



CIRCULAR ECONOMY – A PARADIGM SHIFT FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Sustainable development meets the needs of the present generation without compromising the ability of the future generations to meet their own needs. The single use consumption behaviour of the economy (which is referred to as the linear economy model) has hampered the concept of sustainable development over the years. This linear economy model envisages the conversion of inputs into outputs which are to be disposed of after the consumption without any scope of recycling. This results in underutilization of inputs and add up to the wastage in the economy. This unsystematic production and consumption, tests the physical limits and hampers the sustainable development of the economy.

In such a situation, the concept of circular economy would be a powerful tool that would help revamp the economy and promote sustainable development. This model advocates 3R principles of reducing, reusing and recycling of materials. This results in multiple use of products with less waste generation which would be less harmful for the environment. The concept of circular economy helps the economy to live longer and become capable to cater the needs of both present and future generations. This chapter aims at discussing the concept of circular economy model and its benefits, from the viewpoint of sustainable development.

KEYWORDS: circular economy model, linear economy model, sustainable development, recycle, reuse, reduce, waste

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1. INTRODUCTION

The 18th century saw the emergence of rapid industrialisation. The arrival of machines resulted in massive production of goods/products at cheap prices. Bulk of industrialisation happened in the capitalist world, where there was intense competition among the industrialists. The focus was on reducing the price of the final product. For achieving this objective, there was uncontrolled exploitation of natural resources. The focus was primarily on extraction of raw materials and cost-effective mass production of products using them. There was no emphasis on efficient use of raw materials. Such a type of business/production model (called as the linear economy model) resulted in large wastage of raw materials and energy.

With passage of time, manufacturing based on linear economic model resulted in the depletion of raw materials/natural resources. The cost of extraction of many raw materials like gold, silver, steel, coal, petroleum, etc. became costly. Economists realised that development based on linear economy model cannot be sustained for long. It was also realised that there was a need to change the business practices for the purpose of ensuring that natural resources are also available for future generations. These realisations resulted in major nations of world changing their national development policies to promote sustainable development (Stahel, 2013) (Sariatli, 2017). The various international conventions beginning with the Stockholm Convention of 1972 were the result of this realisation. This change in perception also resulted in the beginning of the gradual remodelling of business/manufacturing processes. The emphasis shifted to better utilisation of natural/raw materials including recycling. The attempt was to decouple economic growth from the extraction and consumption of scarce natural resources (Ruíz, 2015). Such a business/manufacturing model, which came to be known as circular economy model, is now beginning to be preferred over the linear economy model (Frodermann, 2018). This article seeks to critically evaluate the circular economy model of production and consumption from the perspective of sustainable development

2. DEFINITIONAL ISSUES

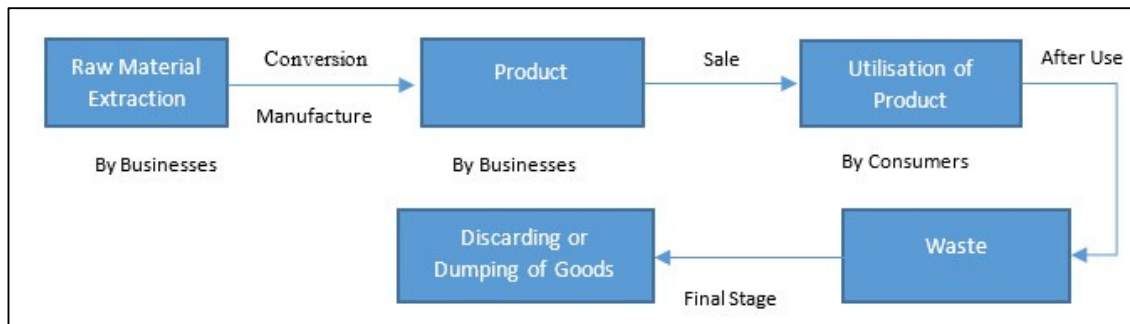
Linear Economy Model (LE Model)

To properly understand the concept of circular economy, it is essential to first understand the concept of linear economy. Linear economy model of production and consumption can be defined as a system wherein products/goods are produced, sold, used and eliminated as waste, once the products/goods have fulfilled their function/utility (Bonciu, 2014). In this model there is no scope of reuse of the product. Consequently, such a model of economy is referred



to as 'take, make and dispose' economy wherein the raw materials are extracted, manufactured, used and then discarded (Millar et al., 2019). Thus, in this model, businesses/companies harvest and extract materials, use them to manufacture products and then sell it to consumers. The consumers use those products and discards it, when its utility is over (Ellen & Company, 2014). These discarded items accumulate in a landfill or are destroyed (Upadhayay & Alqassimi, 2019). The figure 1 below illustrates a linear economy model flow chart (Upadhayay & Alqassimi, 2019).

Figure 1: Linear economy model flow chart



Circular Economy Model (CE Model)

The circular economy model, on the other hand, functions on a diametrically opposite principle, wherein, the emphasis is on a better utilisation of resources. The attempt is to avoid wastage of all kinds, while promoting recycling and reuse. Circular economy is restorative and regenerative by design and aims to achieve highest utility and value for products at all times (García-Barragán et al., 2019) (Moreau et al., 2017). The circular economy aims at extending the life cycle of a product to get maximum value from it (European Environment Agency, 2017). When the life cycle of a product does eventually come to an end, this model attempts to convert that product into an alternative resource/raw material for some other product manufacturing process. Thus the circular economy model is in the form of a closed loop wherein there is minimization of waste (Upadhayay & Alqassimi, 2019). The circular economy model also focuses on reuse of raw materials and hence promotes the minimization of use of virgin raw materials in the production and consumption process (Sariatli, 2017).

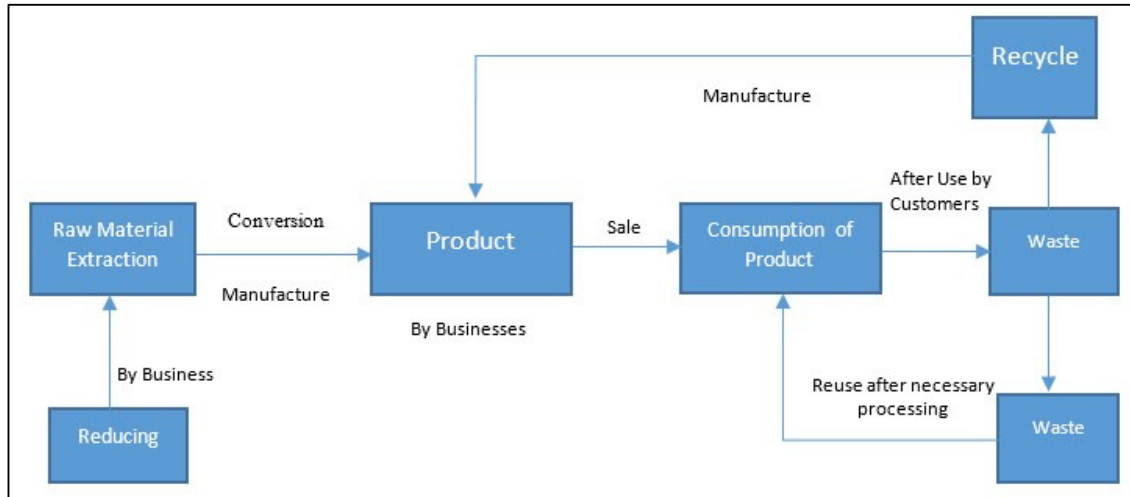
The circular economy model of production and consumption is thus based on the 3R principles namely; i) reducing, ii) reusing and iii) recycling of materials (Heshmati, 2017).

1. **REDUCING:** Reducing the use of materials aims at reducing the flow of materials into the production/consumption process (Zhao et al., 2012). This is achieved by reducing resource consumption and waste production through increased production efficiency (Su et al., 2013).
2. **REUSING:** Reusing of materials relates to the extending of the useful life of the product (zhao et al., 2012). This is achieved by reselling of discarded products or using by-products of other business processes as input resources (Frodermann, 2018).



3. **Recycling:** Recycling of materials relates to reprocessing of recovered materials at the end of useful life of the product by returning them into the supply chain (Upadhayay & Alqassimi, 2019) (Moreau et al., 2017).

Figure 2: Circular economy flow chart (Upadhayay & Alqassimi, 2019)



Waste

No study of the concepts of linear economy and circular economy can be completed without a study of the concept of waste. This is because, the essential difference between linear economy and circular economy lies in the manner in which waste is dealt with, by each of them.

Waste can be defined as the 'material left over or thrown away' during or after the production/consumption process (Merriam-Webster, 1994). Hence, it refers not to the word 'junk' in the usual connotation, but refers to any kind of underutilization of resources/assets (Jain et al., 2018). The waste generated during the different stages of production/consumption process can be classified into four categories (Ruiz, 2015) (Esposito et al., 2018). These are as under:

1. **Wasted resources:** These are materials/energy that cannot be regenerated continually. They are consumed and lost forever when used (e.g. petrol).
2. **Products with wasted life cycles:** These are products that have artificially induced short working life or are disposed of even if there is still demand for them from other users (e.g. mobile phones).
3. **Products with wasted capacity:** These are products which sit idle unnecessarily for most part of their productive life (e.g. cars).
4. **Wasted embedded values:** These are materials, energy and components that are not recovered from disposed materials and put back to use (e.g. battery, motherboard etc. of a mobile phone whose screen was broken and hence disposed of as waste).



Sustainable Development (SD)

An in-depth study of the concept of sustainable development is essential for fully understanding the concept of circular economy. Sustainable development has been defined as a development that meets the needs of the present generation without compromising the ability of the future generations to meet their own needs (Keeble, 1988). Sustainable development, therefore seeks to achieve economic growth and progress without causing damage to the environment. This means that sustainable development aims at the long term stability of the economy and environment (Emas, 2015).

Sustainable development also seeks to change the purposes of conventional development by adding a wide variety of environmental protection goals. It also incorporates environmental issues into social goals that ensures that the economic goals are compatible with environmental protection. It also adds a further dimension to the process of development by recognizing the present generation's responsibility to future generations (Dernbach, 1998). The key concept of sustainable development is the integration of environmental, social and economic concerns into all aspects of business or other such decision making (Emas, 2015). There are four core principles relating to sustainable development. They are outlined below:

1. **Principle of substitution:** According to this principle, all resources should, wherever possible, be replaced with substitutes which have a lower negative impact on the environment. This is particularly true in case of non-renewable natural resources like minerals which do not regenerate themselves (Stoddart, 2011). For e.g. coal is a non-renewable natural resource used for generation of electricity. Instead of using coal to generate electricity, solar energy or stored water energy can be used to generate electricity.
2. **Principle of intergenerational equity:** Accordingly, to this principle, the use of available natural resources must be done in such a manner that the present generation must achieve an equitable balance between satisfying their own needs and leaving enough natural resources for future generations to satisfy their own needs. It is not about the present generation leaving behind an equal share for future generations, but it is about passing on the benefits that the past generation left behind for the present generation, to the future generations (Spijkers, 2018).
3. **Polluter pays principle:** This principle puts an obligation on the governments to require the polluting entities to pay the costs of the pollution caused by them, instead of imposing that cost on others or on the environment (Dernbach, 1998). This principle suggests that government policy should ensure that environmental costs are internalized as far as possible (Emas, 2015).
4. **Precautionary principle:** This principle lays down that wherever there are serious threats or possibility of irreversible damage to the environment, lack of scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental damage/degradation (United Nations, 1992). This means that any person/business entity proposing to carry out an activity, must bear the burden of proving that the proposed action will not cause significant harm to the environment (Emas, 2015).



Comparative Analysis: Linear Economy Model vs. Circular Economy Model

As it has been explained above, the linear economy model focuses on mass production and consumption of goods without any effort to conserve the materials used to produce the finished product. On the other hand, the circular economy model focuses on reducing, reusing and recycling of materials that are used in producing the final product. In today's global economy, where sustainable development is the key priority, the preference is gradually shifting towards the circular economy model. However, both models have their own advantages and disadvantages which are based on their distinct features. A comparative analysis of these distinct features of both the models are discussed below:

1. In the linear economy model, the primary focus is on the mass production and consumption of goods without any concern for resources that are consumed in the process of production and consumption. However in the case of circular economy model, the emphasis is on the efficient use of the resources that are used to produce goods (Lacy et al., 2020).
2. In the linear economy model, there is no effort to increase the life span of the resources/products. But in the case of circular economy model, the business processes are so designed to enhance the circularity of materials, thereby increasing the life span of resources/products (Lopes de Sousa Jabbour et al., 2018).
3. In the linear economy model, there is significant waste generation. This model does not focus on reducing waste. However, in the circular economy model, there is an attempt to reduce waste generation at all stages of the production/consumption process. This is ensured by the 3R principles namely; a) reducing, b) reusing, and c) recycling of materials (Lacy et al., 2020) (Esposito et al., 2018).
4. In the linear economy model, the focus is on obtaining cheap raw materials/resources so as to keep the cost of production low. However, in circular economy model, the attempt is to use raw materials/resources that generate no waste or very little waste. Also materials/resources that can be reused/recycled are preferred. This promotes less dependence on virgin materials/resources (Sariatli, 2017).
5. The linear economy model is based on open loop processes and hence is highly susceptible to price fluctuation of materials. On the other hand, the circular economy model is based on closed loop processes and hence is less susceptible to price fluctuation of materials due to the efficient use of resources in terms of both value and volume (Sariatli, 2017).
6. The linear economy model involves simple processes as there is no reverse material flow at any stage of the production/consumption process. However, the circular economy model has reverse material flow arising from reuse and recycling of materials. Hence the processes involved in such a model is more complex (Sariatli, 2017).
7. The linear economy model has no reverse material flow and consequently, the cost of production and consumption of the product is comparatively lower. However in the circular economy model there is reverse material flow which involves additional complex processes and hence the production and consumption cost is comparatively higher (Sariatli, 2017).



8. The linear economy model produces comparatively more waste and hence is less environmentally friendly. The circular economy model on the other hand focuses on reduction of waste in the production and consumption process. Hence, it is environment friendly and supports sustainable development (Sariatli, 2017).

Circular Economy and Sustainable Development

As seen in the previous sections, circular economy model is based on the 3R principles of reducing reusing, and recycling of materials. The focus is on reduction of waste as well. Circular economy model gives a longer shelf life to both raw materials and products and hence help conserve natural resources for future generations. All these principles of circular economy model are identifiable with the various principles of sustainable development like principle of substitution, intergenerational equity, etc. Also, both circular economy and sustainable development seeks to protect the environment. The adoption of 3R principle and focus on reduction of waste has resulted in circular economy being viewed as a sustainable economic system wherein economic growth is decoupled from resource use, through the reduction and recirculation of natural resources (Corona et al., 2019).

From Theory to Practice

The term 'circular economy' was coined for the first time by Pearce and Turner in 1989 (Segerson et al., 1991). However, the theoretical development of the concept of circular economy can be tracked back to Boulding, who in 1966, suggested to adopt a cyclic economic model instead of the wasteful linear economic model (Cesari & Jarrett, 1967) (Sariatli, 2017). Thereafter, in 1982, Stahel developed the concept of closed/spiral loop, self-replenishing economy, which was subsequently remodelled as 'performance' economy by Stahel himself in 2010 (Walter R. Stahel, 2011). The concept of self-replenishing economy developed by Stahel was, in 2002, incorporated into the cradle-to- cradle concept developed by Bracingest and McDonough. The said concept considers all materials involved in commercial and industrial processes to be nutrients which are basically of two types, namely, technical and biological (Braungart, M., & Mc Donough, 2008). Subsequently, many other authors like Bengus, Ellen MacArthur Foundation, etc. contributed significantly to the growth of theory relating to circular economy (Sariatli, 2017).

In spite of the tremendous growth in theoretical aspects, governments across the world are very slow in implementing circular economy model of development. This is primarily because businesses are reluctant to implement circular economy model for a variety of reasons. One primary reason for such reluctance is the organisational inertia and resistance towards radical transformation. The managers of businesses prefer the existing status quo of the linear model as they are able to predict their future based on available historical data (Lahti et al., 2018). Transition from linear economy model to circular economy model also requires a significant number of businesses to change their entire value chain including the most complex task of establishing and organising reverse value chain activities which spans all activities of the firm, from product returns to the potential recovery of the product's maximum value using recycling and up-cycling activities (Govindan et al., 2015). The uncertainties relating to costs that



surround the transition from linear economy model to circular economy model is also deterring businesses from shifting towards circular economy model.

In spite of these problems many nations around the world have started implementing circular economy related rules and regulations. China is arguably the first country to enforce circular economy related legislation. In 2009, China enacted the Circular Promotion Law to achieve the objective of transition from linear economy to circular economy (Zhu et al., 2019). The European Union (EU) has also taken a number of steps to stimulate transition from linear economy towards circular economy. In 2018, the European Parliament approved a package that aims at reducing waste across Europe. The said package has fixed various targets including recycling targets for EU countries to achieve. In most of the other countries, there is no compulsion to adopt circular economy model, but businesses can voluntarily adopt circular economy model.

3. CONCLUSION

The circular economy model of production and consumption aims at reducing waste of materials/energy and hence promotes sustainable development. Waste is reduced by implementing the 3R principles of reduce, recycle and reuse materials. Shifting from linear economy model to circular economy model offer businesses/companies, a variety of new opportunities including cost savings through waste reduction, better supply chain management, lower sensitivity to resource price volatility and long lasting, better relationship with customers (Sariatli et al., 2018) (Ellen & Company, 2014) (Lahti et al., 2018). These advantages provide the obvious incentive to businesses to shift from linear economy model to circular economy model. In fact, it is estimated that circular economy model can generate annual benefits of up to € 1.8 trillion by 2030 for Europe alone (Ellen & Company, 2014). Similarly, it is estimated that the circular economy development path could create annual value of ₹14 lakh crore (US \$ 218 billion) for India by 2030 (Ghosh, 2020). In spite of these obvious advantages, businesses are reluctant to make the transition from linear economy model to the circular economy model, due to various uncertainties. It is the duty of the national governments/legislatures to enact necessary laws and regulations to address the uncertainties and to facilitate the gradual transition from the linear economy model to the sustainable development enabled circular economy model.

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