14).

4. Increase material productivity by 30 percent by 2030, and by 60 percent by 2040. To enhance material productivity, various strategies can be employed, including reducing the prices paid for materials, improving the availability of suitable materials, and minimizing material consumption and waste (15).

5. Increase the general recycling rate to 40 percent by 2030, and to 75 percent by 2040. It is essential to make recycling services easily accessible to the public, to maximize waste separation, ban non-recyclable items, and maximize revenue from recyclables by establishing appropriate pricing and to make the local market reuse materials.

6. Increase MSW recycling rate to 30 percent by 2030, and to 65 percent by 2040.

7. Recover 50 percent of land affected by illegal dump sites by 2030, and 90 percent by 2040. The term "illegal" refers to the improper disposal of waste in unauthorized areas. Chile currently has over 3,700 illegal dump sites scattered throughout the country. The existence of these sites severely impacts the living conditions of local residents.

In summary, Chile's roadmap for a circular economy demonstrates a wise and elaborate strategy that sets the stage for achieving climate targets and promoting sustainable practices. With clear time frames, lessons learned from international experiences, regional considerations, and broad stakeholder engagement, Chile is well-positioned to make significant progress towards a more sustainable and circular future.

4 Companies Should Be Involved

The closed-loop system in a circular economy extends beyond mere recycling; it fundamentally involves innovation and production, becoming an intrinsic part of an organization's DNA. Companies play a pivotal role in driving the entire circular economy movement. What makes this particularly intriguing is that circular policies offer substantial benefits to businesses, it unlocks new opportunities such as getting ahead of upcoming regulation, increased security in supply chain, innovation and competitive advantage, pricing of externalities and potential shift in taxation models (2).

Effective and visionary leadership from CEOs is instrumental in harnessing the benefits of the circular economy model and driving sustainable economic growth to new heights. By embracing a "circular mindset," businesses can unlock a plethora of opportunities, including job creation (up to 500,000 additional jobs created in France alone), energy efficiency (in the European Union, circular solutions could account for up to 37 percent of total energy consumption), and greenhouse gas emissions reduction (in countries like India, adopting circular practices could result in greenhouse gas emissions being 44 percent lower in 2050 compared to the current development trajectory).

Implementing CE thinking

The EU-LAC Foundation has conducted extensive research on Case studies on Circular Economy, shedding light on the implementation of circular economy thinking (12). In light of this, I would like to share a conclusion drawn from their eight-step guide, which can serve as a valuable resource for businesses and organizations embarking on their circular economy strategies.. The first step for companies is to assess and map their current status in relation to the circular economy so they can identify areas for improvement and set realistic goals for their circular economy journey(develop a business case, define circular economy vision). The successful implementation of circular economy strategies requires cooperation and engagement at all levels of the organization. Senior management should be fully aware of the objectives and actively support the transition towards a circular model. It is equally important to engage key stakeholders, including employees, suppliers, and customers, to ensure their understanding and commitment to circularity. There are many innovative business models that can help companies begin their path(2). For example, the concept of Cir-

cular Supplies promotes the use of renewable energy and recyclable inputs, such as bio-based materials and biocatalysis. Companies like General Motors have made substantial commitments to renewable energy, aiming to achieve 100 percent usage by 2035. Another example is the Sharing Platform model, which connects users of a product and encourages them to share its use. Companies like Uber and Airbnb have built successful businesses based on the idea of access or temporary ownership, demonstrating the potential of this model.

5 Why Is It Hard to Make CE Work in Developing Countries?

Implementing the principles of the circular economy can pose challenges in developing countries, as they often undergo rapid economic and societal transformations. While extensive research has been conducted on the actions of high-income countries towards sustainable development, the topic becomes more complex when addressing emerging economies.

India: Background

Recognizing the significant environmental challenges posed by the most developed economies, the Indian government has taken proactive steps towards embracing the circular economy model and making more sustainable decisions. This shift holds immense potential for India, with projected annual benefits of 624 billion US Dollars by 2050 compared to the current development path, equivalent to 30 percent of India's GDP. These findings are based on a comprehensive economic analysis conducted by the Ellen MacArthur Foundation, focusing on three key areas: cities and construction, food and agriculture, and mobility and vehicle manufacturing. In addition to the economical benefits for households and businesses, by adopting circular economy principles in areas such as cities and construction, food and agriculture, and mobility and vehicle manufacturing, India can achieve a 44 percent reduction in greenhouse gas emissions by 2050 compared to the current trajectory. India's rapid economic growth over the past two decades has resulted in a substantial urban population. By 2008, approximately 340 million people were already residing in urban areas, accounting for nearly 30 percent of the total population. Over the next two decades, urban India is expected to generate 70 percent of all new jobs, which are projected to be twice as productive as equivalent jobs in the rural

sector (11). With an average annual economic growth rate of 7.4 percent in the last decade, India is poised to become the world's fourth-largest economy within the next 20 years (10).

Cases for circular economy; key insights

1. Businesses can unlock material cost savings and enhance their profitability by embracing circular economy approaches. A prime example of this is the shift from traditional car sales to providing vehicles as a service. By transitioning to a vehicle service model, the car industry can not only generate new revenue streams but also increase the overall value derived from each automobile.

2. Embracing a circular economy development path has the potential to significantly mitigate negative environmental effects, particularly in the context of India. By implementing circular economy principles, greenhouse gas emissions can be reduced by 23 percent in 2030 and by 44 percent in 2050, aligning with India's commitments under the Paris Agreement. The construction industry would play a crucial role in achieving these targets by adopting circular economy practices. Through the use of renewable materials and the implementation of recycling and waste management strategies, the construction sector can significantly reduce its environmental impact. Similarly, the adoption of circular economy principles in the mobility sector can have a profound impact on energy consumption in transportation. By transitioning to more sustainable modes of transportation and reducing reliance on fossil fuels, energy consumption in the sector can be reduced by 33 percent in 2030 and by 66 percent in 2050.

3. The adoption of a circular economy in India has the potential to deliver significant benefits to the population, including cheaper products and services, as well as reduced pollution. By embracing circular economy principles, the cost of services for each citizen would decrease, resulting in increased disposable income. The lower costs could also help India implement different initiatives such as the National Food Security Mission. A circular development path could lead to a 38 percent decrease in vehicle kilometers traveled on roads by 2050.

4. Leveraging digital technology. The development of a circular economy relies heavily on a strong foundation of technology and innovation. With the application of advanced technologies and innovative solutions, various sectors such as food systems, supply chains, and sharing platforms can unlock significant benefits.

5. India can avoid getting locked into a linear model. As India becomes

increasingly interconnected with the global market, there is a risk of becoming locked into a basic linear economic model.

Opportunities

1. **Cities and Construction.** In the construction industry, key principles of the circular economy include the use of renewable and recycled materials, as well as designing buildings to be adaptable and efficient throughout their lifecycle.

When applying circular economy principles to construction, buildings can be designed to accommodate changes in energy generation and usage, and integrate with nutrient cycling systems. Various methods can be employed to enhance the efficiency of urban structures, such as constructing buildings for energy and water efficiency, promoting the multi-use of space, and implementing strategies for the circular flow of construction materials.

2. **Food and agriculture.** To foster sustainability and resilience in this sector, efforts are being made to adopt circular economy principles, particularly in closing nutrient loops. This approach provides a framework for preserving natural capital, enhancing ecological flexibility, and establishing a stable supply chain. It could implement digital knowledge sharing, also digitized food supply chains, urban farming, and returning nutrients to the agricultural system.

3. **Mobility and vehicle manufacturing.** India is projected to become the world's third-largest vehicle market by 2030, following China and the US (18). To support sustainable growth in this sector, the application of circular economy principles can play a crucial role. Several strategies can be employed, including the adoption of vehicle-as-a-service models, promoting remanufacturing practices, reducing the reliance on virgin materials, and encouraging the development of zero-emission propulsion technology. Given the relatively low car ownership rates in India, the adoption of circular economy principles in the automotive sector has the potential to be rapid and transformative.

6 How to Make Circular Economy Work in Developing Countries

Taking into account the previous discussions, it is evident that there is no specific "start point" within the closed loop involving consumers, businesses, and

governments. While the government often plays a crucial role in initiating the loop, its effectiveness relies on the awareness and understanding of the other two components regarding the importance of collaboration. In the journey towards a circular economy, there are certain factors that can facilitate the transition for emerging economies compared to their developed counterparts. These factors stem from the inherent opportunity for advancement that emerging economies possess in the present moment.

As countries undergo development, they possess a unique advantage in terms of the ease with which they can change their trajectory. The ability to shape their path and establish a foundation for innovation is more attainable, particularly for developing countries that have the opportunity to build their economies from the ground up based on the principles of the circular economy. In developing countries, informal recycling systems already exist, with small organizations playing a crucial role in peripheral collection, recycling, and occasional material sales. Governments have a unique opportunity to not only change direction but also shape public opinion more easily. Unlike in established democracies, developing countries often have less robust political opposition and a greater capacity to promote and influence ideas. The circular economy model offers governments the opportunity to rethink their economic and political systems by reducing the overall cost of materials, which makes it highly appealing. Many developing countries draw inspiration from the agricultural sector, which is inherently connected to nature and often less influenced by industrialization. There are numerous opportunities to explore and capitalize on including peri-urban and urban farming.

What government controls?

Laws. A notable example is the United States and the Inflation Reduction Act. This comprehensive legislation encompasses various aspects, including the taxation of large corporations, energy security measures, and investments in combating climate change. With regards to the environment, this bill has the potential to catalyze the transition to clean energy.

Standards. EPP (Environmentally Preferable Purchasing) rules are established to regulate water and energy efficiency, recycling processes, and the minimization of pollution, among other factors.

Investment. Government is the biggest investor in this system and has the potential to significantly transform the game. While it shouldn't excessively interfere with the marketplace, it can establish funds and specialized organizations to support the development of new technologies and pave the way for entrepreneurs. By providing financial resources and creating a favorable ecosystem, the government can stimulate innovation and drive the transition towards a circular economy.

Education plays a crucial role in the transition to a circular economy. Firstly, it raises awareness among citizens about the ongoing or impending changes, allowing them to understand and actively contribute to the transition. Secondly, education serves as the foundation for future generations, equipping them with the knowledge and skills to drive innovation and shape new regulations. Governments can play a key role by formulating research questions and studying how the circular economy has been implemented in other countries.

Promotion. Mass media is often influenced by various sectors of the government, and can fulfill the requirements and interests of different government departments. The media's coverage and promotion of initiatives such as Chile's Roadmap, for example, contribute to raising awareness and generating public interest in the circular economy.

Business

Inventions. Businesses play a crucial role in driving the concept of the closed loop economy. They create supply chains, construct new structures and adopt advanced technologies.

Collaboration with policymakers and informal economy. Participation in cross-value-chain networks can help businesses to drive a change they cannot create on their own (9).

Working on the demand. Demand in the circular economy is influenced by a combination of factors, including the international agenda, government regulations, and marketplace trends. Businesses play a crucial role as the driving force behind the implementation of circular practices.

The basis for economy. Businesses play a vital role in society by contributing to economic growth, job creation, and global collaboration.

Consumers/Citizens. The cultural aspect plays a significant role in the successful implementation of a circular path, influenced by factors such as the availability of information, personal beliefs, and the existing products and services within a society. The government's promotion and domestic political attitudes can also impact cultural shifts.

Consumers create the demand. The mindset and preferences of customers significantly influence the future direction of businesses and the application of innovative solutions.

Wise consuming. consumers are encouraged to adopt a mindful approach to their purchasing decisions. It goes beyond simply buying environmentally friendly products that have low greenhouse gas emissions or are made from sustainable materials. It also involves considering the entire lifecycle of the products and ensuring they are recycled.

Active political position. The political landscape in some countries may present challenges in implementing new ideas due to limited political parties and diverse opinions. However, the global context is evolving, and emerging countries are embracing new approaches. Taking an active political stance involves engaging in various activities such as voting in local, state, or national elections, participating in protests, and making donations to support causes. These actions contribute to the interaction with policymakers and the establishment of laws that align with contemporary needs.

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