
Understanding of Circular Processes and Its Impact on Indian Economy

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Abstract: This paper aims at identifying the main processes in the circular economy based on review of definitions given by different eminent researchers. These processes can be adopted and implemented by business entities and policy makers to achieve the desired effects. These effects may include not only environment but also economic and social. These processes may be practiced by businesses to achieve circularity and shift from the traditional linear business model to a circular one. Based on understanding of definitions of circular economy, it is necessary to provide a detailed note of processes in circular economy to conceptualize how stake holders can practice them in actual. This paper aims to identify and characterize the processes in circular economy and then conceptualize the anticipated impacts through using these processes in business models in different sectors in the economy.

Keywords: Circular Economy, Circular Processes, Sustainable Business, Reduce, Recycle, Re use

INTRODUCTION

The relevance to the circular model has gained significance long back, still there are not many researches in this area primarily because of the importance given to the linear growth models.

The focus has been shifted from linear to circular after 2005 when a significant mismatch between future demand and supply had been investigated in a scenario with finite availability of resources. The Google search for circular economy clearly indicates the significant role a circular economy framework holds in the development of strategies and policies for sustainability by business entities and policy makers.

A closed loop ECOSYSTEM is created by the circular economic model for effective consumption and utilization of resources. The circular model configures an ecosystem which adopts the paradigms of reduce, reuse and recycle and is resilient and waste free. (Espito et al,2015, Geng & Doberstein 2008, , Mathew et al 2011,Tse et al 2015, 2016,Yong 2007).

The Ellen MacArthur Foundation has worked very hard at accurately defining circular economy as an industrial system which can be regenerated or restored by an intention and design. The definition provided by the Ellen MacArthur Foundation attempts to focus on three key pillars that together set the base for creating a closed system. This closed system would be one where materials are used in a manner to ensure their highest utility along with minimal environmental damage. It also includes preserving natural capital while fostering effectiveness across the entire system (Ellen MacArthur Foundation, 2015).

Circular economy as a concept is the key in grouping different range of waste resource management approaches by very efficiently drawing the attention towards the capacity of prolonging resource use (Blomsma & Brennan, 2017). Circular economy is more of a holistic framework that attempts to unify different strategies for sustainability (Murray et al., 2017). The inclusive and comprehensive stance of circular economy model has allowed for it to be linked with sustainable development. It has also linked an economy which attempts to work in synchronization with the socioeconomic and environmental systems in which it is imbedded, for a better and sustainable future (Brundtland 1987; Webster 2013; Kirchherr et al., 2017).

Researchers have linked certain attributes that connect the circular economy model and the concept of sustainability. Both concepts have global reach; both include innovations and focus on new product designs, cooperation among the various stakeholders across different sectors (Geissdoerfer et al.,2017). The proponents of circular economy claim it to be a new paradigm for the industry as it is aimed towards improving the ecological, social and economic value of the environment, It attempts to provide a global solution for the issue at hand (Kopina & Blewitt, 2015). The basic idea of circular economy has been around since the 1970's, although the need for it did not exist at that time as there was a sufficient supply of natural resources at that time (Webster, 2013). The need for circular can be attributed to the following reasons:

- The scarcity of natural resources.
- The advancement of information technology that has enabled the tracking of materials within the loop.

- There has been a shift in the pattern of consumer behaviour which has made us more ready for access than ownership.

The world is on the edge of making a very important decision for the future. If we select the wrong option, there's a risk of the results being catastrophic for the global ecosystems (Larsson et al., 2011). In the present scenario there exists a combination of crisis in different areas of industries across the world. To effectively tackle these crises, one must try and look at the bigger picture. To analyse the crisis and develop a solution for the same a holistic perspective would be beneficial.

There is a very close relation between economics and the environment. Irrespective of the close relation between the two, very little attention has been paid to the environment in most economics' textbooks. The circular economy approach provides an insight on how the environment invokes an economic thinking. Also, the 3R principles that include reducing, recycling and reusing clearly indicate a connection between the environment and the field of economics. The concept of circular economy was built to bridge the gap between economics and environment. Pearce and Turner (1990) were one of the first ones to introduce this topic. They elaborated on the theories that existed within and between the economics of resources and their correlation with the concept of how the domains of economics function. They further laid emphasis on environment being an input and the waste receiver as well and not taking the environment into consideration means neglecting the economy since the linearity in economic system is open and does not have an inbuilt recycling system in it. The first law of thermodynamics dictates that it is not possible to destroy the quantity of resources utilized in the consumption and production process and is collected into the environment as waste equally. Kenneth Bounding in 1996 described Earth as the closed economic system thereby explaining the circularity between earth and environment. The speed with which environmental deterioration is taking place is the main reason behind the development of code of conduct, regulations and policies for reducing the undesirable impact on the environment caused by the growth of the economy.

To move in the direction of circular economy, the way things are produced and consumed requires a paradigm shift. Industries must attempt to incorporate a closed loop thinking at the heart of their current business models which will have a significant implication on our society, since the current methods of how we develop things not only decides how we work but also what we buy as well. (Womack, 1990)

Table 1: Circular Economy Definitions

<p>“Circular economy is an approach that would transform the function of resources in the economy. Waste from factories would become a valuable input to another process- and products could be repaired, reused or upgraded instead of throw away” Preston 2012</p>
<p>“Production and consumption of goods through closed loop material flows that internalize environmental externalities linked to virgin resource extraction and generation of waste (including pollution.). Suave et al. 2015</p>
<p>“The core of the circular economy refers to three activities: reuse at the product level (such as ‘repair’ or ‘refurbishment’); reuse at the component level (e.g., ‘remanufacturing’); and reuse at the material level (‘recycling’). Zink and Geyer, 2017</p>
<p>“Although there is no commonly accepted definition of CE so far, the core of CE is the circular (closed) flow of materials and the use of raw materials and energy through multiple phases.”Yuan et al., 2006</p>
<p>“CE is a sustainable development initiative with the objective of reducing the societal production-consumption systems’ linear material and energy throughput flows by applying materials cycles, renewable and cascade-type energy flows to the linear system. CE promotes high-value material cycles alongside more traditional recycling and develops systems approaches to the cooperation of producers, consumers and other societal actors in sustainable development work.” Korhonen et al., 2018</p>
<p>“To solve the contradiction of limited resources and the increased consuming desire of human being[s] and to make use of natural resources rationally to achieve sustainable development, the circular economic development mode follows the pattern of ecological circulation and is based on the recycling of material resources.”Chen, 2009</p>
<p>“The Circular Economy is an economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being.” Murray et al., 2017</p>
<p>Circular economy refers mainly “ to physical and material resource aspects of the economy- it focusses on recycling, limiting and re using the physical inputs to the economy, and using waste as a resource leading to reduced primary resource consumption” EEA2014</p>

<p>“CE involves the radical reshaping of all processes across the life cycle of products conducted by innovative actors and has the potential to not only achieve material or energy recovery but also to improve the entire living and economic model.” Ghisellini et al., 2016</p>
<p>“The objective of the circular economy is to reduce the environmental impact of resource consumption and improve social well-being.” ADEME 2014</p>
<p>“Circular economy is “an industrial system that is restorative or regenerative by intension and design. It replaces the “end of life’ concept with restoration, shift towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems and within this, business models. The primary motive is to “enable effective flows of materials, energy, labour and information so that natural and social capital can be rebuilt.” Ellen Arthur Foundation 2013, 2015</p>
<p>“A circular economy is an alternative to traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extracting the maximum values from them whilst in use, then recovering and reusing products and materials.” Mitchell 2015,</p>

Compiled from various Sources

1.1 Origin of Circular Economy:

Pearce & Turner (1990) for the first time used the formal term “Circular Economy” in an Economic Model based on the Principle that ‘everything is an input to everything else’. On the basis of application of First and second Law of Thermodynamics they developed a new model “Circular Economy” and criticized the existing Linear Model. Considering the three important economic functions of Environment-resource provider, waster assimilator, source of utility highlights the functional relationship between environment and economics. Their work was highly influenced by the work of Boulding (1960) and others who had introduced the concept of closed system and tried to show that future generations would reproduce using limited stock of factors and recycled waste.

In the last few decades studies in various disciplines have been conducted with has help in the development and understanding of the concept of Circular Economy in respect of current scenario, one such related discipline is the Industrial Ecology which has provided the perspective that links the human activity with sustainability. In aligned with this notion is the understanding that natural ecosystem and Industrial ecology are very closely related and linked through flow of information, energy and materials(Ehrenfeld 2007, Erkmann 1997).The energy and resource/material optimization along with economic and cultural evolution would be required for shift the industrial economy towards sustainability is to be achieved(Graedel & Allenby). There should be minimum consumption of scarce material and energy resources and minimum generation of unrecyclable waste (including waste heat) for achieving the optimality (Frosch & Gallopoulos).

There is a requirement of the shift in business models focusing towards improvement in competitiveness and delivering environmental benefits (Tukker 2015). The related fields to this include – PSS (Product Service Systems) and the ‘Blue Economy’. PSS is a mix of tangible product and intangible service to fulfil customer need whereas the latter fundamentally requires innovation in guiding business transformation (Pauli 2010)

1.2 Circular Economy in India: Background

Indian society has always practiced circularity involving repair, reuse and recycling products. With the rise in consumerism and increase in affordability there has been frequent replacement of assets which has increased the waste as well as retarded the adoption of circular economy. . At every stage of value chain there is requirement of the application of 5Rs.The success of adoption of circular economy depends largely on consumer’s awareness, mindset and readiness to participate in it.

The tradition growth model of India was basically predicted through the “linear Model” economic model which is functioning against the limited resources of our planet. Also, this model generated massive waste in every stage of the product life cycle. For the growth of manufacturing sector, it is required that we should not only use the scarce resources diligently but also substitute the primary resources with secondary through the efficient management of secondary resource. Circular Economy can help in achieving this through operating in a closed loop to minimize the leakage or wastage of resources as less as possible through Sharing, Leasing, Repairing, Refurbishing and Recycling.

Circularity concept is not just recycling it is basically a system which is restorative in the industrial processes which treats the waste as a resource. It implies that once a in the product life cycle the product’s life ends attempts should be made to utilize them by creating a value of it (Ellen Mc Arthur 2015). The transition from tradition to circular requires the changes in the functioning of organizations and reshaping of the supply chain process by infusing the mindset of sustainability in product designers (Thelen et al. 2018)

2. Processes in circular economy

The process that fit into circular economy as described in table 2 as follows:

Table 2: Circular Economy Process

Reduce	Reuse	Recycle	Re-manufacture	Repair / refurbish:
<ul style="list-style-type: none"> Efficient utilization of primary resources Use of renewable energy sources 	<ul style="list-style-type: none"> reuse the useful parts / components of a product, to promote greater use of product-as-a-service through Sharing platforms. 	<ul style="list-style-type: none"> Creation of a closed loop system to utilize waste/discard material as a source of secondary resource, through extensive recycling 	<p>Creating new products by utilizing waste multi-sector industry co-operation and coordination.</p>	<p>Extension and preservation of product’s life by innovative designs for the future. (ensuring it at the time of designing) Which in usage- -maximize the lifetime through repair, refurbish and upgrade and may extend a second life through take back strategy</p>

Source: Author’s Elaborations

Recycling is “the re- introduction of residual materials into production processes so that they may be re formulated into the new products” UN 2003). This definition implies that recycling should not only emphases on recovering materials but also should focus on utilization of these materials to the new life cycle. The main requisite to achieve the introduction of recycled material is that the recycling should be of high quality. Recycling should also be done to reduce waste. Recycling can benefit business in terms of reduction in cost / minimization of cost for businesses that depend on primary materials. The price volatility of primary raw materials can be reduced through recycling (WEF et al 2014). Petrochemical substances can be recovered through recycling of plastic waste which can be used for manufacturing the plastics again or for manufacturing other chemicals (Hopewell et al. 2009). The development of plastic or chemical recycling involves the use and development of more viable innovations in technology (EMF,2016). Recycling can also be considered as a use of biological resource, which requires that the industries synchronizes across the supply chain and use the byproducts or wastages of production from other sectors (Jacobsen 2006). The decrease in the utilization and consumption of nonrenewable resources and energy by means of sharing or recycling happens only through the industrial symbiosis. There is a major difference between recycle and re use. Recycling requires the reprocessing of material or waste into new material, product or substance. The utilization of the treated water resource is also referred commonly as “Water recycling” and “water reuse”(Lazarova et al 2012)

The efficient use of resources can result in the less usage of primary resources and using the resources carefully which are harmful, and their life is also short (Nilsson et al 2007, UNEP&Sida ,2006). The efficient use of resource is often considered to be a part of cleaner production which is basically conservation of raw materials, less use of raw materials, reducing the consumption of scarce resources- water and energy, avoiding the use of toxic materials in production and reducing waste and hazardous emissions leading to the decrease in effect -in the entire life chain (since extraction of primary resource to its final disposal (Hilson 2003). The reduction in effects are on environment, health and safety. (UNEP 2001). The “Eco-Design “has been linked with improving the efficient use of resource as it can cover all the aspects including- recycling, extending the product –life and remanufacturing. It also benefits the other aspect of de materialization (Almeida et al. 2010). The efficiency in usage of resources can also be achieved through reduction of waste in production (all stage including production, processing, packaging, transporting) as well as consumption, through this the environmental effects can also be minimized (Pimentel et. Al 2008, EMF2015)

The basic requirement for transiting to circular economy from linear is the maximum use of an energy source should be one which is renewable. The use of non – renewable energy source is huge, and it has multiple negative impacts on environmental hazards and most import is the dependence on imports (Rizos et al. 2017). There is availability of large number of renewable energy alternatives for replacing the traditional fossil fuels in different sectors. The use of these energy reduces the negative environmental, economic and social effects associated with traditional non- renewable energy sources, but it also has some challenges in terms of use of

certain metals which may increase the dependence on imports. The alternate source of energy can also be generated through waste.

The next life to the used product is the key to achieve circularity. This can be achieved through remanufacturing, re using or refurbishment. The material's value added is restored through the "core parts" through remanufacturing and refurbishment. Re manufacturing in an in-depth procedure to provide an discarded product as "new" product while refurbishment is just restoring a product's or its component's value (Weelden et. A. 2016). Reuse is just a re-selling or re usability of the product or its part (JRC, 2011b). All these processes generate the flow pf revenue for the business as they provide a opportunity to generate income by selling for many times (or at least a second time).

Expensive parts are commonly used for re-manufacturing of goods like mobiles, cars, computers (EAF 2013a). This aspect is already being covered during the product designing phase and is related to the eco- friendly practices of the businesses (Bocken et al. 2015). Remanufacturing has both environmental as well as economic benefits (Pigozzo et. Al 2010). The EMF (2013a) has projected that refurbishment can decrease the global iron – ore demand to around 4-6% by year 2025. Remanufacturing insists that corporates must retain their control over there produce and things and design proper buy back or take back procedures or process or system and the post-use stage of the good. This also requires the consumer's behavioural change to return back their product to the manufacturer only (Prendeville et al 2015). Remanufacturing can also help in job creation in small firms as it is labour intensive which require the technician or the crafts men at the local level (EEA 2016). Job may further be created as remanufacturing requires the training and education to generate skillset for integrating design and remanufacturing to product life extension. (Gray et al 2006). Providing an product life extension is much more broader concept than designing for reuse or remanufacturing. Product life extension also addresses to the concept of providing long life- durability to the product. These products are designed for durability and also concentrate on the customer services (Bocken et al 2016) . There is no doubt regarding the environmental benefits from product life extension, but the major drawback is that it may affect the market for new technically upgraded products. (Novel et al. 2014)

Selling a product as an intangible one or as a service is the biggest challenge to the traditional mode of selling products. The business models based on this include- renting, leasing or pay per use practices of business houses. Tukker (2004 identified the eight categories as: Service- related to product, consultancy and advice, leasing the product, sharing and renting a product, pooling product, Management of activities, payment per usage, and the functional result.

The customer is offered the access to the product while the ownership of the product is retained by the company. The company's material resources are maintained at its own disposal which provides the environmental benefits through maintaining and repairing so that the product is in use for a long time (Accenture 2014) .The waste creation during the products life cycle can decrease through practicing recycling and refurbishment. (Beuren et. Al. 2013). The benefits from the product as a service has certain concerns whether the model is motivating the consumers to for usage as their personally owned products are and to retain the ownership till the contract or validity of the agreement (Tukker 2014).

Models based on Sharing have also developed where these has been a transition to accessibility from ownership which has been practiced in several markets like Car and rooms. These models are generally the initiative of private entities who provide temporary usage of the product. All of these product as a service model have the potential to redesign the consumption styles and decrease the underutilization of products. There are large number of factors that affect sustainability (Novel et al 2014). Not just consumers the sharing can among the industries in terms of infrastructure or technology sharing (Halog et al 2016). The improvements in technology and the awareness of consumers can drive the shifts in the consumer consumption behaviours, Consumers may choose the products virtually rather than physically (EMF2016). These shifts in the patterns of consumption are leading to savings of resources and gains from productivity.

The circular processes discussed have the environmental benefits which are significant in comparison to the linear traditional processes. In order to evaluate the circular solutions it is necessary to consider the impacts across every stage of the product life cycle. The concentration of the environmental impacts is on the phase of "use" of the product. The most efficient solution to the end of life for the product depends largely on the resource in consideration and the available technology for recovery. These processes can find the applications in different sectors of the economy.

3. Impact of circular economy

Through the introduction of the disruption business models and new processes the consumption and production models of the economy can be changed. The change in consumption and production patterns due to the radical transformation to circular economy will have significant economic, social and environmental impacts. There are many studies conducted to review and assess the impact of circular economy on Indian Economy. This section discusses review of results and methodologies of some of the available research reports.

The effects are broadly divided into three main categories-

1. Economic Impact – Effects on GDP growth, Employment Investment etc
2. Environmental Impact- Impact on usage or resources, reduction in emission and pollution etc
3. Social Impact- impact on gender, inequalities and social opportunities etc.

3.1 Economic Impacts

As per the report EMF (2016) if India follows circularity the annual value of Rs14 lakh crore (US\$ 218 billion) in 2030 and 40 lakh crore (US\$ 624) in 2050 as compared to the present development status. This has been concluded on the basis of costs in three different focal t areas. They indicated that the cost to provide the same utility levels is much lower in circular development as compared to the linear development. The saving is approximately 11% of the current GDP in 2030 and about 30% in the year 2050.

The adoption of the circularity will help businesses achieve the total material cost savings and thereby increase the profits.

Table 3: Product designing, innovation in business models and reverse logistic are the main drivers for creating value.

Automobile	Construction	FMCG
Shifting for selling cars to providing vehicles as service – creation of new revenue streams	-companies can design modular buildings. Retrieving the leftover material or material after demolition and keeping them in cycles	Profit opportunities increase for FMCG through detailed product – level modelling at the current levels of consumption. The rising middle class provides these opportunities to the Indian businesses and industries. Both which are established or new ventures especially for textile and electronic products
- More intensive use of each car	-capture the value	
- Vehicle design more innovative- makes maintenance easy and increase fuel efficiency. It increases utility and decreases the running cost.	Reduce the cost	

A circular economy can deliver – cheaper products and services and reduced congestion and pollution.

1. Cost of providing services will reduce through circular models.
2. A part of the income will go to the business remaining will help in increasing disposable income.
3. The reduced costs can help India achieve the initiatives like- Pradhan Mantri Awas Yojana and National food security mission.

Following the path of circularity vehicle travelled in kms on roads will decrease by 38% in 2050 and will reduce the time spent on traffic and congestion. The circular scenario will also include zero emission vehicles and will help in reducing pollution and help in reducing negative effects on health and cost. Reduction in use of pesticides by 76 is going to improve the health of farmers.

Reinforcing India’s position for innovation and technology- leveraging digital technology

The interrelationship between digitalization and circular economy provides the ground for value creation, which India can leverage it because of its advanced IT sector. India is well positioned to entertain these opportunities through the ease of connectivity.

Sharing assets through use pf digital supply chain in the food system along with the best practices among small farmers can create significant amount of benefits. The digital devices are providing uninterrupted transport planning, combining diverse modes of transport and provides direct access to mobility when needed the most. In cities there is already utilization of shared solutions for utilization of floor space. Through digitalization. Internet of things along with the principles of circular economy is generation huge value creation opportunities which the emerging new business and the existing business can capture. Current government policies like: Digital India is supporting these opportunities.

India is directly moving into an efficient system through active reinforcement and leverage of circular economy opportunities. Indian system has ensured the use of efficient system avoiding the linear path.

Since the system that provides the necessities like food, house and transport requires developmental approach, India has realized the significant value that can be created through the path of circular economy rather than following the linear path.

The demand for mobility has been increasing in spite that only few of Indian population owns a car. The most desired system for mobility that provides safe, comfortable and convenient transport is required through a well build and designed mobility system. This system ensures cost effective mobility with few externalities and without the ownership of car. This system of mobility has the potential to reduce the consumption of resources and energy for the coming many years inspite of the demand for development of highly efficient infrastructure and buildings.

India has more competitive advantage over the other developed economies because of its high growth market.

If the principle of circularity has been applied to the new activities since from the initiation of the activity, the task would set in proper direction and will also be successful in its endeavour. For the more developed and matured economies because of the existing closed linear system larger transformation in systems is required to reach the same level of circularity. This is the major advantage that india and other high-growth markets as compared to the other developed economies.

Like 70% of the buildings that are expected to finish by 2030 has not yet been built as compared to only 25 % in UK. If both the countries apply the principles of circular economy, India will have high embedded circularity. India has a huge opportunity to develop innovative circular construction skills for exporting to other countries as well. Therefore the total cost of shifting from linear to circular is going to be much less in India as compared to others.

3.2 Environmental Impact

Circular development path can significantly mitigate negative environmental externalities.

1. Green house emissions could be 23% lower by 2030 and 44% lower by 2050 as compare to the current development path that is being followed.
2. Virgin material consumption would lower by 24% by 2030 and 38% by 2050
3. Water usage in construction decreased by 19% by 2030 and 24 % by 2050.
4. Synthetic fertilizer use would be less by 45% in 2030 and 71% lower in 2050

3.3 Social Impact

In literature it has been analyzed that a number of jobs will be created (Bastein et.al 2013, Wijkman et al 2015) but other social impact have not been assessed by the researchers. In relation to social aspects like gender, poverty, welfare and occupations the information available is not adequate to make a reasonable assessment of impact.

CONCLUSION

1. Through the analysis of the literature the study defines the concept of circular economy- its definition , processes and the expected impact. The study highlights the circular economy process that have the potential to attract business and can have significant impact on different dimensions: economic, social and environment. There are different definitions from different discussions which are confusing. The concept can seek attention of academicians, policymakers and business fraternity (Ghisellini et.al. 2016 Vanner et.al 2014) but the major concern is that the application is much diverse.

Although the studies on circular economy have projected several benefits- economic, social and environmental but are not been able to be verified quantitatively. The social aspects like race, gender and equality of social opportunities are not considered in the circular economy concept. (Murray et. Al 2017). The claim to provide opportunities for innovation improves the environmental quality by circular economy is subjected to many constraints or factors. Like the break down or recycling or reusing products may require more energy than the product's life (Murray et al 2017).

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