

## Circular Economy: A Key Towards Sustainable Development

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**Abstract:** Circular economy is an inevitable and indispensable trend for sustainable development taking place all over the world. In the recent years, many countries have been implementing the transition from the traditional linear economy to the circular economy with different ways and priority levels. This paper aims at analyzing the basic concepts of a circular economy, how a circular economy towards sustainable development, advantages and challenges of shifting the Vietnamese economy towards the circular economy.

**Key words:** circular economy; sustainable development; traditional linear economy

**JEL code:** Q2

### 1. Introduction

The traditional linear economy has been exposing its failure. The world is facing with challenges on the availability of natural resources by rising demand from the world's population, environmental pollution from the huge amount of waste disposed every day. The failure of the linear economy highlights the need for a new paradigm — a circular economy — that can address the linear economy's issues. The circular economy serves society, the environment, and the economy.

Vietnam's economy after more than 30 years of reform has undergone a remarkable change. However, along with the growth and development achievements, Vietnam's economy is mainly maintaining a traditional linear economy, which the model of economic growth is developing based on width, meaning the production still consumes a lot of raw materials and disposes a huge amount of waste into the environment, seriously threat to ecosystem. The traditional linear economic model according to the cycle of exploitation, production and emissions has caused significant environmental problems. Vietnam is facing the problems of resource depletion and increased waste. The amount of waste in Vietnam is forecasted to double over the next 15 years (S. Kaza, L. Yao, P. Bhada-Tata, F. Van Woerden, 2018). The above problems have been putting enormous pressure on the Vietnamese economy and require a new development model. To solve these problems, the choice of a circular economy model is necessary for many countries in the world as well as Vietnam to break the longstanding relationship between economic growth and negative impacts on environment. Therefore, the shift to a circular economy model, using resources economically and efficiently, and limiting emissions to the environment is an urgent requirement, both in order to solve environmental problems and develop a green economy, while improving competitiveness, reducing costs of raw materials and fuel for enterprises. In the Draft Document to be submitted to the XIII Congress at the beginning of 2021, the construction of a circular economy has been

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identified as one of the national development orientations for the period 2021-2030 (Minh Son-Thanh Phong, 2021). The circular economy is also a relatively new model in Vietnam. The paper will focus on analyzing the concepts of circular economy and what circular economy towards sustainable development, and discuss advantages and challenges for Vietnam to implement a circular economy model.

## **2. Concepts and Principles of Circular Economy**

The concept of the circular economy appeared from the 1990s in the context of excessive consumption of modern society that has caused environmental hazards and many social problems, negatively affected human health and the ecosystem. There are many different definitions about the circular economy.

The World Economic Forum stated that: The circular economy is an industrial system that is recovered or recreated according to intention and design. It replaces the end-of-life concept with restoring, converting to renewable energy, eliminating the use of toxic chemicals, and aiming at waste removal through superior design of materials, products, systems and business models (EEA, 2017).

Lieder and Rashid (2016) define the circular economy as simply the “4R” framework: reduce, reuse, recycle, and recover. The first three Rs are about conserving natural capital and reducing resource usage. The final R refers to the resource recovery in the form of energy like incineration of wastes for heating. It is also clear that the circular economy appears to prioritise economic prosperity over environmental quality, with the social side of sustainability (i.e., human well-being) receiving little attention (Lieder, M., and Rashid, A., 2016)

According to the Ellen McArthur Foundation, circular economy is defined as a framework for an economy that is designed to be restorative and regenerative. Particularly, this circular economic model aims to build economic, natural, and social capital based on three basic principles: (1) design out of waste and pollution; (2) keep products and materials in use; and (3) regenerate natural systems” (Ellen MacArthur Foundation, 2013).

Thus, the circular economy is a precise, intelligent economic system that operates on basic principles, closely related to the use of recycling, production rotation, processing and using the resource in an economical, efficient way, minimizing and eliminating all kinds of waste that pollutes the environment. A circular economy model, in contrast to the existing linear model, highlights economic growth and activities that are unrelated to the use of finite resources and reduce system wastes, resulting in positive social benefits.

In a linear economy, goods are produced from natural resources, sold to the market, consumed and then discharged into the environment. The linear economic model leads to the depletion of natural resources and the generation of huge amounts of waste. Instead of a linear economy, the circular economy seeks to eliminate waste and safeguard the environment. Businesses that follow the circular economy model use a closed production and consumption cycle, which means that waste that would otherwise be thrown away, squandered, and harming the environment will be "revived" and used as raw materials for production, returning to the product life cycle.

In general, circular economy (CE) refers to the design, production, and service activities that aim to extend the life of materials and eliminate negative environmental impacts; as a result, it minimises damage to people's quality of life through waste recycling solutions and the use of recycled materials as input materials to conserve natural resources.

Circular economy also refers to the rational management and use of natural resources based on the principle of "closed circulation," which includes the efficient use of renewable raw materials, waste management through recycling, and value optimisation based on the principle that the longer materials and resources are used, the more

value can be extracted from them.

There are three principles of circular economics. First, preserve and improve natural resources by controlling finite resources and balancing renewable resource flows. Second, optimize the use of resource by recycling products, ingredients of products and materials at the highest level at all times in both the technical and biological lifecycle. Third, promote the efficiency of the system by detecting vulnerabilities and eliminating negative external influences.

Over the years, many economies around the world have seen a shift from the traditional linear economy to the circular economy. The circular economy can be implemented at three levels: micro (producers, enterprises, and consumers), intermediate (e.g., eco-industrial zones), and macro (the city, region, country and beyond) (Kristensen H, 2019).

Practical applications in effective waste management and responsible natural resource utilisation are at the heart of the circular economy. This new economic model also promotes glasshouse gas emission reductions and aids in the execution of the Paris COP21 Agreement and the United Nations' sustainable development goals.

### **3. Circular Economy Towards Sustainable Development**

The circular economy (CE) is considered a sustainable economic system in which economic growth is decoupled from resource use, through the reduction and circulation of natural resources, achieving both goals, coping with depletion of resources (input) and environmental pollution in development (output).

One of the purposes of the circular economy is to optimize resource yields by rotating the used products, ingredients and materials efficiently in both technical and biological cycles because the product or material in the circular economy will be continuously maintained, reused, and recycled, so there is no longer resources exploitation and waste generation. This has become one of the main components of carbon emission reduction plans in many countries.

The circular economy provides value for both businesses and consumers, prolongs the life of the products, prevents excessive waste generation and recovers the full value of the product. This creates new business opportunities and revenue streams, while minimizing the environmental impact of resource mining, refining, and manufacturing.

There are five main business models in circular economy: prolonging the life of products, selling services instead of selling products (e.g., selling lighting services instead of light bulbs), sharing platforms, regenerating and efficient use of resources.

The circular economy is linked to many of the 17 Sustainable Development Goals (SDGs) adopted by countries in 2015, including goals such as zero poverty, responsible consumption and production, sustainable cities and communities, and inclusive and sustainable industrialization and innovation. This is reflected in the benefits that circular economy brings in the economic, environmental and social fields.

In terms of economic benefits, circular economy creates a great potential for economic growth and creates more jobs. By the efficient use of resources, businesses have the opportunity to provide products with cheaper price by offering products and services with multiple use functions. When compared to the linear strategy's raw material extraction, the circular economy has the potential to save more material (up to 70 percent) than the linear approach (up to 70%) (Mayer A., Haas W., Wiedenhofer D., Krausmann F., Nuss P., Blengini G. A., 2018). While

the demand for raw materials will increase due to the increase in world population and consumption, activities in the circular economy model use less raw materials by focusing on extending the cycle of raw materials.

Moreover, the development of the circular economy model could bring more local jobs especially primary and semi-skilled jobs. A study on implementing a circular economy conducted in August 2018 suggested that 50,000 new jobs could be created in the UK and 54,000 in the Netherlands (Kalmykova, Y., Sadagopan, M., & Rosado, L., 2018).

For businesses, the circular economy model helps businesses become more flexible, increasing their ability to cope with changes in raw material supplies. The circular economy offers new profit opportunities due to lower input costs and stable raw material supply, reduction of the amount of raw materials, increased recycled materials, and creating new profits. The circular economy also creates the demand for new services, so businesses can seek new business opportunities. New services that may arise are collection logistics and support services of end-of-life products introduced into the system, product marketing services and sales platforms that facilitate the longevity of the products; reprocessing of parts and accessories, refurbishing products or services and providing expertise.

In terms of environmental benefits, the circular economy reduces greenhouse gas emissions, having positive impacts on ecosystems and combating overexploitation of natural resources, increasing the sustainability and efficiency of use of land in agriculture. A circular economy optimizes agricultural productivity and reduces negative externalities brought about by the linear model, eliminating greater pollution caused by the production of new materials.

The transition to a circular economy is a great opportunity for rapid and sustainable development because the implementation of a circular economy model not only achieves economic, social and environmental goals but also copes with climate change. This is an adjustment process aimed at minimizing negative effects of the traditional linear economy, creating long-term resilience, business opportunities as well as environmental and social benefits.

As the basis for the implementation of sustainable development goals through ensuring sustainable production and consumption such as: reducing the current rate of resource degradation, meet the needs of future generations; raise awareness of people about waste reuse and recycle, limit consumption of non-necessary single-use items; raise the responsibility of producers to support 100% material recycling rates.

A pathway towards a low carbon economy, especially in heavy industries. The circular economy development could halve carbon dioxide emissions from industry by 2030, compared with 2018 levels. The European circular economy model in agriculture has the potential to reduce the use of man-made fertilizers by 80%, thereby contribute to the natural balance of the soil. Land degradation causes an estimated damage of 40 billion US dollars in annually worldwide, and also creates potential costs such as increase in fertilizer use, loss of biodiversity and loss of unique landscapes (Blanca Corona, Li Shen, Denise Reike, Jesús Rosales Carreón, Ernst Worrell, 2019).

Over the world, the circular economy has a huge impact on economic development. The 2016 report by the Ellen MacArthur Foundation and the United Nations Conference on Trade and Development (UNCTAD) shows that India will generate \$218 billion in economic value added by 2030 and reach nearly triple the figure by 2050 when applying the principles of circulation in three areas: city and construction, food and agriculture, vehicle manufacturing and mobility. Similarly, in China, the circular economy makes goods and services cheaper, reducing fine dust emissions by 50%, greenhouse gas emissions by 23% and traffic congestion by 47% by 2040 (Phong Du, 2019).

Circular economy helps the world save 4,500 billion USD by 2030, Europe alone can save 600 billion EUR

(about 660 billion USD) per year (European Commission, 2018a). The European Union moves towards the circular economic model as one of the pillars of the 2020 EU strategy and applies the principles of circular economy as a part of the sustainable development strategy, which defines various actions in the European Union's Action Plan for the circular economy, aiming to make all waste become resources. As a result, new industries focus on recalling, cleaning, and reusing old products to produce new products.

The European Union made a proposal to define a primary target for material productivity to measure the amount of value produced per unit of raw material. Based on GDP related to raw material consumption, this figure will be set at 30% by 2030. It also includes a legislative proposal to review waste targets including 70% recycling of municipal waste, 80% recycling of packaging waste and bans any recyclable landfill (European Commission, 2018a).

By the end of 2018, there were 34 countries in the world taking the first step in laws and policies to promote a circular economy<sup>1</sup>. In cities around the world, city governments are becoming an incubator of ideas that can deliver broader policies and can inspire action in both the public and private sectors. Sweden is one of the leading countries in the world for waste management and recycling. The waste is recycled and used for purposes such as biogas and energy. Sweden has now become a waste importer with over 2.3 million tons of waste being imported each year. Thanks to people's awareness of environmental protection, government encouragement as well as an efficient garbage collection system, the proportion of recyclable waste of households has increased from 38% in 1975 to 99%, only 1% of the waste goes to landfills today<sup>2</sup>.

Toronto collects organic waste from households in the city and turns it into biogas that can fuel trucks or be used for heating. In New York, city governments promote capital recycling initiatives by extending the life of products through recycling, reusing, and adopting a sharing economy (Christina Nunez, 2020).

#### **4. Vietnam Develops More Sustainably Through the Implementation of Circular Economy Model**

Vietnam has recently achieved a relatively high economic growth rate for a long time. However, Vietnam's model of economic growth is mainly developing based on width. The transformation of the growth model from width to depth is being carried out, shown in documents of the Party Congress. The view of the XI Congress is to develop a model of economic growth reasonably combining width and depth. The XII Congress affirms that the economic growth model focuses on depth. The concept of the circular economy has also been mentioned in recent Party documents such as Resolution 55-NQ-TW in February 2020 of the Ministry of Politics, Draft Resolution of the XIII Party Congress and has been concretized into policies and laws such as the revised Draft of the Law on Environmental Protection in 2020, officially referring to the concept and regulations of a circular economy. In the Draft Document to be submitted to the XIII Party Congress, economic development must be based on an economic growth model, basically in depth. Moreover, in this Draft, the construction of a circular economy has been also identified as one of the national development orientations for the period 2021-2030. Thus, the circular economy development helps Vietnam's economy to develop sustainably, contributing to thoroughly solving the risks of resource depletion, environmental pollution and degradation. In addition, the circular economy contributes to creating more career opportunities and enhancing the competitiveness of the private sector.

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<sup>1</sup> <http://tapchithongtindoingoi.vn/print/doanh-nghiep-fdi-tren-hanh-trinh-phat-trien-nen-kinh-te-tuan-hoan-37378>.

<sup>2</sup> <https://www.trtworld.com/europe/swedish-recycling-so-successful-it-is-importing-rubbish-24491>

The sustainable development of the country was confirmed in the Conference "The National Assembly and the sustainable development goals" held in Da Nang at the end of 2018, National Assembly Chairwoman Nguyen Thi Kim Ngan affirmed: the central mission is sustainable development, considering people and quality of life as the central factor of development policies.

Many policies issued by the State aim to develop a sustainable economy. For example, Directive 36/CT-TW on enhancing environmental protection in the period of national industrialization and modernization, of which focus on supporting the application of clean technology with less material consumption. Since 2016, the Government has issued the National Program of Action on Sustainable Production and Consumption (SCP). In 2017, the Prime Minister approved the Project to develop Vietnam's environmental industry to 2025, aiming to form an environmental industry that can meet the contents of a circular economy. Moreover, the Ministry of Industry and Trade is also drafting a National Action Program on SCP with solutions and perspectives of circular economy to implement in the period 2021-2030. In addition, there are also a number of related policies such as the Mineral Law, the Law on Natural Resources and Environment, and the Vietnam Sustainable Development Strategy.

Vietnam participated in the World Forum on circular economy in 2019 in Finland and participated in the program to share experiences in policy development, visited production models, and business practices of products from circular economy in Germany. These are good opportunities for Vietnam to receive a lot of information, learn from successful experiences and ideas in order to develop policies and apply to the circular economic model.

In 2018, according to World Bank, Vietnam ranked 69/190 in business environment; According to the World Economic Forum (WEF), Vietnam ranked 77/140 in terms of national competitiveness. Also in 2018, Vietnam ranked 54/162 countries in the top 30% of countries in sustainable development and the 2<sup>nd</sup> after Thailand in ASEAN<sup>3</sup>.

Circulating economy in Vietnam is associated with the goals of environmental protection and sustainable development in different sectors of the economy. Currently, many new production and business models that are moving closer to the circular economy in the private sector have been implemented quite successfully, such as the model of ecological industrial zones in Ninh Binh, Can Tho and Da Nang (saving 6.5 million USD/year)<sup>4</sup>, aquatic by-products processing model, Vietnam Packaging Recycling Alliance (PRO), renewable energy centers in Ninh Thuan province.

The foreign investment sector plays an active role in promoting the circular economy in Vietnam through recycling plans for waste and by-products with modern, advanced waste treatment processes and being transparently controlled. For example, Nestlé company produces unburnt bricks from boiler waste, processing fertilizers from non-hazardous sludge and using milk cartons for ecological roofing. Nestlé also has plans to recycle and reuse 100% of packaging of products by 2025<sup>5</sup>. Nearly 99% of waste or by-products of Heineken Vietnam have been reusing or recycling, 4 out of 6 beer factories have been using heat energy from renewable energy and fuels without carbon emission. Unilever Vietnam implements a program to collect and recycle plastic

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<sup>3</sup> <http://vneconomy.vn/kinh-te-tuan-hoan-canh-cua-than-ky-dua-viet-nam-phat-trien-ben-vung-20190912174728576.htm>.

<sup>4</sup> <https://tuoitre.vn/9-cong-ty-bat-tay-thanh-lap-lien-minh-tai-che-bao-bi-viet-nam-20190621143616913.htm>.

<sup>5</sup> <http://tapchimoitruong.vn/moi-truong-va-doanh-nghiep-59/Nestle-C3%A9-Vi%E1%BB%87t-Nam-g%C3%B3p-s%E1%BB%A9c-x%C3%A2y-c%C3%B4ng-tr%C3%ACnh-tr%C6%B0%E1%BB%9Dng-h%E1%BB%8Dc-b%E1%BA%B1ng-g%E1%BA%A1ch-t%E1%BB%AB-s%E1%BA%A3n-xu%E1%BA%A5t-c%C3%A0-ph%C3%AA--1380>.

packaging and sort waste at source ...

In addition, in June 2019, nine pioneering companies founded the Vietnam Packaging Recycling Alliance (PRO Vietnam), including TH Group, Coca-Cola Vietnam, Friesland Campina Vietnam, La Vie, Nestlé, Nutifood, Suntory PepsiCo Vietnam, Te tra Pak and Universal Robina Corporation<sup>6</sup>.

In the textile industry, the rags are recycled by the enterprise into new fabrics. Clothing products created using a portion of this recycled fabric are labeled as CE products. Parts such as coffee bean grounds and pods are utilized and produced into standard coffee cups and also labeled as CE products.

However, there are still many challenges for Vietnam to implement a circular economy. Although Vietnam there are also many products made from by-products, scrap, recycled materials, these products have not been “certified” and the market’s acceptance is still very limited. Currently, the natural resources depletion, rapidly increasing energy consumption, land pollution and degradation and especially climate change, are seriously affecting Vietnam’s economic development. According to World Bank, air pollution alone caused Vietnam to lose 5.18% of GDP in 2013. Water pollution can also cause damages to Vietnam up to 3.5% of GDP<sup>7</sup>.

According to the Business Council for the Sustainable Development of Vietnam, in recent years, Vietnam has had a large amount of plastic waste dumped into the sea (ranked the 4th in the world in terms of plastic waste discharge). In which, about 80 tons of plastic waste is generated every day from two big cities (Hanoi and TP. In Ho Chi Minh City). Notably, the amount of plastic waste and plastic bags nationwide currently accounts for about 8-12% of domestic solid waste. If 10% of plastic waste on average is not reused but completely disposed, the amount of plastic waste and plastic bags discharged into the environment is approximately 2.5 million tons/year. This will be a burden on the environment, possibly even leading to the “white pollution” disaster (Thu Huong, 2019).

Therefore, in the context of global economic integration with commitments on ecological safety standards with many countries and economic regions through Free Trade Agreements, Vietnam cannot stand outside of circular economy. Therefore, the application of the circular economy model in Vietnam is an inevitable and indispensable trend.

#### **4.1 Advantages for Vietnam in the Implementation of Circular Economy**

Vietnam continues to improve the institution of a socialist-oriented market economy, the transition from “linear economy” to “circular economy” contributes to rapid and sustainable economic development. With the development of science and technology and the fourth industrial revolution, the circular economy associated with high technology, along with the promotion of digital transformation will be a great opportunity to explore and discover many methods to improve the efficiency of natural resource use. This is a favorable environment for the transition from a linear economy to a circular economy with many new business models based on science and technology and policy innovation. Circulating economy will also reduce the pressure of resource shortages, environmental pollution, large amounts of waste, especially plastic waste. Thus, the transition will get the consensus of the whole society. In addition, we are implementing sustainable development goals (SDGs) and responding to climate change, reducing greenhouse gases, which are recovered almost completely, not emitted into the environment. Globally, the circular economy is a common trend that has been implemented in many countries such as Sweden, Denmark, Finland, Canada, Japan, China, Singapore and so Vietnam can learn

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<sup>6</sup> <https://tuoitre.vn/9-cong-ty-bat-tay-thanh-lap-lien-minh-tai-che-bao-bi-viet-nam-20190621143616913.htm>.

<sup>7</sup> <http://vneconomy.vn/kinh-te-tuan-hoan-canh-cua-than-ky-dua-viet-nam-phat-trien-ben-vung-20190912174728576.htm>.

experience from these models.

From the business perspective, the circular economy is an inspiration that encourages businesses to invest in research and development (R&D) to introduce innovative technologies, thereby “incarnating” into new business models. The struggle is between business, investment and production on the one hand and environmental protection on the other. Perhaps the circular economy is a good solution, helping to resolve the above conflict because the pre-eminence of the circular economy is to both help businesses do business well, while move to a zero-emission economy and protect the environment. The circular economy also brings a new perspective on the relationships between markets, customers and natural resources, thereby promoting new innovative business models, breakthrough technologies to help businesses grow more rapidly through cost cutting, reducing energy consumption and CO<sub>2</sub> emissions, increasing supply chains and resources conservation. The circular economy is a distinguished business model, forcing companies to consider everything from design and manufacturing of products to their relationships with customers. One of the biggest differences is the role of the customer. The focus is no longer on consumption, but instead on using a function. This places different demands on the business community in building long term relationships in business models<sup>8</sup>.

#### **4.2 Challenges for Vietnam in the Implementation of Circular Economy**

While implementing a circular economy emphasizes opportunities and benefits, cost is a major challenge because waste has value, but recovering that value is complex and expensive. This is the biggest obstacle for Vietnam in implementing the circular economy model. The high rate of waste causes difficulties in management, collection and recycling of waste resources. The proportion of waste recycling in Vietnam is less than 10% of the total amount of waste. This is a small percentage compared to other countries where have been implementing the circular economy. Significant amounts of waste are being buried directly in landfills or discharged into the ocean. With 13 million tons of waste discharged into the sea each year, Vietnam ranks the 17th in the world and 5th in Asia for ocean plastic waste pollution, emitting more than 500,000 tons per year into the oceans (Thu Huong, 2019). This will be a burden on the environment.

In fact, the current economic system in Vietnam is moving towards the needs of a linear economy and has not yet well prepared the conditions about the legal basis, the infrastructure for the circular economy development, making it difficult to deploy new business models. When making economic decisions, priority is given to the market signals and does not pay attention to the positive or negative externalities of society and the environment. Therefore, it is important to rethink product formulation in the first place, minimize unnecessary resource usage, design products to last as long as possible, and plan to bring materials back to the economy later. Achieving this will require a large investment in the infrastructure of collection, sorting and recycling. The circular economy is the best way to break the longstanding relationship between economic growth and its negative environmental effects.

Moreover, secondary raw materials with good quality cannot compete with cheap raw materials. Business models under circular economy are more difficult to develop because most investors are still working on the linear economy logic. Demand for circular and alternative products remains small. There is a lack of qualified specialists with technical or information technology and communication knowledge. In addition, many companies still have goals and systems that focus on short-term value creation, while the circular economy model is the one that

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<sup>8</sup> More detailed summaries of the concept and principles can be found in the two reports Towards the Circular Economy 1 and 2, 2012 and 2013, Ellen MacArthur Foundation.



creates long-term value. The GDP index does not consider social and environmental factors, and does not encourage value creation in both of these areas.

### 4.3 Some Policy Implications for Vietnam to Implement a Circular Economy

The improvement of the legal and policy system to promote a circular economy in Vietnam in the next years is an urgent requirement to reduce dependence on natural resources, require companies to be responsible for waste from the products they create. It is necessary to build a database on the circular economy associated with the digital economy transformation and the fourth industrial revolution. Promoting cooperation and linkage to mobilize the participation of all stakeholders in the value chain is essential in building a circular economy in Vietnam. In which, the Government plays a leading and constructive role, along with the active participation of the private business sector and the support of civil society organizations and important partners such as the Chamber of Commerce and Industry, Ministry of Natural Resources and Environment and World Economic Forum. In addition, communication strategy should be enhanced to raise the producers' awareness of their responsibility for products they produce; it is necessary to propagate and educate to raise the public's awareness about classifying waste at the source to facilitate collection, recycling and reuse; encourage community to change consumption behavior towards environmentally friendly products.

## 5. Conclusion

Circulatory economy with its core is connecting points end to the beginning of the economic system, helping recovered materials are back into inputs of economic system, saving resources, saving costs for businesses, minimizing waste into the environment, is the choice of many countries around the world. The early steps of a circular economy in Vietnam have shown remarkable efforts of the Government, business community and citizens. The successful application of a circular economy model is expected to bring growth and development to enterprises, improve the quality of life of the community, and to be the key to Vietnam towards more sustainable development. However, increasing the circularity of the economy itself is not enough to solve the whole problem, but needs to be combined with many other factors such as changing thinking about growth, reducing demand, improving technology.

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