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Linear or Circular Economy: A Review of Theories, Practices, and Policy Recommendations for Vietnam

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Abstract

The traditional linear economy has created unstainable development. A circular economy (CE) is considered as a crucial means and has been adapted by many governments to achieve sustainable development goals. By narrative literature review, this article aims to discuss the concepts of linear and circular economies and CE models, examine countries' CE development experiences, and make recommendations for successfully adapting a CE. The findings show that a CE is different from a linear one in terms of the step plan, focus, system boundaries, reuse, and business models. The CE model includes slowing and closing resource loops and a narrowing of resource flows and is based on the foundation of renewable and non-toxic resources as well as through long-lasting design, and reducing, maintaining, repairing, reusing, remanufacturing, refurbishing, recovering, and recycling. Many countries around the world have adapted a CE model with different circularity levels with the main focus to reduce waste. The paper also recommends that a CE should be percieved as the central point of socio-economic development programs and policies that must address the full cycle, from product design to production processes, consumption, and recycling rather than having only a waste reduction focus. Producers should use a CE framework as the basis for product design, manufacturing, and recycling strategies. Consumers should change their perception of CE and adjust their behaviors towards making decisions to buy and consume toward circularity. Also, there is a need to change the perceptions of policy makers and other stakeholders on the CE concepts and framework.

Keywords

Circular economy, linear economy, theory, experiences, policy recommendations

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Introduction

The current economic system is based on a traditional form of production called "linear economy". In this system, all production

units make products, then consumers use and dispose the products. Material flow is understood as the conceptual logic of value creation in which only virgin materials enter the beginning of the value chain (Ellen MacArthur Foundation, 2012). This linear thinking has dominated since the beginning of the third industrial revolution, and it has led to growth and prosperity in many parts of the world (Jorgensen & Pedersen, 2018). According to Kharas (2010), the linear economy is threatened by several factors which cause serious environmental damage including irrational waste and scarcity of resources (land, water, and energy). Since the world population surpassed 8 billion in late 2022, the challenge of expanding supply to meet increasing demand has become unprecedented and the demand for use of natural resources continues to increase. At the same time, the use of finite spaces in the capacity to assimilate pollution generated by the linear economy has also increased (Spangenberg *et. al*., 2010). Several scholars have suggested that high resource scarcity, increased emissions, solid waste, climate changes, and other environmental problems have been caused by the limitations of the traditional linear economy (Kharas, 2010; Spangenberg *et al.*, 2010; Jorgensen & Pedersen, 2018).

In order to diminish the impact of economic development on the natural environment, producers must find solutions from design to production and consumption in ways that allow continuous reuse of resources. Recognizing the fundamental role played by the environment, its functions, and its interactions within the economic system, a circular economy (CE) has been considered as a solution. A CE incorporates a regenerative system that minimizes the entry and waste of resources, emissions, and the expenditure of energy through slowing down, closing, and straightening material and energy circuits (Geissdoerfer *et al.*, 2017).

Circular energy socio-economic development strategies have been adapted by many governments around the world in attempts to respond to the challenges of resource scarcity, environmental impacts, and socio-economic benefits. In recent years, a number of countries such as Sweden, the Netherlands, France, Germany, Canada, the United States, China, Japan, South Korea, and Singapore have begun strongly transitioning to circular economies (Trang Nguyen, 2022).

Based on information of CE implementation collected from 20 countries, Ghosh (2020) proposed four groups of countries as follows: (1) Those that have formed a fully developed society in the direction of a circular economy and have achieved a high level of CE implementation (Germany, Norway, and the United Kingdom); (2) The countries where social progress has been carried out towards a CE (Canada and China). These countries have developed CE for a long time but with limited results; (3) The third group countries have initiated a CE with a number of specific actions and strategies (Bhutan and Vietnam). Similar to Bhutan, Vietnam has encouraged reduction and utilization of resource consumption in many sectors of the economy; and (4) The forth group includes other countries where the early stages of implementing CE have been carried out.

In analyzing these situations, two questions arise: (i) How do different actors (academics, policy makers, and practitioners) perceive the meaning and principles of CE? and (ii) How do policy makers adapt the CE principles in designing and implementing their economic policies? This article aims to review the concepts and differences between linear and circular economies; discuss the characteristics of a circular economy model as well as to review the CE experiences from different countries; and make policy recommendations for successfully adapting and implementing a circular economy in Vietnam.

To achieve the purposes stated by this work, a qualitative study was conducted by employing a narrative literature review using the most recent and relevant articles to obtain knowledge about the related themes that have been indexed in Google Scholar, Science Direct, and the Web of Science. Except for 7 books which were published before 2008, all articles, policies and action plans have collected from 2008 to 2023. In analyzing and comparing the ways in which different academics have captured, investigated,

and argued about circular economy, the keywords relating to the topic were defined first, and then the main contents of each article (definitions, characteristics, advantages, and limitations of linear and circular economies) from the search would be outlined. Among the 150 articles and documents collected (mostly suggested by Kirchher *et al*., 2017), 58 articles and documents (of which 44 were academic articles and books, 8 were documents from practitioners, 3 were newspapers, and 3 were from policy makers) were selected for review.

The Linear Economy and Circular Economy

Linear Economy: Characteristics and Limitations

The traditional economy has been seen as a model in which raw materials are collected and transformed into products that consumers use until discarding them as waste, with inadequate concern for their ecological footprint and consequences. This is called a linear economy because the model transforms resources into wastes linearly. There are many definitions of linear economy (IGI Global, 2022). Although expressed in different ways, the definitions of linear economy have a common view in that a linear economy starts with the extraction of resources as inputs for all economic sectors, then products are produced and consumed, and finally the products are disposed of as waste as shown in **Figure 1**. In the current economic model, raw materials were taken from the earth, used to make products to sell and use, and once these products have reached the end of their useful life, they are disposed.

In a linear economy, a process of transforming resources to waste inevitably leads to resource scarcity and degradation, and environment pollution. At the disposal stage, much of waste ends up in landfills or incinerators. This system cannot work in a long term because the resources on planet are finite. A linear economy results in unavoidable environmental and human health impacts, inefficient use of natural resources, and an over-dependency on resources from outside each nation (Peter *et al.*, 2017). Every year, people dump a massive 2.12 billion tons of waste, including electronic waste, hazardous chemical waste, waste from ship-breaking, persistent organic pollutants, and the global waste trade (The World Account, 2023). Both developed and developing countries face a number of problems related to waste, including the high generation of waste, difficulty in finding new waste treatment facilities, and an increase in illegal dumping (Zenbird, 2023). Developed countries continue to be the biggest contributors to the problem, but developing countries are rapidly catching up (TCO certified, 2023; The World Account, 2023). Most waste materials are being disposed of in landfills, which creates multidimensional impacts. Firstly, it means valuable materials are being buried. This is not only wasteful but also has additional negative environmental effects. Secondly, it means more of raw materials must be extracted from the earth, and more energy and water must be used to make new materials and products. Thirdly, it encourages a culture of consumption where the value of materials is insufficiently recognized at their end-of-life (Taylor, 2020). The linear economy has an ecological disadvantage as it creates excessive pressure on ecosystems and jeopardizes the provision of essential ecosystem services, such as water, air, and soil cleaning (Michelini *et al.*, 2017).

Circular economy: Definition and principles

Definition of circular economy

The Ellen MacArthur Foundation (2015) estimated that the waste produced annually will reach 2.59 billion tons by 2030 and that the total will surge to 3.4 billion tons worldwide by 2050.

Figure 1. A model of a Linear Economy

Agenda 2030 of the Sustainable Development Goals identified three dimensions of sustainable development, namely economic, social, and environmental, and highlighted the importance of the management of natural resources (United Nations, 2015). Recognizing the fundamental roles played by the environment, its functions, and its interactions with the economic system, CE has emerged as a crucial solution.

The concept of CE has been gaining momentum since the late 1970s (Ellen MacArthur Foundation EMF, 2012). However, its definition is not static but contested (Korhonen *et al.*, 2018), its principles and proposals have changed over time according to different schools of thought. Andersen (2006), Ghisellini *et al.* (2016), and Su *et al.* (2013) attributed the concept to Pearce and Turner (1990). By describing how natural resources influence the economy by providing inputs for production and consumption as well as serving as a sink for outputs in the form of waste, they investigated the linear and open-ended characteristics of contemporary economic systems. This was influenced by the work of Boulding (1966), which described Earth as a closed and circular system with limited assimilative capacity, and the authors inferred from this that the economy and the environment should coexist in equilibrium.

The contemporary understanding of a CE and its practical applications to economic systems and industrial processes has evolved to incorporate different features and contributions from a variety of concepts that share the idea of closed loops. Some of the most relevant theoretical influences are cradle-to-cradle (McDonough & Braungart, 2002), laws of ecology (Commoner, 1971), looped and performance economy (Stahel, 2010), regenerative design (Lyle, 1994), industrial ecology (Graedel & Allenby, 1995), biomimicry (Benyus, 2002), and the blue economy (Pauli, 2010).

The most renowned definition has been framed by the Ellen MacArthur Foundation (2012), which introduced the CE as "an industrial economy that is restorative or regenerative by intention and design". Similarly, Geng & Doberstein (2008), described the CE as the realization of a closed-loop material flow in the whole economic system. Webster (2015) added that a CE is one that is restorative by design, and which aims to keep products, components, and materials at their highest utility and value at all times. Accordingly, Yuan *et al.* (2008) stated that at the core of a CE is the circular (closed) flow of materials and the use of raw materials and energy through multiple phases. Bocken *et al.* (2016) categorized the characteristics of the CE by defining it as design and business model strategies that are slowing, closing, and narrowing resource loops.

Based on different contributions mentioned above, Geissdoerfer *et al.* (2017) defined CE as a regenerative system in which resource input and waste, emissions, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.

In short, the existing definitions of circular economy found in the literature are highly diverse with over 100 definitions (Tan & Lamers, 2021). These can be categorized into two lines of thought: based on EMF's definition or based on other researchers' descriptions. In the EMF's view, a circular economic model aims to create economic, natural, and social capital based on three core principles: (1) Eliminate waste and pollution; (2) Circulate products and materials at their highest, keeping materials in use, either as a product or, when it can no longer be used, as components or raw materials. This way, nothing becomes waste and the intrinsic value of products and materials are retained; and (3) Regenerate natural systems by moving from a linear economy to a circular economy, supporting natural processes and leaving more room for nature to thrive.

Principles of circular economy

Based on the aforementioned definitions, a CE model principally consists of a resource foundation and loops. The resource foundation

contains renewable and non-toxic resources. The model includes slowing, narrowing, and closing of the resource loops based on the foundation of renewable and non-toxic resources as well as through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling (Bocken *et al.*, 2016). The resource loops consist of the following (**Figure 2**), in which s*lowing resource loops* can be reached through the design of long-life goods and product-life extension, the utilization period of products is extended and/or intensified; *narrowing resource flows* aimed at reducing resource use and/or using materials that are more renewable and with less negative environmental impacts; and *closing resource loops* means reusing materials from post-use goods via recycling.

Furthermore, Boon & Anuga (2020) proposed a circular model with a 6R framework: rethink, refuse, reduce, reuse, recover, and repair. Rethink relates to current lifestyles and the way we design and make products. Refuse refers to not buying materials and products that are unsustainable. Repair implies repairing a product to enable it to be continuously used instead of throwing it away. Jacqueline (2020) recommended a 9R framework showing the priority of each level of circularity as shown in **Table 1**.

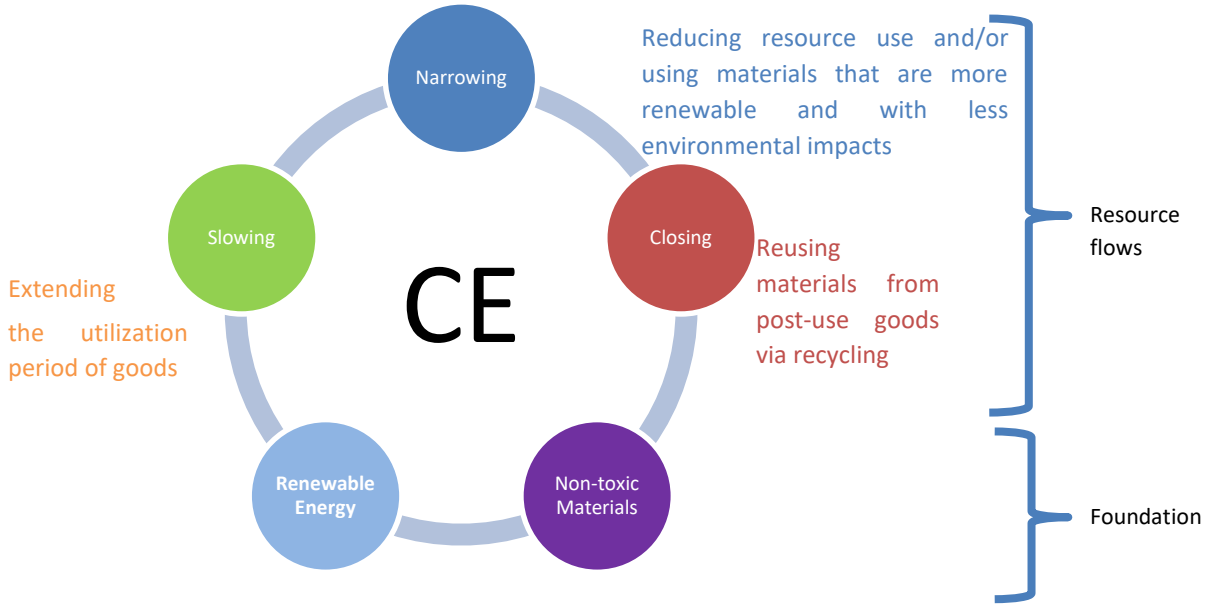

Figure 2. Basic model of a circular economy (Modified from Bocken *et al.*, 2016)

Table 1. Levels of circularity - 9Rs

Level of priority	Circularity
High	**1. Refuse**: Prevent the use of resources
	2. Reduce: Decrease the use of resources
	3. Reuse: Find new product uses (second hand)
	4. Repair: Maintain and repair
	5. Refurbish: Improve products
	6. Remanufacture: Create new products from second hand products
	7. **Repurpose**: Reuse products for different purposes
Low	**8. Recycle**: Reuse the raw materials of products
	9. **Recover**: Recover energy from waste

Source: Jacqueline (2020)

Although the framework in **Table 1** includes the above mentioned model and shows the levels of priority, it does not reflect clearly the full cycle and process of resource use decision-making in production and consumption. With the views of minimizing the consumption of natural resources and maximizing the use of waste materials, by combining the aforementioned frameworks, it is recommended that a broad circularity include a 10Rs framework: rethink, repurpose, refuse, reduce, reuse, repair, refurbish, remanufacture, recycle, and recover. The first 3Rs (rethink, repurpose, and refuse) must be first practiced so that the remaining 7Rs can be realized (**Table 2**).

It should be mentioned that levels of priorities from high to low should not be a right triangle as recommended by Jacqueline Cramer (2020) but be a trapezium shape as shown in **Table 2** with considerable level of resource recovering. The main focus of the circular economy appears to be on economic prosperity, followed by environment quality, while the social aspect of sustainability (i.e., human well-being) is rarely explored. The desired outcome of the circular economy transition is to overcome the current production and consumption model based on continuous growth, and increasing resource throughput by decoupling economic growth from environmental pressure (Ghisellini *et al.*, 2016).

Practitioners may view that the circular economy is a concept based on one simple rule: The more material is kept in circulation, the better. However, the mere fact that materials are circulated does not necessarily equate to greater sustainability. Nevertheless, practitioners often cite the quest for sustainable development as an argument in favor of a CE. If people want CE to deliver its promises, industry and policy practitioners must assess sustainability aspects before implementing CE activities. When sustainability aspects are taken into account, a transition towards a CE can be ensured (Blum *et al.*, 2020).

Circular economy versus linear economy

In recent years, CE has gained significant momentum in response to the wasteful linear system. In order to explain and evaluate the CE's importance, the simplest analogy is with the linear economy. As presented in a previous section, a linear economy is mainly based on the simplest principle of "*take-make-dispose*", whereas a CE tries to keep something in use as much as possible that has been produced through repair and recycled in order to be able to take the cycle from the beginning, preventing the production of a large amount of waste.

As a result, CE works in a far smoother and more sustainable way. CE focused on maintaining the added value of materials while

Table 2. Recommended levels of circularity and priority - 10Rs

Level of priority	Circularity
High	**1. Rethink**: change current lifestyles, strategies, policies, and the way products were designed, made, and used to meet the needs of a CE
	2. Repurpose: use products for multiple purposes
	3. Refuse: don't use toxic materials and non-renewable resources in the design, make, and consumption of products
	4. Reduce: decrease resources in production and consumption, generating value while decreasing environmental impact
	5. Reuse: find new product uses (second hand products)
	6. Repair: maintain and repair products to avoid wasting
	7. Refurbish: improve products that bring more value and decrease environmental impacts
	8. Remanufacture: create new products from second hand products
	9. Recycle: process waste materials into products or reuse the raw materials of products
Low	**10. Recover**: recover energy from waste, recovering eco-systems and resources

Source: Modified from Jacqueline (2020)

eliminating waste as best as possible. CE considers products as resources (Afteni *et al.*, 2021). **Table 3** shows the fundamental differences between a linear economy and CE in terms of step plan, focus, system boundaries, reuse, business models, and treatment of products that have reached the end of their life.

A linear economy traditionally follows a step-by-step plan, with short-term system boundaries from product purchase to sales, down cycling, and/or low-grade cycling, leading to products that have reached the end of their life becoming invaluable and wastes. Whereas, a CE pursues principally the 3R approach of reduce, reuse, and recycle with long-term system boundaries consisting of multiple life cycles and high-grade cycling, leading to products that have reached the end of their life still being valuable for next use. Reduce means resource use is minimized, reuse means products and parts are maximized, and recycling implies raw materials are reused to a high standard. In a circular system, value is created by focusing on value preservation. In a linear economy, we mine raw materials that we process into a product that will be thrown away after use. A CE closes the cycles of all these raw materials with an upcycling approach. Closing these cycles requires much more than just recycling. It changes the way in which value is created and preserved, in how production is made more sustainable, and in which business models are used so that sustainable development goals are achieved. It should be mentioned that a circular economy differs from a green economy. A green economy aims at reducing carbon emissions and pollution, enhancing energy and resource efficiency, and preventing biodiversity loss (United Nations Environmental Program, 2023). A circular economy includes a green economy and is broader in terms of scope and objectives.

Experiences in Transition to a Circular Economy

The CE concepts and its principles serve as a foundation for designing policies at national, regional, and company levels (Christensen & Hauggaard, 2020). At the national (macro) level, CE is considered as a central point of socio-economic development policies as well as laws and regulations. At the regional (meso) level, the CE framework is used for the creation of closed-loop production and consumption systems. At the company (micro) level, this framework is used as a basis for the formulation of corporate product design and recycling strategies. For transitioning from a linear economy to a CE, Lieder & Rashid (2016) suggested a simultaneous approach that operates from the top-down in public institutions and from the bottom-up in industry. This section highlights various experiences at the national level in CE development strategies and performance.

According to Kirchher *et al.* (2017), government initiatives of CE have mainly come from developed countries in which the increasing flows of waste materials back to industry through recycling programs to close the materials loop have been addressed. Sweden, Germany, and Japan have often been cited as countries that have pushed legislation towards waste reduction and recycling programs. Ekins *et al.* (2019) showed a number of countries (China, Finland, France, the Netherlands, and Germany) have introduced CE

Table 3. The differences between a linear and a circular economy

Criteria	Linear economy	Circular economy
1. Step plan	Take - make - use - dispose	Reduce - reuse - recycle
2. Focus	Eco-efficiency	Eco-effectivity
3. System boundaries	Short term, from purchase to sales	Long term, multiple life cycles
4. Reuse	Down cycling, low grade recycling	Upcycling, cascading, and high grade recycling
5. Business model	Focuses on products	Focuses on services
6. Products reached the end of its life	Invaluable and wastes	Valuable as next use resources

Source: Modified from Kenniskaarten (2022)

roadmaps, whereas some others have introduced strategies with a similar intent but under other names.

China

China is widely seen as a leader in CE (Bleischwitz *et al*., 2022). The CE concept emerged in China with its origins in cleaner production, industrial ecology, and ecological modernization thinking. The central Chinese government formally accepted the concept of CE as a new development strategy in 2002 (Bleischwitz, 2019). China's main national level framework for pursuing a CE is the "Circular Economy Promotion Law" which came into force in 2009. Following this Law, a number of action plans have been issued in order to provide detailed guidelines for particular sectors and clarity on its implementation.

Lessons that can be learned from the Chinese case in CE development are its multilevel system and multidiscipline nature. In its planning-oriented policy system, China placed attention to three levels, namely: (1) micro, which largely equated to cleaner production in each firm; (2) meso, which was identified with many eco-industrial parks; and (3) macro, which involved region-wide CE thinking and planning at provincial levels and the country as a whole (Ghisellini *et al.,* 2016; Murray *et al*., 2017). For the multidisciplinary approach, China integrated CE principles into land-use planning. China's CE policy focused on environmentally sensitive spatial integration of residential, agricultural, and industrial activities rather than on a particular aspect.

Japan

Japan has paid much attention to promoting a circular economy in the country. In 2000, the Basic Act on Establishing a Circular Society was passed in Japan (Zenbird, 2023). This was the reaction to a number of problems related to waste in the late 1990s. These included the high generation of waste, difficulty in finding new waste treatment facilities, an increase in illegal dumping, and efforts in recycling. The law comes in twofold: (i) Dictating a move away from mass production, mass consumption, and mass disposal; and (ii) Guiding law implementing for individual waste and recycling.

In the enforcement of this law, a Plan of Establishing a Circular Society (with three main contents: a regional revitalization through a circulation system; the full circulation of the resources' life cycle; and the appropriate processing of waste) was formed by the Central Environmental Council in 2018. Along with this plan, "the Circular Economy Vision 2020" was announced to encourage digital transformation in Japan. Even though the implementation is relatively weak. Thus, in order to push CE as a business model, a stronger leadership need to be encouraged (Zenbird, 2023).

Japanese Ministry of the Environment launched the "Circular Economy Challenge" program as part of the Platform for Accelerating the Circular Economy (PACE) with aims at promoting and recognizing the efforts of businesses that carry out initiatives contributing to a CE. Japanese companies have begun recognizing the value of a CE and have started introducing new models like recycling, reducing, and up-cycling into their operations.

European Union (EU)

CE development is considered as a top priority in the EU (McDowall *et al.* 2017). In July 2014, the European Commission (EC) published the report "Towards a CE: A zero waste program for Europe" (European Commission, 2014) in order to establish a policy framework for a resource-efficient economy. The report addressed three main aspects: (i) "design out waste"; (ii) investing in green public procurement; and (iii) redefining waste policy and targets. The EC had also adopted a legislative proposal for revised waste policies that aimed to increase the CE in 2014. In differentiating from the Chinese approach, the EU, along with other countries, have adapted a bottom-up approach that emphasizes stakeholder involvement, including NGOs, civil society, and research community. The EC developed the CE Package including proposals for 2025 and 2030 targets for a range of waste streams under the EU Waste Framework, the Landfill, and the Packaging and Packaging Waste. This package was revised and

finally adopted in 2018. The revised package included an action plan for a CE (European Commission, 2015) that addresses the full cycle, from product design to production processes, consumption, waste management, and recycling. It was framed as a holistic macro-level strategy for economic growth and job creation, climate and energy, industrial innovation, and sustainable development (European Commission, 2015; Ellen MacArthur Foundation, 2014). Following this package, The EC adopted the new CE action plan (CEAP) in 2020. The EU's transition to a CE will reduce pressure on natural resources and will create sustainable growth. It is also a prerequisite to achieve the EU's 2050 climate neutrality target and to halt biodiversity loss. According to the European Commission (2021), the action plan includes legislative and non-legislative measures to make sustainable products the norm in the EU; empower consumers and public buyers; focus on the sectors that use the most resources and where the potential for circularity is high such as electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water, and nutrients; ensure less waste; make circularity work for people, regions, and cities; and lead global efforts on circular economy.

As a part of the European Union, all country members not only have complied with the EU's regulations, but have also issued and implemented policies themselves. For example, Sweden has a long history of promulgating policies on resource efficiency, producer responsibility, and other key circular economy aspects. However, Swedish public inquiry on circular economy was initiated for the first time in 2016 when the term was picked up in Swedish public policy making (Slunge *et al*., 2021). The inquiry discussed opportunities for a broader green tax reform and proposed specific instruments aiming to increase the utilization and reuse of consumer products, such as car-sharing rules and tax deductions for repair services.

A National Strategy on Circular Economy was published in July 2020 (Swedish Ministry of the Environment, 2020) and followed by an Action Plan in January 2021 (Swedish Ministry of the Environment, 2021). The CE strategy contributes to reaching the national environmental and climate targets as well as the global targets in Agenda 2030. The vision is to achieve a society where resources are used effectively in non-toxic, circular flows. The CE strategy and action plan is structured in four areas, namely: (i) products and product design; (ii) consumption and use; (iii) non-toxic and circular flows; and (iv) innovation and circular business models. Six material flows are prioritized: plastics, textiles, food, renewable and bio-based raw materials, the construction sector, and critical metals and minerals for innovation.

Relevant Policy Recommendations for Vietnam

After 30 years of renovation, Vietnam has become a middle-income country. However, the country also faces problems of a linear economy such as an increase in wastes. Solid wastes accounted for 25.5 million tons in 2018. More seriously, plastic, electronic, and construction wastes have increased very quickly. Plastic consumption per capita increased from 3.8 kg in 1990 to 41kg in 2019. Vietnam ranks as the fourth largest plastic waste-producing country (2.1 million tons per year) after China, Indonesia, and the Philippines (Jambeck *et al.*, 2015). The country is also projected to be a net energy importer of about 100 million tons of coal yearly by 2030.

In order to deal with these problems, the country started to move to a CE by enforcing Environmental Protection Law in 2020 and related regulations. The term of CE was first officially stated in the 2020 Environmental Protection Law. The government approved the Circular Economy Development Plan in Vietnam in 2022 to facilitate the adaption of CE in the country to obtain the objectives: (i) by 2030, the greenhouse gas emission rate in the GDP will be reduced by at least 14% as compared to 2014, then "net zero" by 2050; and (ii) by 2030, 50% of municipal solid wastes will be collected, standardly treated, and recycled in CE models, and 100% of organic wastes in the cities and 70% of that in rural areas will be recycled, minimizing

the amount placed in landfills. These policies state that a CE should be incorporated into industrial policies as well as strategy planning and project formulations and in product design (Government, 2022). The government has begun to encourage society to develop CE models as presented in **Table 4**. It can be said that the Vietnamese government has promulgated a number of policies and strategies for CE development in different sites and sectors. However, the legal regulations towards CE encouragement are scattered in many documents and are mainly focused on the aspects of environmental protection and the response to climate change. There are not any policies which clarify the CE indicators or how to provide support for enterprises, consumers, and institutions in applying CE principles. The CE concept and models are still not yet popular in Vietnam. Some existing models are still imperfect with low levels of circularity (Bui Van Huyen & Nguyen Ngoc Toan, 2021).

The aforementioned country experiences show that most countries have used the CE framework to formulate industrial policies and regulations to reduce waste, and a few countries have fully adapted a CE framework that addresses the full cycle, from product design to production processes, consumption, waste management, and recycling. Therefore, in order to promote the development of CE in Vietnam, we propose the four following policy recommendations, which were drawn from theoretical and practical reviews:

Firstly, *in the policy making stage*, a CE should be considered as the central point of the government's socio-economic development policies that aim at promoting CE processes, creating closed-loop production and consumption systems, and encouraging sustainable production and consumption, ensuring that waste is prevented and the resources used are kept for as long as possible. The CE policies should include a full CE cycle, from taking resources, product design to production processes, consumption, waste management, and recycling rather than only focusing on waste reduction.

Secondly, *in the implementation stage*, the CE framework needs to be considered in both the production and consumption sides. *For the production side*, the CE framework should be used as a basis for product design, and

Table 4. Appearance of regulations for the development of a circular economy in Vietnam, China, and Europe

Sectors	Vietnam	China	Europe
1. Production site			
Agriculture	X	X	
Processing industry		X	
Electricity, gas, air condition	X	X	X
Construction	X		X
2. Consumption site			
Government	X	X	X
Household & Individual	X	X	X
3. Waste management			
Solid waste	X		X
Sewage	X	X	X
4. National administration			
Technology	X	X	X
Finance		X	X
Mearuring indicators		X	X

Source: Nguyen Duy Thai (2020)

manufacturing and recycling strategies within the entire life cycle of products. In designing and producing products, business companies and other producers should rethink the way they design in order to meet society's CE needs, refuse to use toxic materials and non-renewable resources, reduce the use of resources in production, improve products that bring more value and have a decreasing environmental impact, recycle waste materials into new products, and recover energy from wastes, eco-systems and resources; *For the consumption side*, consumers should *rethink* how they make decisions to buy and use products to meet their demands, *use* products for multiple purposes, *refuse* to buy or use products produced from toxic or non-renewable resources, *reduce* their consumption generating value while decreasing their environmental impact, *reuse* secondhand products, *maintain and repair* products to avoid wasting and *recycle*.

Finally, for the whole society, there is a need to upgrade the knowledge and attitudes of policy makers and practitioners on the concepts and framework of a CE so that they can be able to comprehensively formulate and implement macro and industrial policies that address a full CE cycle from taking resources, to product design, to production, and to consumption. On other side, producers and consumers should be aware of the roles and framework of a CE so that they will take appropriate actions in product design, production, and consumption toward a CE.

Conclusions

The traditional linear economy has created high resource scarcity, increased solid waste and emissions, and has contributed to climate change and other environmental problems. A CE is considered as a solution for harmonizing human needs and environmental protection. CE is fundamentally different from a linear one in terms of the step plan, focus, system boundaries, reuse, and business models. The CE model includes slowing and closing resource loops, and a narrowing of resource flows, based on the foundation of renewable and non-toxic resources as well as through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling. The circularity in the model includes the 10 Rs principles of rethink, repurpose, refuse, reduce, reuse, repair, refurbish, remanufacture, recycle, and recover.

The adaption and implementation of a CE strongly depend on how decision makers and involved stakeholders perceive the meanings and approaches to CE. Many governments around the world have adapted CE models with different circularity levels. Most countries have formulated industrial policies and regulations for reducing waste. Particularly, in Vietnam, the 4 Rs principles, which are: rethink, refuse, reuse, and refurbish, have not been included in government policy documents or implemented by the private sector.

Therefore, in order to develop a CE in Vietnam, the CE framework should be considered as a central point of socio-economic development programs as well as government policies that must address the full cycle, from product design to production processes, consumption, post-use product management, and recycling. On the production side, the CE framework should be used as a basis for product design, and manufacturing and recycling strategies. Business companies should rethink product designs, refuse to use toxic and non-renewable resources, reduce the use of resources, improve products that bring more value, decrease environmental impacts, recycle, and recover energy. To encourage the private sector to apply the CE framework in production, the Vietnamese Government needs to review, amend, and supplement the current tax and fee system in order to determine appropriate tax rates (environmental protection tax, natural resource tax, special consumption tax, export-export tax, and environmental protection fees, etc.) for taxable goods to ensure consistency and transparency. On the consumption side, consumers should change their perception of CE and their behaviors in making decisions to buy and use products (*use* products for multiple purposes, *refuse* to buy or use products produced from toxic or non-renewable resources, *reduce* consumption while decreasing environmental impact, *reuse* secondhand products, and

maintain and repair products*)*. Furthermore, upgrading the knowledge and attitudes of policy makers and other stakeholders on the concepts and framework of CE are crucial for the successful development of CE.

References

Afteni C., Viorel P. & Mitica A. (2021). Study on the Transition from the Linear Economy to the Circular Economy. The Annals of "Dunărea De Jos" University of Galați Fascicle V, Technologies in Machine Building. DOI: 10.35219/tmb.2021.1.08.

Andersen M. S. (2006). An Introductory Note on the Environmental Economics of the Circular Economy. Journal of Sustainability Science. 2(1): 133-140. DOI: 10.1007/s11625-006-0013-6.

Benyus J. M. (2002). Biomimicry. Harper Perennial, New York.

Bleischwitz R. (2019). The Circular Economy in China. In: Ekins P., Domenech T., Drummond P., Bleischwitz R., Hughes N. & Lotti L. (Eds). The Circular Economy: What, Why, How and Where. Background paper for an OECD/EC Workshop on July 5, 2019 within the workshop series "Managing environmental and energy transitions for regions and cities". Paris.

Bleischwitz R., Yang M., Huang B., XU X., Zhou J., McDowall W., Andrews-Speed P., Liu Z. & Yong G. (2022). The circular economy in China: Achievements, challenges and potential implications for decarbonisation. Resources, Conservation and Recycling. 183(2022): 1-11. DOI: 10.1016/j.resconrec.2022.106350.

Blum N. U., Haupt M. & Benin C. R. (2020). Why "Circular" doesn't always mean "Sustainable". Resources, Conservation and Recycling. 162 (2020): 1-3. Retrieved from https://doi.org/10.1016/j.resconrec.2020.105042 on February 27, 2023.

Bocken N. M. P., de Pauw I. C., Bakker C.A. & van der Grinten B. (2016). Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering. 33(5): 308-320. DOI: 10.1080/21681015.2016.1172124.

Boulding K. E. (1966). The economics of the coming Spaceship Earth. In: Jarrett H. (Ed). Environmental Quality in a Growing Economy. Baltimore: Johns Hopkins University Press: 3-14.

Bui Van Huyen & Nguyen Ngoc Toan (2021). Development of circular economy in Vietnam at present. Retrieved from https://mof.gov.vn/webcenter/portal/vclvcstc/pages_r/l/chi-tiet-tin?dDocName=MOFUCM188376 on February 27, 2023 (in Vietnamese).

Ghosh S. K. (2020). Circular Economy: Global Perspective. Springer Singapore. DOI: 10.1007/978-981-15-1052-6_16.

Government (2022). Decision No. 687/QD-TTg of Priminister on approval of Circular Economy Development Plan in Vietnam on June 7, 2022. Retrieved from https://vanban.chinhphu.vn/?pageid=27160&docid=205921 on March 3, 2023.

Christensen T. B. & Hauggaard-Nielsen H. (2020). Circular Economy: Practices, knowledge bases and novelty. Journal of Transdisciplinary Environmental Studies. 18(1): 2-16. Retrieved from https://rucforsk.ruc.dk/ws/portalfiles/portal/75152371/20201016_Christensen_Hauggard_Nielsen_TES_18_1_FINAL_3.pdf on March 5, 2023.

Commoner B. (1971). The Closing Circle: Nature, Man, and Technology. Random House, New York.

Ekins P., Domenech T., Drummond P., Bleischwitz R., Hughes N. & Lotti L. (2019). "The Circular Economy: What, Why, How and Where", Background paper for an OECD/EC Workshop on 5 July 2019 within the workshop series "Managing environmental and energy transitions for regions and cities", Paris.

Ellen MacArthur Foundation (2012). Towards the Circular Economy (Vol. 1). Cowes, Isle of Wight.

Ellen MacArthur Foundation (2014). Towards the Circular Economy: Economic and Business Rationale for an Accelerated Transition. Retrieved from https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf on February 23, 2023.

Ellen MacArthur Foundation (2015). Growth within: A Circular Economy Vision for a Competitive Europe. Ellen MacArthur Foundation, Isle of Wight, UK.

Boon E. K. & Anuga S.W. (2020). Circular Economy and Its Relevance for Improving Food and Nutrition Security in Sub-Saharan Africa: the Case of Ghana. Materials Circular Economy. 2(5): 1-14. DOI: 10.1007/s42824-020-00005-z.

European Commission (2014). Communication from the Commission to the European Parliament, The Council, the European Economic and Social Committee and the Committee of the Regions - Towards a circular economy: A zero waste programme for Europe, COM(2014) 398 final/2, Brussels, Belgium.

European Commission (2015). Commission work programme – key documents. Retrieved from https://ec.europa.eu/info/publications/work-programmecommission-key-documents-2015_en on March 2, 2020.

European Commission (2021). Circular economy action plan: The European Green Deal. Retrieved from https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en on March 3, 2023.

Geissdoerfer M., Savaget P., Bocken N. M. P. & Hultink E. J. (2017). The circular economy – A new sustainability paradigm? Journal of Cleaner Production. 143: 757-768. DOI: 10.1016/j.jclepro.2016.12.048.

Geng Y. & Doberstein B. (2008). Developing the circular economy in China: Challenges and opportunities for achieving "leapfrog development." International Journal Sustainable Development and World Ecology. 15: 231-239.

Ghisellini P., Cialani C. & Ulgiati S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner Production. 114:11-32. Retrieved from http://dx.doi.org/10.1016/j.jclepro.2015.09.007 on March 3, 2023.

Graedel T. E. & Allenby B. R. (1995). Industrial Ecology. Prentice Hall, Englewood Cliffs: 412 pages.

IGI Global (2022). What is linear economy. Retrieved from https://www.igi-global.com/dictionary/operationalization-of-circular-economy/75076 on November 22, 2022.

Jacqueline C. (2020). Moving towards a circular economy in the Netherlands: challenges and Directions. Utrecht Sustainability Institute.

Jambeck J. R., Geyer R., Wilcox C., Siegler T. R., Perryman M., Andrady A., Law K. L. (2015). Plastic waste inputs from land into the ocean. Science. 347(6223): 768-771. DOI: 10.1126/science.1260352.

Jorgensen S. & Pedersen L. (2018). RESTART Sustainable Business Model Innovation. DOI: 10.1007/978-3-319-91971-3.

Kenniskaarten (2022). How-is-a-circular-economy-different-from-a-linear-economy? Retrieved from https://kenniskaarten.hetgroenebrein.nl/en/knowledge-map-circular-economy/how-is-a-circular-economy-different-from-a-linear-economy on November 30, 2022.

Kharas H. (2010). "The emerging middle class in developing countries," OECD Development Centre Working Paper No. 285. Retrieved from https://www.oecd.org/development/pgd/44457738.pdf on March 2, 2023.

Kirchherr J., Denise R. & Marko H. (2017). "Conceptualizing the circular economy: an analysis of 114 definitions". Resources, Conservation and Recycling. 127(04): 221-232. DOI: 10.1016/j.resconrec.2017.09.005.

Korhonen J., Nuur C., Feldmann A. & Birkie S. E. (2018). Circular economy as an essentially contested concept. Journal of Clean Production. 175: 544-552. DOI: 10.1016/j.jclepro.2017.12.111.

Taylor L. (2020). What is the linear economy and why do we need to go circular? Retrieved from https://planetark.org/newsroom/news/what-is-the-linear-economy-and-why-do-we-need-to-go-circular on December 12, 2022.

Lieder M. & Rashid A. (2016). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. Journal of Clean Production. 115: 36-51. DOI: 10.1016/j.jclepro.2015.12.042.

Lyle J. T. (1994). Regenerative design for sustainable development. John Wiley & Sons, New York.

McDonough W. & Braungart M. (2002). Cradle to cradle: Remaking the way we make things. North Point Press, New York.

McDowall W., Geng Y., Huang B., Bartekov E., Bleischwitz R., Türkeli S., Kemp R. & Domenec T. (2017). Circular Economy Policies in China and Europe. Journal of Industrial Ecology. 21(3): 651-661. DOI: 10.1111/jiec.12597.

Michelini G., Moraes R. N., Cunha R. N., Costa J. M. H. & Ometto A. R. (2017). From Linear to Circular Economy: PSS Conducting the Transition. Procedia CIRP. 64: 2-6. Retrieved from DOI: 10.1016/j.procir.2017.03.012 on December 12, 2022.

Murray A., Skene K. & Haynes K. (2017). The circular economy: an interdisciplinary exploration of the concept and application in a global context. Journal of Business Ethics. 140: 369-380. Retrieved from https://www.jstor.org/stable/44164300 on May 7, 2023.

Nguyen Duy Thai (2020). Policies for circular economy development in Vietnam. Retrieved from https://congnghiepmoitruong.vn/stores/customer_file/nguyenduythai/012022/05/3._Kinh_tY_tuYn_hoan_Y_VN.pdf on May 9, 2023.

Pauli G. A. (2010). The blue economy: 10 years, 100 innovations, 100 million jobs. Paradigm Publications, Taos, NM.

Pearce D. W. & Turner R. K. (1990). Economics of Natural Resources and the Environment, Hemel Hempstead: Harvester Wheatsheaf.

Peter L., Edward S., Olivia B., Harry S., Nia B., Lucie P., Pernilla S., Henning W. & Meghan O. (2017). Towards a circular economy - Waste management in the EU Science and Technology Options Assessment, European Parliamentary Research Service, Scientific Foresight Unit (STOA), PE 581.913.

Slunge D., Andersson I., Wikström P. & Sterner T. (2021). Circular Economy – a Conceptual Review and Analysis of Implications for Swedish Development Cooperation, EBA Working Paper. May 2021. Expert Group for Aid Studies (EBA), Sweden.

Spangenberg J. H., Fuad-Luke A. & Blincoe K. (2010). Design for Sustainability (DfS): the interface of sustainable production and consumption. Journal of Cleaner Production, 18(15): 1485-1493. DOI: 10.1016/j.jclepro.2010.06.002.

Stahel W. R. (2013). Policy for material efficiency - sustainable taxation as a departure from the throwaway society. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences. 371(1986). DOI: 10.1098/rsta.2011.0567.

Stahel W. R. (2010). The performance economy. Palgrave Macmillan, Basingstoke, New York.

Su B., Heshmati A., Geng Y. & Yu X. (2013). A review of the circular economy in China: moving from rhetoric to implementation. Journal of Cleaner Production. 42(2013): 215-227. DOI: 10.1016/j.jclepro.2012.11.020.

Tan ECD & Lamers P. (2021). Circular Bioeconomy Concepts — A Perspective. Frontiers in Sustainability. 2: 701509. DOI: 10.3389/frsus.2021.70150.

TCO certified (2023). E-waste — a toxic waste stream where valuable finite resources are lost. Retrieved from https://tcocertified.com/e-waste on February 27, 2023.

Trang Nguyen (2022). Outstanding circular economy models in the world. Journal of Finance. Retrieved from https://tapchitaichinh.vn/nhung-mo-hinh-kinh-te-tuan-hoan-noi-bat-tren-the-gioi.html on May 8, 2023 (in Vietnamese).

The World Account (2023). A World Waste. Retrieved from https://www.theworldcounts.com/challenges/planet-earth/state-of-the-planet/world-waste-facts on February 27, 2023.

United Nations (2015). Transforming our world: The 2030 Agenda for Sustainable Development. Retrieved from https://sustainabledevelopment.un.org/post2015/transformingourworld/publication, on February 22, 2023.

United Nations Environmental Program (UNEP) (2023). Green Economy. Retrieved from https://www.unep.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/green-economy on March 12, 2023.

Webster K. (2015). The Circular Economy: A Wealth of Flows. Ellen MacArthur Foundation, Isle of Wight.

Yuan Z., Bi J. & Moriguichi Y. (2008). The Circular Economy: A New Development Strategy in China. Journal Industrial Ecology. 10 (1-2): 4-8. DOI: 10.1162/108819806775545321.

Zenbird (2023). Circular Economy in Japan, Retrieved from https://zenbird.media/circular-economy-in-japan on February 22, 2023.