

Circular economy: basic theories, China's experiences and suggestions for Vietnam

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Abstract: *Increasing interest has been paid to circular economy as an alternative to the linear economy at the request of sustainable development and environmental protection. China, among others, has implemented circular economy at all levels. Since circular economy is new to Vietnam, the circular economy application has limited to a few enterprises in certain fields. The article provides a review of the literature on some theoretical issues of circular economy, analyzing China's experiences and Vietnam's barriers in circular economy implementation, thereby suggesting some basic solutions to promote circular economy model transformation in Vietnam.*

Keywords: Circular Economy, Circular Economy Model, Sustainable Development, China, Vietnam

1. Introduction

Natural disasters related to climate change, air pollution, soil erosion, and deforestation have increasingly escalated in modern life. Environmental challenges are compounded by problems such as microplastic, declining insect populations, and greenhouse gas emission, coupling with dwindling natural resources. These disasters and challenges are sometimes responded to or addressed as discrete problems; however, their relationships, in fact, need addressing from the root causes through fundamental changes in production methods and consumption habits. With that requirement, the concept of circular economy (CE) has recently attracted much attention, providing an alternative to the

familiar linear consumption and production model of "take - make - dispose".

2. Concept and principles of Circular Economy

The concept of CE was initially put forward by D.W. Pearce and R.K. Turner. In the book *Economics of Natural Resources and the Environment* published in 1990, the authors outlined the theories of resource economics, and the concept of the environment as both an input and a waste absorption. The authors argue that ignoring the environment factor means looking at the economy as a linear relationship or a start-to-finish cycle without an integrated recycling system (Heshmati, 2015). That initial approach has resulted in numerous concepts of CE. S. Yang and N. Feng (2008) consider CE to

be short for “Closed Circle Economy” or “Circulating Resource Economy” (Murray et al., 2015). T. Cooper (1999) explained the CE as follows: “A linear economy model, which assumes an unlimited supply of natural resources, and an environment capable of absorbing unlimited waste and pollution, is eliminated. Instead, there is a CE, in which the amount of energy and raw materials is reduced” (Murray et al., 2015). CE is implemented based on the 3Rs’ principles (Reduction of material use, Reuse, and Recycling). The implementation of CE based on the 3Rs’ principles is embedded in both the production and consumption as the flows of raw materials and energy are involved in these areas. Zhu and Qiu (2007) elaborate on the principles and flows, that is - they consider CE a sustainable economic growth model, aiming at efficient use and circulation as the principles. By way of an efficient use and circulation, considering demand and reducing consumption, low emissions and high materials, efficient use of water and energy in production, and maximizing the use of renewable energy resources are the core characteristics. The *Reduction* principle refers to the reduction of inputs to energy and raw materials, which can be accomplished through improvements in production efficiency. The *Reuse* principle suggests using by-products and waste from a stage of manufacturing for another stage, including the use of products to maximize utilization capacity. The *Recycling* principle means the recycling of used materials as a substitute for virgin materials (Heshmati, 2015).

The level of CE application is determined based on the approach of each country. From the author’s point of view, there are

4 levels of innovation in CE, including (i) enterprises and manufacturers at the micro level; (ii) clusters linked by supply chains, typically eco-industrial parks (EIPs) and agro-ecological zones; (iii) provinces/cities directly under the central authority associated with the transition to CE; and (iv) national level and economic sectors at macro level. With such feature, in order to implement CE effectively, it is necessary to approach from micro, intermediate, and macro levels.

3. Circular economy and sustainable development

In contrast to the linear economy based on the take-make-dispose approach, resulting in unsustainable economic growth due to resource scarcity, CE is based on resource-reuse approach (Dinda, 2020). In its purest form, CE is considered a method of balancing economic development with the protection of natural resources and the environment. The UNEP 2006 report (Retrieved from: Murray et al., 2015) pinpointed the characteristics of CE, including “low energy consumption”, “low pollutant emissions”, and “high efficiency”. As a result, CE appears to be inseparable from the EIP, and is associated with the three pillars of sustainable development comprising economy, environment, and society.

Economic indicators are often clearly visible; therefore, we cannot expect simultaneous progress on all three pillars of sustainable development. Each pillar - acting as a leg in a tripod - depends on the other two pillars to create a secure bond. CE could narrow the discourse related to all three pillars. Taking environment as an example, the focus on key raw materials might encourage a pragmatic approach to environmental problems, which means focusing on the benefits of

CE through its readily available capital resources instead of promoting biodiversity. This can be seen in how commercial forests are managed, in which species are selected to maximize yield. With respect to society, circular business models (CBMs) can provide benefits to those directly involved, but often without due consideration to those having no stake, thereby incentivizing the rentiers rather than the producers (Hart, Pomponi, 2021).

One of the promises of CE is that it will result in the decoupling of economic growth from resource use, but this is wishful thinking in the case of weak CE. In a study on low carbon cities in China, the authors report the successful achievement of such decoupling as follows: “the relationship between carbon emissions and economic development showed that GDP increased, and carbon emissions also increased; however, the economic growth rate was higher than the growth rate of carbon emissions” (Hart, Pomponi, 2021). This basically showcases that a reduced impact intensity per unit of GDP does not mean that economic growth is free from additional environment impact.

It is important to understand that a CE in which nothing is wasted is practically impossible, but humans can at least move towards a circular ideal. On the other hand, a modern zero-carbon economy is technically achievable by leaving fossil fuels unearthed and trying our best with renewable resources. The world resembles a seesaw with the economy at one end, and the environment at the other. Unless crucial tipping points have been crossed, then going ‘zero-carbon’ will prevent catastrophic climate change. In fact, a zero-carbon economy - currently

a theoretical benchmark - is a basic prerequisite for a CE as energy inputs will always be required to keep the CE turning (Hart, Pomponi, 2021).

New technologies are thought to offer an escape from the vicious circle of take-use-dispose, which has increasingly caused environmental problems to mount up since the industrial revolution. On the other hand, technology also contributes to problems that CE seeks to solve: the energy demand of big data, and the material resources needed to support planned obsolescence (Hart, Pomponi, 2021).

4. Experiences of circular economic development in China

China is the country that is most fully aware of the implementation and development of CE concepts. China is also the only country that has developed the concept of CE and implemented it as an ambitious large-scale development strategy. The experiences of China are summarized as follows (Heshmati, 2015):

i) Driving forces to promote the development of the knowledge-based economy become a development strategy

China’s special environmental situation has prompted the government to make efforts to promote CE as a national economic development strategy with a comprehensive scale in order to reduce environmental challenges (related to land degradation, increased desertification, deforestation, water depletion, air pollution, biodiversity loss, and waste generation). The 12th Socio-economic Development Plan (2011-2015) is evidence of the government’s determination to continuously implement and develop CE. *Firstly*, China is facing major environmental challenges due to the scale and speed of industrialization

and urbanization in the absence of strict regulations and supervision mechanism. *Secondly*, the shortage of resources and energy to satisfy growing demand and increasing economic growth rate has become more serious. CE is an alternative to reduce the large gap in resource demand and supply shortage related to population and industry structure. The explosive economic growth and increased output of heavy and energy-intensive industries have resulted in a doubling energy consumption over the past decade. *Thirdly*, environmental and manufacturing regulations and standards have been stricter in international trade relations in recent decades. There has been a tendency to implement higher labor standard, also known as “green technical barriers”, which is expected to further affect the competitiveness and export turnover of developing countries. The implementation of these standards requires advanced technology and apply “green innovation” in manufacturing and shipment. CE is considered a fundamental solution that meets the “green technical barriers” and helps China achieve the goal of improving national competitiveness in international trade relations. *Fourthly*, CE helps enhance national security as it promotes the replacement of raw energy sources while strengthening the use of resources in an economical and efficient manner. In addition, positive environmental effects improve the overall societal well-being, advance knowledge, technology, and modernization.

ii) Implementing CE at micro, intermediate, and macro levels

According to studies undertaken by Chinese scholars, in order for CE to be successful, it is necessary to simultaneously implement

CE at the 3 levels including micro, intermediate, and macro, and in 4 fields comprising manufacturing, consumption, waste management, and other support.

At the micro-level, in the production of businesses and agricultural products, producers are encouraged and required to adapt to clean production methods (low emissions) and ecological design (incorporating environmental aspects in innovatively designing production processes and products in an effective and sustainable manner). In 2003, China issued the Law on Promotion of Cleaner Production to address the main problems related to pollution and efficient use of resources at all manufacturing stages. This law is mandatory for enterprises causing heavy pollution to reduce energy intensive use, and the use of negative external materials. Surveys on electrical businesses and electronics manufacturers show evidence of eco-design for products. From the perspective of consumption and waste management, encouraging green consumption, using environmentally friendly services, recycling waste in all stages of manufacturing are a part of the industrial ecology.

At intermediate level, the implementation of CE includes development of EIPs and agro-ecological systems, supplemented by other measures such as eco-friendly design in industrial parks and adequate waste management. Waste trading system and static industrial zones should be developed to recover resources from green products. By adopting the concept of industrial symbiosis, EIPs take advantages of the shared infrastructure and services, allowing clusters of enterprises to collaboratively control resource flows and do industrial by-products’ businesses that reduce the

external impact of the environment and dependence of enterprises and countries on resources. Along with EIPs and agro-ecological systems, a green design program for the public must be available to create a friendly living environment. It is necessary to regulate and control the consumption of energy, water, and soil in urban areas to reduce the consumption, manage and recycle water and solid waste to improve the overall societal well-being.

Finally, the implementation of CE at macro-level requires the formation of a wide and sophisticated cooperation network, and active cooperation between industries and industrial parks, including tier-1, tier-2, and tier-3 economic sectors in both manufacturing and residential areas. In China, the macro-level is aimed at major cities, regions, or provinces. The goals of the 3Rs' principles can be achieved by designing and managing standards for urban infrastructure, industrial production, and peri-urban agriculture, and by creating public programs to eliminate energy-intensive and polluting technologies, replacing them with environmentally friendly technologies.

5. Basic obstacles to circular economy implementation in Vietnam

In Vietnam, the development of EIPs began in 2014 within the framework of the project of "Implementation of eco-industrial park initiative towards a sustainable industrial park model in Vietnam" implemented by the Ministry of Planning and Investment (MPI) and the United Nations Industrial Development Organization (UNIDO). Four industrial zones participated in this project, including Khanh Phu and Gian Khau (located in Ninh Binh province), Hoa Khanh (located in Da Nang City), and Tra Noc 1 and 2 (in Can Tho City), with a

total of 72 enterprises involved. Enterprises in participating industrial zones were provided with information on the latest technology transfer and cleaner production solutions, thereby helping them make the most of their raw input materials, efficiently use energy, use water economically, and ensure safe chemical use and waste-water management. These enterprises offered peer-support and utilized other enterprises' waste as their input materials (UNIDO, 2019). The CE model is spontaneously developing in some enterprises in several fields, including (i) agriculture, typically Loc Phat livestock farm in Binh Duong (Vu Anh, 2019) and some ecological farming or high-tech agricultural models in Lam Dong (Hua Huy Hoang, 2019); (ii) seafood by-product processing industry, with typical examples of Vinh Hoan Collagen company and Vietnam Food JSC (Retrieved from: *Industry and trade magazine*, 2019); and (iii) food industry, with typical examples of Heineken Vietnam, Ajinomoto Vietnam, Nestle Vietnam, Vinamilk Dairy Company, and Vietnam Package Recycling Alliance comprising 9 leading companies in consumer goods and packaging (Thu Huong, 2019).

The efforts of a few enterprises in a limited number of business fields make the financial burden of transforming to the CE model mainly fall on the producers while there is no change in the awareness and behaviors of consumers related to circular economic products and environment protection. The financial pressure in transforming technology and production lines towards CE, the availability and price of raw materials and recycled materials do not create enough incentive for enterprises to switch to using recycled materials.

Furthermore, there is lack of regulations and mechanism in Vietnam, hence, CE model transition is still in the initial state. Some main barriers to the transition to and development of CE in Vietnam are set out as below:

i) Cultural barriers: Cultural barriers specifically emphasize consumers' culture/habits and corporate culture. With respect to consumers, changing the culture/habits of "convenience first" without regard to product origin and whether packaging uses recycled materials or not requires time to get used to, adapt and change behaviors. Consumption orientation, the habit of using products with recycled or recyclable origin, the habit of exchanging old goods for new ones have not been paid due attention to. Consumers are mainly concerned about the quality of goods and the level of convenience when using them. With respect to enterprises, it is obvious that changing production methods using recycled materials requires investment in technological innovation, which will affect the business' profitability. The requirement here is to change the business culture towards more social and environmental responsibility, lessening the mere focus on business' interest. Corporate culture requires adjustments in the policy framework, promoting the role of industry associations, and adjusting behaviors of each enterprise. In fact, most enterprises are mainly after short-term economic gains while the level of concern and social and environmental responsibilities are limited.

ii) Market barriers: From the perspective of each individual enterprise, production methods to the approach of CE are more costly than those of linear economy,

particularly in a situation with "low cost of raw input materials" and "high initial investment" (Kirchherra et al., 2018). In the early stage of CE, although raw materials are increasingly scarce, their prices are low, and they are more readily available than recycled materials to ensure the continuous operation of the production cycle. Vietnam is considered a country rich in resources; however, the input materials and components for processing activities in manufacturing namely textiles and garments, footwear, etc. are mainly dependent on China. In the event that the supply of materials from China is interrupted (due to Covid-19 and global supply chain disruption), key industries, especially those involved heavily in exports and global supply chains, are significantly affected, thereby affecting the development of the economy and the country's role in the global supply chain. In addition, Vietnam has not developed a market for recycled materials, partly due to the lack of infrastructure and the lack of enterprises operating in modern waste collection, sorting, and treatment to provide recyclable materials; meanwhile, the rate of solid waste separation at source is relatively low due to the lack of technology and resources.

iii) Financial barriers: Innovating the production mode in CE requires an increase in initial investment costs for technological innovation in accordance with the approach to CE. These initiatives are often very expensive, requiring financial support from the government. Enterprises in Vietnam are mostly small and medium in size, many of which are of small or even micro size, have very limited financial capacity. As a result, it is necessary to have financial support programs available from the government

for the investment in the technology change in CE. Meanwhile, the operational efficiency of funds to support innovation and start-up businesses is limited as these funds require local counterpart funds with complicated loan procedures, resulting in only a modest number of enterprises being able to access such credit capital.

iv) Legal barriers: Legal barriers consist of the lack of “smart regulations” for CE transition such as the lack of a “supportive policy framework”, and regulations preventing the shipment of materials across international borders (Kirchherra et al., 2018). In Vietnam, CE was first mentioned in the document of the 13th Party Congress. Regarding the legal framework, Vietnam has the Law on Environmental Protection (2014), Green Growth Strategy (2012), and Vietnam’s Renewable Energy Development Strategy to 2030, with a vision to 2050; National action program on sustainable production and consumption in accordance with Decision No. 76/QĐ-TTg issued by the Prime Minister on 11 January 2016 providing support for enterprises and production facilities to apply business management and production model to make high quality, environmentally friendly and resource saving products; The government has provided tax incentives, capital and land support to build waste recycling facilities. Nonetheless, the legal framework, mechanism and policies that promote the transition to CE in Vietnam are still inadequate and inconsistent as they lack the evaluation criteria and waste management standards.

In addition, Vietnam does not have an overall strategy for developing CE at national level, therefrom providing orientations and making policies to support the development of CE, the change

of technology and production method towards CE, the establishments of EIP and agro-ecological zones. Due to the lack of strategic orientation, a roadmap for the implementation of CE is unavailable. At macro-level, the Law on Environmental Protection needs to add regulations related to CE such as businesses’ responsibilities to recover and restore resources from used products. This law lacks instruments and economic policies such as royalty and environmental protection fees which should be included in the amendment and supplement to a number of articles in this law (Doan Nguyen, 2020). The planning of EIPs and agro-ecological zones has not been given due attention with regards to the formulation of local socio-economic development master plans and sectoral development plans. The legal framework, regulations and policies to support the development of CE for enterprises are either absent or weak; therefore, it is challenging to encourage the establishment of technologically capable enterprises running recycling activities. In terms of mechanism and policies, there is no clear difference in those subject to policies between enterprises applying CE approach and those not applying, between consumers using CE productions and those not using. Therefore, there is neither motivation for enterprises to change into CE models nor impact on behavioral change of consumers. There is no fee tools for non-refundable old products, and a lack of price support for using recycled products to encourage behavioral changes in Vietnamese consumers.

v) Technological barriers: Technical bottlenecks are considered one of the biggest challenges. Having the right

technology in place is a prerequisite for the transition to CE. The opportunities for CE are abundant if technological barriers are addressed. However, even when technology is available, other stumbling blocks such as designing circular products are considered key challenges for the successful transition to CE. In Vietnam, technological barriers are accompanied by financial barriers as the majority of enterprises are from micro to small scale, lacking financial capability to invest in changing technology and production line towards CE. The technology market is also underdeveloped in Vietnam; therefore, it is unable to provide much support for enterprises to access new and advanced technology.

6. Some suggestions for promoting the development of circular economy in Vietnam

i) Promoting circular economy in relation to the requirements of sustainable development

Currently, the awareness and understanding of CE in Vietnam is incomplete top down, which means CE has not been fully understood from macro to micro levels. As a result, the application of CE in reality is sporadic, spontaneous and frivolous without a national strategy for CE development. Developing CE and CE models is an inevitable trend in sustainable development. Countries around the world are gradually transitioning from linear economy to a CE to make best use of resources and increase the use of recycled materials to replace raw materials and mitigate negative impacts on the environment, thereby improving life quality for people. Vietnam is not an exception to that general trend. Since CE was first mentioned as one of national main tasks as stated in the

Document of the 13th Party Congress, Vietnam needs to timely issue resolutions of the Party and government to make CE development strategies and direct the transition to CE model consistently at all levels. China's experiences show that it is necessary to implement CE at 3 levels (micro, intermediate, and macro levels) in 4 stages (manufacturing, consumption, waste management, and other support). More information and education on CE should be given to enterprises and people to trigger the change of business culture in corporations and consumption behaviors of people, thereby promoting enterprises and people to actively participate and take responsibility in circular economic cycle.

ii) Develop and finalize the legal framework, mechanism, policies and regulations for enterprises to transition to CE model; regulations on the participation of consumers in circular economy

Policy makers should note that CE requires a systemic change in actions committed by actors for goods produced and resources wasted along the value chain. Nonetheless, a comprehensive legal framework including all actors involved is not available in Vietnam. At national, sectoral, and provincial level, CE needs to be specifically mentioned via the planning of EIP and agro-ecological zones in the national, local and sectoral socio-economic development plans. According to China's experiences, EIPs and agro-ecological zones should be designed to be environmentally friendly, linking the manufacturing area with infrastructure and technology for waste collection and reusing. Provinces and cities under central government need to have regulations and mechanisms to promote enterprises and manufacturers to

use energy-saving and environmentally friendly technology, expand production scale, and well manage solid waste and wastewater. At sectoral level, ministries need to restructure the industries they oversee and select appropriate sub-sectors based on typical features of their industries to promote the implementation of CE. China's experiences reveal that industries and sectors showing transition to CE include iron and steel, paper production, emerging industries, manufacturing, leather and footwear, mining, chemicals, construction, semi-conductor, ecological and circular agriculture, oil and gas exploitation, electric power, tourism management, and green supply chain.

It is necessary to amend and supplement a number of articles on the Law on Environmental Protection, in which provisions related to CE must be included, clearly defining the responsibilities of enterprises for the recovery and restoration of resources from used products. It is vital to develop a legal framework to support businesses and manufacturers transitioning to CE model by way of financial support from CE transition funds. On the basis of expansion and integration with the Innovation fund, inadequate regulations should be reviewed and amended to simplify procedures and improve the fund's efficiency, enabling more enterprises get access to preferential credit to effectively support small and medium enterprises overcome the current financial weakness. Economic instruments and policies should be supplemented, namely royalty and environmental protection fees so that enterprises and manufacturers quickly transform their production cycle and apply circular economic technology. Consumers'

responsibilities to participate in CE should be clearly defined through the policy of imposing prepaid fee for household goods that can be recycled and reused to enhance their societal and environmental responsibilities.

iii) Building linkage mechanism and infrastructure between basic industries and supporting industries, developing CE technology market

Vietnam still lacks large enterprises operating in the field of waste treatment, especially enterprises producing recycled and reused goods. Industrial enterprises often lack a stable supply of recycled and reused materials. This is one of the barriers for businesses to convert to CE. Vietnam needs to group basic industries (those directly involved in the extraction of raw materials for production, distribution, product consumption and discharge into the environment) and supporting industries (industries that collect, transport, destroy, recycle and safely dispose of waste). For the basic industry group, there should be a mechanism to promote the design of circular economic products, develop cleaner production processes, and increase the use of recycled products from supporting industries to provide more environmentally friendly products, and invest in technology and waste separation process at source as input for supporting industries. For supporting industries, it is necessary to focus on investing in infrastructure and technology for waste collection, treatment and recycling, and on developing enterprises specializing in waste treatment and those producing recycled and reused products. The waste collection infrastructure, supporting industry enterprise system and linkage

mechanism with basic industrial enterprise system are either absent or weak in Vietnam. The implementation of solutions with high synchronization and linkage between the two industry groups will help overcome market barriers, proactively prepare (recycled) input materials for industrial enterprises, and gradually reduce dependence on the Chinese market.

The technology market in Vietnam is still underdeveloped with limited investment capital for circular economic manufacturing. It is therefore necessary to develop the technology market to help enterprises get access to novel, modern and advanced technology that fits the circular economic model.

iv) Developing cooperation mechanism and infrastructure between producers and consumers for recycling and reused product collection

Consumption habits are one of the barriers to the implementation of the knowledge economy in Vietnam. Therefore, it is necessary to have mechanisms and tools to make using recycled and reused goods more appealing to consumers so that they can become more conscious in participating in the circular economic cycle. Manufacturers need to build a convenient collection system for recycled and reused products at retailing business and service establishments for old goods, equipment, and packaging that are capable of being recycled or reused from consumers, along with an ATM system to refund prepaid fees applicable to some household products to consumers after these items are returned to the system. Economic tools are one of the most effective tools to influence and change consumer behaviors, waste behaviors, and social and environmental

responsibility. Both the recycling and reused product collection infrastructure and the cooperation mechanism between producers and consumers mentioned above are the missing puzzle pieces in Vietnam.

v) Developing a set of indicators to measure CE

Vietnam needs to develop a set of basic national-level indicators to assess the development of CE, including: an index to measure the effective use of natural resources to GDP, an index to gauge the recycling rate out of total materials used in the economy, an index to measure the amount of waste that ends up at landfill sites and being released into the environment. In addition to this group of basic indicators, each economic sector with its specificity needs to add other specific indicators to evaluate the basic economic activities in CE. Assessments and evaluations drawn from the measurement and analysis of these indicators are the basis for the central government and local authorities to adjust mechanisms, policies, and solutions to promote the implementation of CE on a scientific and practical basis.

7. Conclusion

Of the 12 key national development tasks for the 2021-2030 period mentioned in the Resolution of the 13th Party Congress, the sixth task clearly indicates the goal of Vietnam's economy towards sustainable development as follows: "... building a green, circular, and environmentally friendly economy" (Central Executive Committee, 2021). The concept of "circular economy" was mentioned in the official document of the Party for the first time ever, showing the inevitable trend and the need to develop CE in close relationship with

environmental protection and sustainable development. However, the understanding and application of CE in Vietnam is at varying degrees from central government to local authorities and business owners, from researchers to policy makers and managers. Therefore, the implementation of CE is greatly affected at various levels. With the “followers’ advantage”, Vietnam needs to study and refer to world experiences, apply creatively, and overcome barriers to develop a CE with a clear roadmap at all levels □

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