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Towards a circular economy: An emerging economies context

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ABSTRACT

Circular Economy (CE) and the adoption of its principles globally are more important than ever to sustain the rate of production of goods and services to meet the ever-increasing consumer demand that is burdening the environment and society. This study investigates the adoption of CE principles amongst emerging economies as the challenges faced by these economies are generally different in terms of resource availability, varying government policies and consumer behaviour from those of developed economies. This research presents an empirically validated CE adoption model using a sample of 183 consumer responses. The study highlights the strong influence of factors such as consumer behaviour on the acceptance of remanufactured products and using products as a service to encourage the adoption of CE practices in emerging economies. This research offers businesses, consumers and policy makers insights into measures that have been taken by emerging economies that are in line with CE principles.

1. Introduction

Most businesses still tend to operate based on the principle of "Take, Make and Dispose" model, wherein they would source the raw material, transform it into a finished product, and sell in the market to the end consumer. The consumer, in turn, would discard the product once it reaches the end of its lifecycle resulting in waste (Ghisellini, Ripa, & Ulgiati, 2018). In this linear approach, organizations or businesses are not to be concerned with what happens to the product once it gets thrown away. The assumption in the linear economy is that there are infinite resources available to manufacture the product, and there are no concerns about the depletion of resources (Goyal, Esposito, & Kapoor, 2018). The concept of quality is associated with newness, caring never thought of, and long term used is loathed upon (Stahel, 2016). Since the industrial revolution and over the last century, most business models revolved around produce-use-discard/incinerate and this has been the philosophy of the efficient industries and economies around the world, and this "cradle-to-grave" (McDonough, 2010) model followed religiously.

The cycles in nature (e.g. water cycles, nutrient cycles) exist to help the waste of one become the resource of the other. Sustainable development of an economy needs to mimic nature's efficiency in resource production and consumption. "Efficiency" has always been misunderstood as cost-cutting and not through value creation in the business environment (Aras & Crowther, 2009). There is an increasing focus by businesses exploring better resource and process efficiency at different stages of production and consumption to promote the principles of circular economy (CE). CE principles promote minimizing or eliminating waste and pollution, maximizing products and materials use, and regeneration of natural systems (EMF, 2020). Organizations and businesses are looking towards technological innovations such as 3D printing (Despeisse et al., 2017) and numerous entrepreneurial initiatives, where the cost of pollution are also factored in, and gaps between environmental costs and economic growth are bridged (Ries, 2017). The practice of reduce, reuse and recycle (3R) are growing in significance amongst businesses and consumers alike (Confente, Scarpi, & Russo, 2019; EMF, 2013; Ghisellini et al., 2018). Advancement in Big Data (Song et al., 2017) is also driving CE, as it supports better use of resource and waste and control pollution through data driven insights (Jabbour, de Sousa Jabbour, Sarkis, & Godinho Filho, 2017). CE is widely acknowledged to promote economic growth by creating new businesses and job opportunities, saving material cost, dampening price volatility, improving the security of supply, while at the same time reducing environmental pressures and impacts (EMF, 2013).

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A shift in economic behaviour from "cradle-to-grave" to "cradle-to-cradle" supports the movement of CE (McDonough, 2010). In other words, this has meant that the society reuse what they can, recycle what they cannot reuse, repair what gets broken, and remanufacture what cannot be repaired (Stahel, 2016). The topic of CE is also right at the top of political agenda across Europe and in other developed countries (World Economic Forum, 2016; EMF, 2014). Different industries are adopting the principles of CE as it is evident that the global economy cannot sustain with its current consumption growth rate by using what nature has to offer. Various industries like clothing and fashion (Moorhouse & Moorhouse, 2017; Morlet, 2017), plastics and its associated industries (Leslie, Leonards, Brandsma, De Boer, & Jonkers, 2016; Neufeld, 2016), electronics (Garlapati, 2016); construction (Ghisellini et al., 2018; Nasir, Genovese, Acquaye, Koh, & Yamoah, 2017), manufacturing (Jawahir & Bradley, 2016; Parida, Burström, Visnjic, & Wincent, 2019) and agriculture (Jun & Xiang, 2011) are giving priority to closed loop systems in the economy. Some are using intelligent supply chain management and logistics (De Angelis, 2018; EMF, 2014) by harnessing the power of information exchange and data analytics to assist the transition to CE (Jabbour et al., 2017; Pagoropoulos, 2017; Song et al., 2017). The move has also been towards alternative renewable and sustainable sources of energy from conventional fossil fuel (Geng, Sarkis, Ulgiati, & Zhang, 2013; Winans, Kendall, & Deng, 2017).

Circular economy thoughts and practices are important for business and sustainable development across all industries. The challenges faced by these economies are quite different from those of emerging economies. Emerging economies need high economic growth, and with its normally high population, they are generating an enormous amount of waste and adding strain on its depleting resources. The initiatives that the developed economies have taken cannot be simply adopted or taken as a role model and extended to some emerging economies. Against this backdrop, the aim of this research is to investigate the adoption of Circular Economy practices within the emerging economies context. In particular, the research objectives are as follows:

1. To identify the factors influencing the adoption of Circular Economy and establishing a functional relationship among the factors.
2. To examine the Circular Economy related practices that some of the emerging economies have developed.

The rest of the paper is organized as follows. Section 2 provides a critical review of the extant literature on circular economy and the proposed conceptual model for circular economy adoption in emerging economies. Section 3 provides the research methodology. Section 4 provides the study results of the factors that influence the adoption of circular economy principles. Section 5 provides the theoretical and managerial implication and Section 6 concludes the paper.

2. Literature review and research model

2.1. The shift towards a circular economy

An examination of the conceptual origin of Circular Economy reveals that some decades ago, Kenneth Boulding and others contemplated the biophysical limits of the present linear economic system and the increasing ecological deficit. In 1966, Boulding introduced the concept of closed systems and envisioned a future economy that would operate by regenerating existing finite resources (Rizos, Tuokko, & Behrens, 2017). Even though the concept had been conceived decades earlier, the term Circular Economy was first used formally by Pearce and Turner (1990). Since then, many attempts have been made at a definition, emphasizing various aspects of the model Jonker, Stegeman, and Faber (2017) claim that the CE is based on the redesign of production systems at various levels, where the focus is on value preservation in closed loops throughout the lifespan of raw materials and goods. According to Rogge and Reichardt (2016), circular business models are characterized by (1) the closing of raw material chains, (2) a transition from ownership to the provision of services, and (3) more intensive utilization of the functionality of products. In this sense, such business models are based on the five recognized building blocks: (1) closing loops, (2) creating (multiple value), (3) choosing an appropriate strategy, (4) designing an entity that fits with organizing between parties, and (5) developing circular earnings models. As per the Ellen MacArthur Foundation (EMF, 2013;2014), a circular economy is an industrial system that is restorative or regenerative by intention and design.

The circular flow of income in any industry is a simplified yet significant aspect of their functioning. The flow, however, illustrates how businesses interact with the other economic participants within the key macroeconomic markets that coordinate the flow of income or goods throughout the system (Zink & Geyer, 2017). This aspect is critical to understand, especially for every business professional because it provides everyone with a valuable tool for understanding the economic environment in which businesses operate. The notion of Circular Economy gained traction in 2010 with the Ellen MacArthur Foundation (EMF) spearheading this agenda, but the concept has origins that are deeply rooted and directly connected to no single author or date.

The development of the concept of circular economy has been revolving around the principles of 3R/4R such as Reducing, Reusing, Recycling and Renewing (Vasiljevic-Shikaleska, Gjozinska, & Stojanovikj, 2017). Extant literature emphasizes that the circular economy model will get developed further and refined as there is wider application in different industries (Khalamayzer, 2018). The rise of Big Data has helped circular economy by providing insights into the regeneration of resources, preservation of resources, re-use of waste resources, redesign of business model, collaboration for a joint venture, and product forecasting (Snapp and Pound, 2017). Additionally, concepts such as product sharing platforms have begun to re-emerge and so have different success metrics which were previously criticized (Ayres & Ayres, 1996). Large organisations such as Unilever are pushing forward with the circular economy movement by producing design guidelines such "Design for Recyclability" which represents a new business model, better recycling and expanded use of refills.

The path to a sustainable future will always reflect several principles of the circular economy and institutions such as EMF have helped standardize the understanding of the circular economy, i.e., Redesign, Redistribute, Reuse and Recycle (EMF, 2014). Even though the concept of the circular economy and its benefits are beginning to be understood, the actual implementation and change towards a circular economy is an obstacle for its wider application.

2.2. Research model and hypothesis development

There is emerging literature (e.g. Goyal et al., 2018; Dokmai, 2018; Garlapati, 2016) that asserts that there is a need to enable and influence the growth of circular economy in emerging economies. Some of the CE drivers are factors such as extending the life cycle of products through 3R, ecological balance and protection, data-driven analytics, government policies and behaviour of consumers. These factors and the proposed hypothesis of this study are now outlined below.

2.2.1. Extending the life cycle of products through 3R

The objective of 3R (i.e. reduce, reuse, and recycle) practices are to reduce create-use-discard and moving towards create-use-reuse, and the cycle continues. It has a direct impact on the society, ecology, economy, and the environment. The enabling factors that help in promoting 3R are Product-as-a-Service, consumption patterns, collection of used goods, repair, and then finally an efficient distribution and material handling system.

Product-as-a-Service: The concept of Product-as-a-Service also, popularly known as PaaS, has been a major enabler of life cycle

extension of the product. Though not a very new thought (Stahel, 1994), it has been well established and discussed in various research that focus on presenting products as service to customers will increase the resource efficiency through reuse but also increase jobs related to the economies that support this service model (Lindahl, Sundin, & Sakao, 2014). It is also widely recognized that service-related model for products will increase efficiency in utilization of resources and thus reduce consumption which in turn reduces waste generation (Fujimoto, Umeda, Tamura, Tomiyama, & Kimura, 2003). As adoption of 3R practices increases, it also influences the migration to the service model of companies and value creation for the customer (Mangun & Thurston, 2002).

Sustainable consumption: Sustainable consumption involves avoidance of wastage and reduction of the consumption in perishable natural resources and energy (McDonough, 2010; Zhijun & Nailing, 2007). According to the United Nations sustainable consumption is about promoting efficient resource and energy use whilst providing access to basic services and better quality of life for all (United Nations (2020) ()2020, 2020).

Collection: Generally, collection of used products is driven by efficiency gains and lower costs. However, if there is a need to increase 3R practices, the emphasis should be towards value creation at every step of the transaction (Stahel, 2016). The different material collection mechanisms that will move from a collection of waste to take back model by producers will help reduce the use of virgin resources (Singh & Ordoñez, 2016) thereby reducing the impact on ecology.

Repair: Given the economic conditions of emerging markets, repair has always been on the agenda of the general population. It extends the life of the product, and a parallel economy caters to the demand (Doron, 2012). Innovative technologies such as 3D printing (Despeisse et al., 2017) can also extend the life of products that are well beyond its intended lifespan. Not just plastics, but through innovation, metallic parts can also get repaired, and additive life of the products increased (Leino, Pekkarinen, & Soukka, 2016). Even developed economies are moving towards maintenance/repair and reuse as seen by an increase in smartphone repair services in Denmark (Riisgaard, Mosgaard, & Zacho, 2016).

Distribution and Material movement: Material flow and distribution of resources are very important to close the loop and hence create a cycle (Stahel, 2016). There is a need for a sustainable and integrated supply chain to achieve efficient 3R for CE**.** Green material movement and distribution is needed to balance industrial development in the traditional sense and for environmental protection (De Angelis, 2018; Govindan & Hasanagic, 2018). Integration of supply chain to form a closed loop between upstream and downstream partners will also play an important role (Zhu, Geng, & Lai, 2010). Reverse logistics increases the relationship between the consumer and the producer by closing the loop as the customer will now get tempted and willing to try out old and refurbished goods without fear of return or refund (Zhu et al., 2010).

Hypothesis H1. *3R/Extended life cycle of products highly influences the adoption of Circular Economy in emerging economies*

2.2.2. Ecological balance and protection

The core concept behind circular economy in nature is cyclical. It uses its resources and reuses them again once its use is complete. At the current rate of the population growth, the consumption stands at 1.7 times its capacity (Denise, 2017) which is not sustainable in the long run. The drivers to achieve ecological balance are to work on energy/resource efficiency, clean and renewable energy sources, waste management to reduce what goes into our landfills and waste to energy (WTE) to harness the energy lost.

Energy and resource efficiency: The more efficient utilization of resources on product creation means less wastage. Process efficiency also reduces wastage (Despeisse et al., 2017) and allows for harnessing waste energy and letting it flow back into the system. Energy efficiency can get integrated into green housing (Roufechaei, Bakar, & Tabassi, 2014). The movement to electric vehicles from fossil fuel-driven ones is a remarkable step toward energy efficiency and zero-emission (Sang & Bekhet, 2015).

Clean and renewable energy: The continued use of fossil fuels after the industrial revolution has resulted in global warming (Bose, 2010). Thus, the use of clean and renewable energy sources that do not produce noxious waste is a major contributor to CE ecology (Geng et al., 2013). However, the challenges are presented due to the shortage of renewable energy sources, and the rising environmental pollution caused by fossil energy (Dincer, 2000). This is further compounded by the ever-increasing burden of growth of the economy in particular for emerging economies is a challenge. Nevertheless, globally there has been advancements in harnessing clean energy sources such as wind, thermal, and solar (Obama, 2017; Panwar, Kaushik, & Kothari, 2011) which will help drive CE.

Waste management: Waste can be in any state (solid, liquid, gas) and normally gets discarded. They make their way into the environment and landfills. Toxic waste if not disposed properly are hazardous to the environment and health and well-being of the society (Triassi et al., 2015). Plastic waste is threating our marine life and ecology (Wilcox, Van Sebille, & Hardesty, 2015). Waste management and recovery is a very important step towards having ecological balance and protection (Nelles, Gruenes, & Morscheck, 2016). Electronic waste (e-waste) is another problem (Widmera, Oswald-Krapf, & Sinha-Khetrival, 2005) that the world and in particular emerging economies are facing now more than ever, and efforts are on to harness the value in them and reduce pollution (Garlapati, 2016). Methodologies to locally manage e-waste and infrastructure network needed to facilitate these are also taking place (Wang et al., 2012).

Waste to energy: Waste to energy (WTE) completes the cycle of the flow of energy within the system with minimization of loss of energy in the system and environment (Pan et al., 2015). It also reduces the burden on landfills (Unnikrishnan & Singh, 2010). Use of waste from one process for the creation of energy for another complete the cycle (Jabbour et al., 2017). Food waste from the food processing industry could get harnessed for energy generation (Lipiński et al., 2018).

Hypothesis H2. *Ecological balance and protection highly influence the adoption of Circular Economy in emerging economies*

2.2.3. Big data and information flow

The proliferation of intelligent systems and tracking, data and information flow play an important role in developing a sustainable economy (Jabbour et al., 2017). Hence, data-driven insights play an important role (Geng et al., 2013) as an enabler for circular economy adoption and evolution. The major factors that have fueled Big Data and analytics are cloud computing, Internet of Things (IoT) and Artificial Intelligence (AI) driven data analytics (Sivarajah, Kamal, Irani, & Weerakkody, 2017).

Cloud computing: Cloud computing (Rashid & Chaturvedi, 2019) is a technology that has the capability of executing powerful and complex calculations and analytics but eliminates the costs associated with maintaining hardware resources by the consumers (Hashem et al., 2015). It has allowed even small and emerging economies (Yeboah-Boateng & Essandoh, 2014) to use the services of cloud service providers. Cloud computing is providing “Computing as service” and competitive economics to harness the power of big data (Murugesan, 2011).

Internet of Things (IoT): To capture the data needed for analysis, IoT plays an important role (Solanki, Díaz, & Davim, 2019). The proliferation of intelligent devices and coagulating the data over the internet is integrating different aspects of our life and ecology (Srinivasan, Rajesh, Saikalyan, Premsagar, & Yadav, 2019). The role of IoT in the industry can never get underestimated for efficiency and sustenance (Yaqoob, Salah, Imran, Jayaraman, & Perera, 2019) through meaningful data gathering, processing, and analysis.

Data-driven analytics and Artificial Intelligence (AI): The data captured and stored through IoT devices needs analysis in real-time to predict usage patterns and hence efficiently utilize our resources (Singh & El-Kassar, 2019). The application of data-driven insights is significant in the context of managing resources and waste (Yeo et al., 2019) for sustainable business development (Raut et al., 2019). Artificial intelligence driven data analytics is providing new insight for decision making for business managers (Duan, Edwards, & Dwivedi, 2019). AI is beginning to play an important role in the prediction and estimation of waste produced in society (Oliveira, Sousa, & Dias-Ferreira, 2019) and this information can be used for planning efficient management and increase 3R applicability. AI is able to have a pivotal role in accelerating and adopting circular economy principles. For example, AI generated product concept designs can be used to change how materials are developed for consumer electronics. Also, AI-enabled predictive maintenance which is extensively used in industrial machinery and installations environment could be adapted and applied to consumer electronics. In doing so, enhancing the product life cycle, and reducing the design cycle and waste material.

Hypothesis H3. *Big data and Information flow highly influences the adoption of circular economy in emerging economies*

Hypothesis H4. *Big data and Information flow highly influences the adoption of 3R/Extended life cycle adoption of products in emerging economies*

2.2.4. Government policies

Policies in an economic environment play an important role in the adoption of sustainable methodologies (Koval & Weis, 2019). It is achieved sometimes by incentivizing innovative approaches or by enforcing regulations (Jones & Calster, 2019). Policies in terms of capacity building, proper urban planning, asset management, and legislation and regulations are the major elements.

Government policies promote capacity building: Handling of waste, energy requirements of society (Arapostathis & Fotopoulos, 2019) and eco-efficient industrial parks play a major role in kick-starting sustainable industrial development (Chen, Song, & Anggraeni, 2019). Capacity-building activities where institutions and communities come together to engage in activities towards sustainable society actively get initiated by the government (Gupta & Koontz, 2019). Capacity building for proper educational outreach is a necessity for social upliftment (Shahidullah, 2019)

Urban planning: Resource management with efficiency is dependent on proper urban planning that helps in efficient waste management (Furlong, Dobbie, Morison, Dodson, & Pendergast, 2019). Sustainable development is mainly possible through urban planning which can also result in a healthier society (Carmichael et al., 2019). Urban planning is important to tackle the enormous challenges that developing countries face due to rapid growth in economy and population and wish for a better quality of life (Ahluwalia, 2019).

Legislation and regulation: Regulations play an important role in the adoption of policies and abidance (Gurtoo & Antony, 2007). A strong regulation can guide the development towards the desired level (Yang, Qiu, Yan, Chen, & Jiang, 2019). Regulations and policies dictate how business gets conducted, be it supply chain management (Harland, Telgen, Callender, Grimm, & Patrucco, 2019) or energy efficiency (Kozhukhova, Amanzholova, & Zhiyenbayev, 2019). Policies create an ecosystem, where firms collaborate towards innovative alliances and promote sustainability (Zhang, Xue, & Zhou, 2019).

Hypothesis H5. *Government policies highly influence the adoption of Circular Economy in emerging economies*

Hypothesis H6. *Government policies highly influence the adoption of Ecological balance and protection activities in emerging economies*

Hypothesis H7. *Government policies highly influence the adoption of 3R/Extended lifecycle of products in emerging economies*

2.2.5. Consumer behaviour

Consumer behaviour is an important psychological attitude toward circular behaviours (Singhal, Tripathy, & Jena, 2019). The individual behaviour attitude or the collective attitude of a community has an important role in influencing circular behaviour. The collectives attitudes can affect society and can even influence the regulating authority towards enforcing regulations and can also lead a movement towards circular behaviour (Muranko, Andrews, Chaer, & Newton, 2019). Education, communication, and economic factors have a major impact on the behaviour of the population towards the adoption of circular economy at all levels (Aras & Crowther, 2009).

Education: Education has a direct effect on consumer behaviour and attitude. Education is related to knowledge, and it affects the perception of the consumers and their attitude towards the environment and other social causes (Okur & Saricam, 2019). Knowledge acquired also affects what they buy and how they perceive the value (Chandrasekaran, Thiruvenkadam, & Subrahmanian, 2019). With education, consumers become more concerned towards the welfare of the ecology with consumer behaviour (McGregor, 1999). Psychographic profiling also known as the study of personality, values, attitudes and lifestyles has shown that conscious consumer behaviour towards ecology is dynamically related to the level of education they receive (Straughan & Roberts, 1999; Sun, Yang, Huisingh, Wang, & Wang, 2015).

Persuasive Communication: Proper and effective communication on a cause and its effects can induce and influence consumer behaviour be it a brand or a social cause. Consumer behaviour shift can be achieved through effective advertisement, promotion, etc. (Hudders, Van Reijmersdal, & Poels, 2019). Effective CSR communication also helps effective participation of individuals in a cause during a crisis (Ham & Kim, 2019). With social media being widely used, it has become an effective channel in influencing consumer, individual and social behaviour and attitude (Schivinski & Dabrowski, 2016; Stephen, 2016).

Cultural factors: Consumer behaviour is driven through cultural ideologies. A consumer is often influenced by their culture, social class and peer groups. (Ramya & Ali, 2016). Consumer behaviours vary by ethnicity and society as a whole (Jafari & Visconti, 2015). Even attitude towards activities such as sports gets influenced by culture (Funk, Funk, Alexandris, & McDonald, 2016). Consumer ethics and culture have even influenced how they utilize products over their life and extend their use through 3R (Tang & Zaichkowsky, 2019). Consumer behaviour, specifically in emerging markets, is driven by culture and often leads to the sustainable use of materials (Kumar, 2019). Cultural factors affect the way consumers' dress, eat and buy products which in turn has an impact on the business economy (Nair & Gulati, 2019).

Hypothesis H8. *Consumer behaviour highly influences the adoption of ecological balance and protection activities in emerging economies*

Hypothesis H9. *Consumer behaviour highly influences the adoption of 3R/Extended lifecycle of products in emerging economies*

Hypothesis H10. *Consumer behaviour highly influences the adoption of Circular Economy in emerging economies*

The proposed research model derived from the extant scholarly research is presented in Fig. 1 below.

Through the review of literature and scope of future work specifically for emerging economies, five major factors stood out from the rest as the influencers of adoption of circular economy in developing countries and a few of these are unique to these economies. These are 3R/extended life cycle of products, Ecological balance and protection, Big data and information flow, Governmental policies, and Consumer behavior.

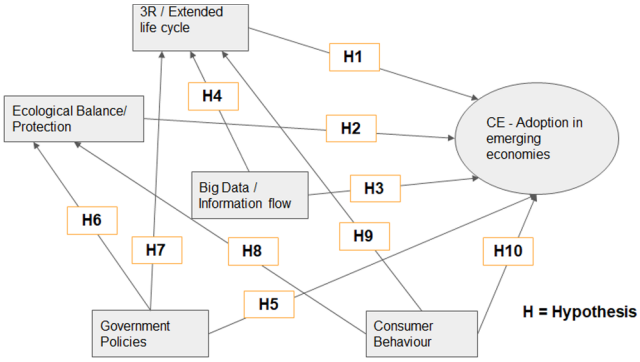

Fig. 1. CE-EE (Circular Economy – Emerging Economies) Research Model.

3. Research methodology

3.1. Data collection

This research utilized questionnaires to collect data from consumers which were distributed mostly online, with a few being distributed offline using a hard copy. The questionnaire was pre-tested with a sample size of 20 participants which helped improve the questionnaire based on the feedback received. The final questionnaire consisted of twenty-one questions in addition to the demographic information (i.e. three questions on overall understanding about circular economy, five questions on 3R/Extended lifecycle, four questions on Ecological balance, three questions on Big data/ information flow, three questions on government policies and three questions on consumer behavior). There were also four questions to collect demographic data such as gender, age, income and work profile. A five-point Likert scale was used to measure the responses, with 1 as Strongly Disagree and 5 as Strongly Agree. A total of 183 consumer responses were used for analysis, excluding responses with vague and missing responses and outliers. About 56% of the respondents were male and 44% females with a majority (64%) from the 25–40 age group. The respondents were mostly from an Asian ethnic background with work experience for more than six years up to 20 years. The data collected from the questionnaire was analyzed using ADANCO 2.0 to build a process model using a variance-based structural equation. Variance-based Structural Equation Model (SEM) first creates proxies as linear combinations of observed variables and, then uses these proxies to estimate the model parameters. It is a popular statistical technique because of its ability to model selected independent variables and consider all possible forms of measurement error to test an entire theory.

3.2. Measurement model

Common method bias was tested through confirmatory factor analysis (Chang, Van Witteloostuijn, & Eden, 2010). The model was tested in ADANCO 2.0, which presented the model fitness. The standardized root mean square residual (SRMR) value was 0.0563 where SRMR < 0.08 is generally considered a good fit (Hu & Bentler, 1999). The hypothesis was tested through *t*-test (Armstrong & Overton, 1977) where respondents with missing demographic values were considered non-respondents (Kam & Meyer, 2015). All the constructs' data were not found to be significantly different.

The reliability was assessed using Cronbach's alpha value (α), and Jöreskog's Rho (ρc) where all the values were considered acceptable since Cronbach's alpha, and Rho was much higher than 0.7 (Cronbach, 1951) as shown in Table 1. The researchers assessed the research model by assessing the convergent validity by factor loading and composite reliability measures (Hair, Sarstedt, Matthews, & Ringle, 2016) convergent validity as recommended by Hair et al. (2016) with factor loading of 0.7 and above, average variance explained (AVE > 0.5), and composite reliability (>0.7) as shown in Table 2. All the values exceeded the threshold suggested, and thus, the convergent validity was confirmed. The discriminant validity was examined by comparing the correlation between the constructs and the square root of AVE. The researchers followed the guidelines from Fornell and Larcker (1981), whereby the square root of the average variance extracted should be higher than the row and column values of the correlations (Bhattacharjee, Pritchard, Nelson, & Arjas, 2004). All the values on the diagonal exceeded the row and column values, thus confirming satisfactory discriminant validity as highlighted in Table 3.

Table 1
Overall reliability of variables.

Construct	Jöreskog's rho (ρ_c)	Cronbach's alpha(α)
Circular Eco Adop	0.9215	0.8722
B Data/Information flow	0.8891	0.8127
Ecological Balance	0.9204	0.8847
Government Policies	0.9283	0.8841
Consumer Behaviour	0.9040	0.8405
3R/Extended life cycle	0.9471	0.9302

Table 2
Average Variance Extracted (AVE) for reach constructs.

Construct	Average variance extracted (AVE)
Circular Eco Adop	0.7966
B Data/Information flow	0.7280
Ecological Balance	0.7431
Government Policies	0.8119
Consumer Behavior	0.7585
3R/Extended life cycle	0.7819

To determine model reliability, Cronbach's alpha (Cronbach, 1951; Sijtsma, 2009) and Jöreskog's Rho for composite reliability were used (Wertz, 1978).

Convergent validity assesses the degree two measures of constructs should be, in fact, hypothetically related. An acceptable value for the average variance extracted (AVE) should be ≥ 0.5 (Campbell & Fiske, 1959; Carlson & Herdman, 2012).

All unrelated factors were analyzed and proven to be unrelated (Campbell & Fiske, 1959; Carless, 2004). Overall discriminant validity for each construct is highlighted in the table below.

3.3. Structural model

As presented in Fig. 1, to test the hypotheses, the process macro was used, utilizing an indirect bootstrapping method (Preacher & Hayes, 2004, 2008). The bootstrapping analysis demonstrated that mostly all the relations were significant as indicated by Preacher and Hayes (2008) shown in Fig. 2. The research concludes that the mediation effect is statistically significant which indicates that though all the ten hypotheses were supported, a few were supported marginally whereas others were supported very strongly as highlighted in Table 4.

4. Findings and discussions

The analysis and discussion of the findings are provided below in line with each of the study hypothesis and its results. Table 4 provides a summary of the results of the hypothesis testing in the study.

Hypothesis. *3R/Extended life cycle of products highly influences the adoption of Circular Economy in emerging economies* ($t = 2.1352$, $\beta = 0.2494$, *and* $P < 0.05$) *was strongly supported.*

In developing economies like India, repair and reuse has been the traditional norm (Goyal et al., 2018). Although there are environmental concerns, India has seen cars running on the road that are 40 years old

Table 3
Discriminant validity for each variable.

Construct	Circular Eco Adop	B Data/Information flow	Ecological Balance	Government Policies	Consumer Behaviour	Extended life cycle
Circular Eco Adop	0.7966					
B Data/Information flow	0.5269	0.7280				
Ecological Balance	0.5795	0.6917	0.7431			
Government Policies	0.5662	0.5125	0.6417	0.8119		
Consumer Behaviour	0.5637	0.5168	0.6559	0.6734	0.7585	
3R/Extended life cycle	0.6121	0.5878	0.6764	0.7497	0.7168	0.7819

as repairing and reuse is encouraged. The country has a parallel economy that provides jobs for many citizens which cater to such repair shops. These can be a small repair workshop, a neighborhood mechanic or a watch repair shop around the corner. There is traction in other sectors too which are giving rise to startups that handle electronic discards such as laptops and mobiles, and refurbish them to be sold in a secondary re-sale market. These products are even available on e-retailers like Amazon and Flipkart etc. These initiatives are preventing such products from going into landfill thereby preserving valuable resources.

With the Indian population expected to continue to rise till 2060 (Ritchie, 2019), urbanization and construction will remain a key problem in the country. The use of CE principles in this context will allow for modular construction methods and thus help reduce costs and minimize waste. Initiatives such as product as a service, be it for furniture, cars, or even a light bulb is allowing users to change their consumption pattern. Instead of discarding the used product, it is recovered and reused by someone else. When a product can no longer be used, it is recycled to another value-added product thus being given a new life. For example, fashion clothing products such as Jeans made from fibers of plastic bottles and powdered glass being used as sand in construction are all ways in which the cycle of the economy is continued. In doing so, developing economies such as India have found multiple uses of products in a sustainable manner.

Hypothesis. *Ecological balance and protection highly influence the adoption of Circular Economy in emerging economies* ($t = 1.6033$, $\beta = 0.1507$, *and* $P > 0.05$) *was weakly supported.*

Rising landfills have destroyed wildlife and forests and discarded plastic waste is affecting marine life. There is no doubt that fulfilling the needs of the population is damaging the ecosystem. However, there is a collective movement towards awareness about ecology conservation being important for our own selves as well as for the survival of our future generation. Energy conservation and its generation from ecological sources such as solar, wind and hydel is giving a boost to the reduction of conventional energy sources and thus minimising exploitation of natural reserves. India is building the largest solar farms in the world (Bengali, 2018) in order to become a solar energy-rich country. This is further sustained by the reduction of dependence on oil thereby saving costs over foreign exchange trade.

Energy efficiency and pollution go hand in hand and the push towards Electric vehicles (EV) from fossil fuel powered vehicles is a paradigm shift for the whole society. India and China have become the focus point of the development of EV engines and technology (Groenewald, Grandjean, & Marco, 2017). Change of attitude towards the use of mass transits instead of private vehicles for regular use is rising, and the government is also pushing for the development of infrastructure needed for this transformation.

Effective waste management and segregation systems help recycling of waste, thus reducing the negative impact on the ecology. India does have an unorganized sector that generates a parallel economy and has a huge impact on the ecological balance. However, this is a very small percentage of the total waste generated, and efforts are being placed on embedding the concept of effective segregation at the source so that more participation from the lowest level allows the society to address this problem in a much more efficient manner. India now has public–private-partnership models running successfully across the country.

However, there is a need for emerging economies such as India to complete the energy cycle by tapping into energy that gets lost due to discarded waste that ends up in the landfills. The Waste to Energy (WTE) concept helps harness and extract the energy lost into the ecosystem. Waste from industry, household, biomass, and biomedical origins has the potential to generate more than 3000 MW of energy according to the Indian Ministry of New and Renewable Energy (MNRE, 2018). Indian Renewable Energy Development Agency (IREDA) estimates that they have harnessed only around 2% of this potential energy

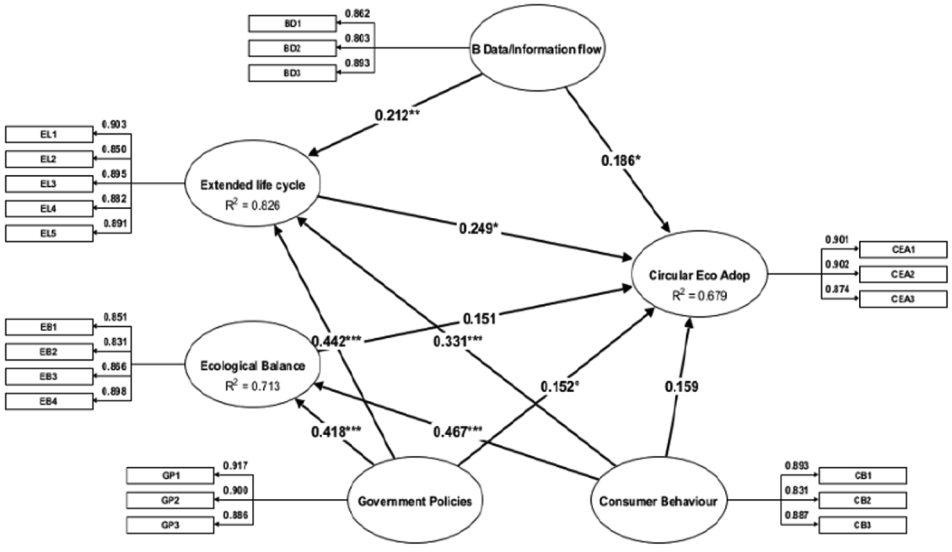

Fig. 2. Graphical representation of the model.

Table 4
Results of hypothesis testing.

Effect	Original coefficient	Standard error	t-value	p-value
B Data/Information flow -> Circular Eco Adop	0.2390	0.0903	2.6471	0.0082
B Data/Information flow -> 3R/Extended life cycle	0.2117	0.0653	3.2417	0.0012
Ecological Balance -> Circular Eco Adop	0.1507	0.0939	1.6053	0.1087
Government Policies -> Circular Eco Adop	0.3253	0.0906	3.5904	0.0003
Government Policies -> Ecological Balance	0.4179	0.0679	6.1558	0.0000
Government Policies -> 3R/Extended life cycle	0.4423	0.0642	6.8946	0.0000
Consumer Behaviour -> Circular Eco Adop	0.3121	0.1022	3.0533	0.0023
Consumer Behaviour -> Ecological Balance	0.4670	0.0667	6.9976	0.0000
Consumer Behaviour -> 3R/Extended life cycle	0.3315	0.0586	5.6549	0.0000
3R/Extended life cycle -> Circular Eco Adop	0.2494	0.1168	2.1352	0.0330

source. The government is promoting all technologies available for WTE.

Hypothesis. *Big data and Information flow highly influence the adoption of Circular Economy in emerging economies* ($t = 2.6471$, $\beta = 0.2390$, *and* $P < 0.05$) *was positively supported.*

With the advent of IoT, there is an increase in generation of data, and hence the efficient analysis of this volume of data can support decisions to better manage precious resources in emerging economies. The timely flow of information is helping the industries in this context to better use material and energy efficiency and hence manage losses. Be it reverse logistics or smart flow of energy through intelligent grids, data analytics are capturing and modifying social psychology by efficient information exchange and education and thus changing the mentality of adoption of circular economy in all aspects of life.

Tracking each product across its lifecycle allows the producer to track it more efficiently and can even allow timely and proactive maintenance, thus extending the product life cycle. It also allows resource forecasting and planning efficiency, thus reducing wastage. Intelligent waste management systems allow proper tracking and retrieval for WTE. The governments in emerging economies are also leveraging big data to manage agriculture, natural resources, water supply, energy distribution, transport, etc. and create policies accordingly.

Hypothesis. *Big data and Information flow highly influence the adoption of 3R/Extended life cycle of products in emerging economies ($t = 3.2417$, $\beta = 0.2117$, and $P < 0.05$) was also supported.*

Big data is helping managers to extend the life of products through better reverse logistics, information exchange of availability of refurbished products and, easy returns. For example, the management of waste and recycle industry through efficient route optimization, reduced transportation usage, and better performance. IoT and smart cities are driving usage of refurbished goods with full confidence. AI and big data are empowering companies to be aware of potential issues in products and provide timely service to products, thus extending their life through proper and preventive maintenance.

Hypothesis. *Government policies highly influences the adoption of Circular Economy in emerging economies* ($t = 3.5904$, $\beta = 0.3253$, *and* $P < 0.05$) *was supported strongly*.

Government and its policies play a role in encouraging innovation, circular economy, and new initiatives for consumption. They create platforms for idea exchange and cooperation between industries and improve awareness amongst the masses over circular economy and related opportunities. The government may seed ventures and provide a platform for all stakeholders in the private and public sector. The desired targets can be through rules and regulations or facilitation. Phasing out fossil fuel driven vehicles and encouraging electric vehicle usage through lower taxes and encouraging research and development, are some of the initiatives. Providing a platform for logistics and information exchange for small scale farmers leveraging digital technology and economy, introducing the just-in-time concept and bridging the urban-rural divide are some of the initiatives the governments of emerging economies are taking. NITI Aayog, a policy think tank of the Government of India has an agreement with IBM to develop a model for crop yield productions. China has launched pilot projects in industrial parks in provinces and cities. It has enacted controls through auditing, providing tax rebates for investment in resource utilization measures, differential pricing for efficient energy utilization (Lin, 2016).

Hypothesis. *Government policies highly influences the adoption of Ecological balance and protection activities in emerging economies ($t = 6.1558$, $\beta = 0.4179$, and $P < 0.05$) was strongly supported.*

The Indian government is introducing policies for ecological protection through various public–private initiatives. It has stopped mining in many eco-sensitive areas and is promoting the use of renewable energy sources, even in housing complexes and other institutions. India proposed to upgrade Bharat Stage VI norms from Stage IV by March 2020. The Bharat Stage emission standards (BSES) are introduced by the Government of India to regulate the output of air pollutants from compression ignition engines and Spark-ignition engines equipment, including motor vehicles. This move has proposed challenges for the auto industry as the costs of the vehicles will increase and hurt the industry, thus reducing economic growth. However, considering pollution as a major health factor, the government is still implementing such policies.

Hypothesis. *Government policies highly influences the adoption of 3R/Extended lifecycle of products in emerging economies* ($t = 6.8946$, $\beta = 0.4423$, *and* $P < 0.05$) *was strongly supported.*

Many government rules and incentives aim towards “Zero waste”. The Indian government focuses on the scientific method of 100% municipal waste, looking towards waste as a resource and recognizes and rewards industry and civil society working towards 3R and increasing public media information on concepts of 3R. Government organizations are also harnessing AI and Big data to increase its efficiency in planning and handling 3R. Policies that promote various industries can lead to economic opportunities for eco-friendly industries. Policies for controlled use of natural resources such as fisheries, forests and mines indirectly make them more sustainable in the long run and promote business in the long run.

Hypothesis. *Consumer behaviour highly influences the adoption of ecological balance and protection activities in emerging economies ($t = 6.9476$, $\beta = 0.4670$, and $P < 0.05$) was supported strongly.*

This study highlights that consumer awareness is the key factor in the adoption of CE principles in emerging economies which is in line with findings from studies in developed countries. Consumers or users of products and services as a collective can influence the government, and they can as a group influence society to adopt practices and philosophies that promote CE. Consumers through their support can help

organizations that help the environmental cause grow. Consumer efforts can influence even the government to take steps to enact policies that help the ecology. People and society in emerging economies like India can generate a mass movement towards environmental protection to stall industries, dams, mining, whether private or public that can harm the environment. Such social movements have been seen in many developing countries as they need to balance development/ jobs against ecology and sustainable development (Gower & Schröder, 2016).

Hypothesis. *Consumer behaviour highly influences the adoption of 3R/ Extended lifecycle of products in emerging economies ($t = 5.654907$, $\beta = 0.3315$, and $P < 0.05$) was also strongly supported.*

The acceptance of remanufactured products and viewing products as a service instead of buying products are all in the consumer mindset. As consumer mindsets are changing, there is a proliferation of such services. It has become fashionable to rent household furniture, cars and goods instead of buying them. With an education from the root, the population is accepting such concepts and thus extending the useful life of products instead of landing up in the landfill. Product design is also changing due to this mindset. If design thinking gets brought into the development process, this can ease the repair and maintenance process and consequently increase the longevity of the products. Developed nations are also borrowing the ideas of repair and reuse to promote circular economy (Riisgaard et al., 2016). This study observes that education has a major role to play and the adoption of CE principles is more prevalent in developed countries which have a direct relationship to education and economic wellbeing.

Hypothesis. *Consumer behaviour highly influences the adoption of Circular Economy in emerging economies ($t = 3.0533$, $\beta = 0.3121$, and $P < 0.05$) was also supported.*

The perception and behaviour change with education, and as the challenges and limitations in exposure due to rapid population growth in developing countries get tackled, new avenues of job creation will be developed. Developing countries were already socially and culturally aligned towards ecological friendliness and respecting nature and it was the industrial revolution and adoption of the linear economy over the last century and a half that has taken the movement away. Existing research has shown that in Thailand, people when made aware of the benefits of CE were even ready to pay premium prices for eco-friendly products (Dokmai, 2018). The people's perception is changing in using refurbished goods and this has been seen in developed nations for example with Swedish retailer Ikea selling refurbished furniture to promote recycling and reuse (Guardian, , 2019). This study shows that with renewed and effective communication, the concept and benefit of the circular economy are coming forward, and it is the consumer who will drive the movement.

5. Theoretical and managerial implications

This research has contributed to the extant literature towards the adoption of Circular Economy practices within the emerging economies context. The key findings of the study contribute to the business and management literature by empirically validating factors that influence the adoption of a) Circular economy b) 3R/ Extended lifecycle of products and c) Ecological balance and protection activities, in emerging economies. The study highlights that adoption of circular economy requires an attitude and behavioral change by society (i.e. consumers). Extant management literature has rarely considered the interactions between various constructs presented within the research such as complex interconnections between government policy and extended product life cycle, consumer behavior and ecological balance research and these interconnections in the context of a circular economy adoption. This research asserts that a behavioral change through communication, education and economic elevation will finally lead to the adoption of CE culture in society. This paper has offered insights into the possible measures and actions to be taken for a relevant emerging economy and what would be the probable outcome on the relevant parameters.

In terms of managerial implications, this paper creates awareness regarding the concept of circular economy amongst the stakeholders that are consumers, policy makers (government) and businesses. There is scope for every stakeholder to benefit from the empirically validated research providing insight of CE adoption in emerging economics. Businesses are recommended to better use information exchange and data driven insights to benefit from CE practices of making components that can be recycled and used again in new products which can help socially responsible production. Policy makers in emerging economies are encouraged to create economic opportunities for developing eco-friendly industries and educate consumers on better resource use and household waste management.

6. Conclusions and future research

The shift from a linear to a circular economy based operations is not an easy task for most organization or businesses. However, there is a growing shift towards a CE as society becomes more aware of the effects of the the former has on the ecology and sustenance of this ecosystem for the future generation. It is a significant task and needs the participation of many stakeholders such as consumers, businesses, non-governmental organizations and governments. This research finds that the need for extending the lifecycle of products that the consumers use through 3R practices and preventing the waste of resources plays a major role in the shift towards a CE. Ecological balance and protection are the goals of the practices of CE. Waste to Energy concepts, use of renewable energy and efficient resource utilization lead to reduction in wastage and thus giving rise to economic efficiency and CE.

This research asserts that the government plays a very important role in seeding the adoption of CE concepts in emerging economies. They initiate educational programs, provide platforms for design thinking and facilitate infrastructure development for sustainable development. This study also highlights that all the above cannot be achieved without the engagement of people (consumer). It requires an attitude and behavioral change by consumers. A mainstream behavioral change through communication, education and economic elevation will finally lead to the adoption of CE culture in society. The emerging economies struggle with all the steps toward CE as it is seen as a costly investment and therefore there is a need to better inform businesses and organizations of the long term benefit. Showcasing successful businesses adopting CE principles that have become more resource efficient using new technologies, saving costs and creating new markets will drive CE in emerging economies.

This study proposes future research to be carried out in developing countries like Mainland Southeast Asia and African countries. The lessons learnt from these countries will extend the CE adoption principles for developing nations. The challenges in the adoption of CE may be unique to different countries within emerging economies and need investigation at the micro and not at the macro level. Another key recommendation for future research is to undertake a study to understand the organizational perspective of adoption of CE principles by surveying different companies in emerging economies in order to provide insights into best practices and barriers faced by these businesses.

There is no doubt that the adoption of CE will require systemic change in the whole structure of the economy. This research highlights that the adoption of CE principles is a time-consuming process in developing nations, but the findings assert that the benefits seek to outweigh the costs incurred during the adoption of CE and it will be a step forward towards a better tomorrow.

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