

## Plastic Product Consumption in Selected Countries and Vietnam

### Author's Details:

<sup>(1)</sup>Thi Chuyen Hoang <sup>(2)</sup>Thi Thuy Linh Tran <sup>(3)</sup>Hieu Thao Hoang  
<sup>(1)(2)(3)</sup> University of Economics - Technology for Industries, Vietnam

**Correspondence:** Thi Chuyen Hoang, 456 Minh Khai, Hai Ba Trung, Ha Noi

### Abstract:

*The goal of this article is to analyze the current situation of consumption of plastic products in countries in the world and in Vietnam. From the situation of countries around the world, we give lessons for Vietnam. At the same time, we also make recommendations for the use of smart plastic products and to minimize negative impacts on the earth's habitat*

**Key words:** Circular economy, plastic products, Vietnam

### 1. Introduction

In recent years, due to its convenience and low cost, plastic items are increasingly used in daily life, especially disposable plastic items such as plastic bags and bottles. plastic jars, boxes ... Therefore, the amount of plastic waste discharged into the environment is also increasing. According to estimates of the United Nations, each year, the world produces more than 400 million tons of plastic, most of which are plastic bags. Each year, about 1 to 5 trillion plastic bags are consumed globally, corresponding to the consumption of nearly 10 million plastic bags every minute of the world. If the current consumption of plastic products continues and waste management is not improved, by 2050 it is estimated that there will be about 12 billion tons of plastic waste in landfills. in the natural environment, of which notably half are emitted from Asian countries.

In Vietnam, according to statistics, each household uses about 1 kg of plastic bags per month, particularly in the two big cities, Hanoi and Ho Chi Minh City. In Ho Chi Minh City, on average, each day discharges into the environment about 80 tons of plastic and plastic.

With difficult decomposition properties, plastic and plastic waste, especially plastic bags, have a long decomposition time. Products from plastic in the process of decomposition will be decomposed into microscopic plastic pieces, along with microplastic particles (microplastics) will mix into the water source, go into the food cycle, directly affecting health. human. Burned plastic waste will produce dioxins and furans, which are very toxic substances, lasting in the environment for a long time. Therefore, the amount of plastic waste increases rapidly year by year, which is a huge burden on the environment and to human health. The problem of plastic waste, therefore, has become increasingly painful in many countries around the world in general and in Vietnam in particular.

### 2. The status of plastic product consumption in the world

The significant increase in plastics consumption is also observed in other regions of the world. For example, rapid industrialization and economic development in Singapore have caused a tremendous increase in solid waste generation. The yearly disposed solid waste increased from 0.74 million tonnes in 1972 to 2.80 million tonnes in 2000. It is estimated that solid waste generation in Singapore has amounted to about 4.5–4.8 million tonnes per year. Plastics accounts for 5.8% of the total solid waste, positioning himself at the third position after food waste (38.3%) and paper/cardboard (20.60%). Taking into account that plastic bags and bottles have become one of the major solid waste stream, using waste plastics to manufacture polymer concrete and developing biodegradable plastics have received much attention in recent years.

In Australia, the annual plastics consumption has increased from 1,336,386 in 1997 to 1,476,690 tonnes in 2011–2, whereas the total recycling rate of plastics has increased from 7.0% to 20.5%. A total of 302,635 tonnes of plastics were sent for recycling, either locally or via export in 2011–2012.

In China, along with urbanization, population growth and industrialization, the quantity of municipal solid waste generation has been increasing rapidly. MSW generation in China has increased rapidly in the past 30 years, from 31,320 thousand tons in 1980 to 178,602 thousand tons in 2014, with an annual average growth rate (AAGR) of 5.5% [10]. As well as MSW generation in 2014 is 5.7 times than that in 1980. A slight decline is observed during the five consecutive years of 2006–10, which could be attributed to the revision of the ‘Law on Solid Waste’ in 2004. MSW generation per capita increased rapidly until the early 1990s. After that, the MSW generation per capita showed an unsteadily decline from 913.0 to 653.2 g/per/day during between 1994 and to 2014. It was explained that the rate of urban population is increasing faster than the rate of MSW generation.

### **2.1. Asian countries**

Collection and management of MSW in Asian countries are part of the problems whose solution has always rallied around sustainability based on the implementation of the 3Rs (reduction, reuse and recycling) technologies. Solid waste generated in Asian countries has risen to almost an equal amount to those generated in the developed countries at 0.7–0.8 kg/person/day.

Municipal solid waste management constitutes one of the most crucial health and environmental problems facing countries in the Arabian Gulf. It is estimated that 120 million tons of waste is produced per year in Gulf Cooperation Council states, of which little is recycled or even managed; 60% is from Saudi Arabia, 20% from the United Arab Emirates.

(UAE) and the rest is from Kuwait, Qatar, Oman and Bahrain. According to Qatar MSW organization, Qatar reached 1,000,000 tons of solid municipal waste annually corresponding to a daily solid waste of about 3,000 tons/day. About 60% of MSW is organic material. Polymers account for about 14% of the total waste volume (5% by weight) produced by the municipal sector. Only 1–2% of this is being recycled, while the amount of polymers waste is expected to increase to 50% by the year 2020 from 2009 waste tonnage figure of 1,900 tons.

Environmental problems including disposal of municipal solid waste are recognized in Korea due to its limited carrying capacity. The population in Korea is 481 people per km<sup>2</sup>, ranking the third-highest in the world. In Korea, the total MSW per person per day changed from 2.3 kg per day per person in 1991 to 1.04 kg per day per person in 2008. In 1995, the Korean government implemented a volume- based waste fee system (unit pricing system) that required every household to purchase certified plastic bags for waste disposal.

In Japan a detailed analysis of the composition of household waste was carried out for more than 30 years in Kyoto city. It was reported that packaging waste accounted for 60% more than other household waste in volume ratio, and this pointed out that measures to deal with packaging waste were vital to reduce household waste.

### **2.2. Africa**

The per capita plastic consumption in Africa in 2015 was 16 kg for a population of 1.22 billion. Based on this, the estimated plastic consumption for the entire continent for 2015 was 19.5 Mt. For the 33 countries considered and assessed in more detail in this study because they had consistent plastic import data in the Comtrade database (Table 1), the 2015 cumulative population was 856,671,366 (i.e. 70.22% of African population in 2015). Considering the above per capita plastic consumption (16 kg/year), the 33 countries used approximately 13.71 Mt of plastics in the year 2015. Consumption by the other 21 mostly smaller African countries (out of 54 countries) was approx. 3–6 Mt in 2015.

#### **Estimate of total historic consumption of plastic (1990–2017)**

The total volume of plastic importation for the selected 33 African countries was approximately 117.6 Mt (translating to \$194.6 billion), consisting of approximately 86.14 Mt of polymers (all polymers in categories HS 3901–3914) and 31.50 Mt as plastic products (categories HS 3915–3926), spanning a period from 1990 to 2017

(approx. 27 years). Recalculating from the 33 countries to the continental level shows that roughly 172 Mt of plastics (consisting of 126 Mt of primary and 46 Mt plastic products) were imported between 1990 and 2017.

One general observation is that plastics are imported at higher amounts in primary form than as finished products. This implies that the rates of plastic processing and production activities using imported primary polymers are high in many countries of Africa.

It needs to be stressed that plastic components of products such as cars, electronics, and sport equipment were not considered although these plastic sources contribute significantly to national consumption. For example, in Nigeria, these sources accounted for approximately 5.55 Mt for the years 1996–2014 compared to 17,620 Mt of primary plastics and plastic products imported for the same period. Since there are insufficient data for the robust estimation of these uses in many African countries, a brief discussion of this is presented in the section on the relevance of “secondary plastic”.

The current study shows massive plastic consumption (virgin polymers and finished plastic products) in Egypt, Nigeria, South Africa, Algeria, Morocco and Tunisia (in decreasing order). These six countries have contributed a significant share of the continental consumption. This observation is in agreement with the data reported for recent years by EUROMAP (see Table 2). However, the EUROMAP import estimates for Nigeria and Egypt did not reflect the particularly high import data for selected years as observed in the Comtrade database. This may indicate that the exceptionally high data reported for some years in the Comtrade database might have higher uncertainties. Weight data are more prone to uncertainties compared to the monetary value of imports, since national customs are more interested in the later.

### **2.3. Brasil**

The urban solid waste generated in Brasil reaches 190,000 Mg/day, in which São Paulo Municipality solely is responsible for about 7.5% of that total. Almost 64% of urban solid waste (USW) collected in Brasil (2008) is disposed in sanitary landfills, 16% in controlled landfills, 18% in open sky dumps, 2% is recycled and a negligible fraction is incinerated. In São Paulo Municipality, the Sorting and Composting Waste Treatment Plant (SCWTP) is suggested as an appropriate way to manage the 14,000 Mg of USW generated daily by 11 million habitants in 2010. The majority amount (84.5% in wet weight) of USW in São Paulo Municipality is taking to sanitary landfills, only 13.5% is sent to SCWTP, and the remaining 2% is incinerated. In 2015, Brazil's generation of MSW was around 79.9 million t, corresponding to 1.071 kg MSW person<sup>-1</sup> day<sup>-1</sup>.

Recently, a zero-waste strategy is growing in popularity as one of the most visionary concepts for solving waste concepts. Zero waste means designing and managing products and processes systemically to avoid and eliminate waste, and to recover all resources from the waste stream. It not only focuses on recycling of products but also aims to restructure their design, production and distribution to prevent waste emerging in the first place. Three high consuming cities (Adelaide, San Francisco and Stockholm) have declared their zero waste vision. The average person generated around 681 kg of MSW in Adelaide in 2008–9. Around 46% of all MSW was recycled, 8% was composted and the remaining 46% was disposed to landfill. In San Francisco 609 kg per person per year of MSW was generated in 2008. MSW was managed by recycling (52%), composting (20%) and landfill (28%). The average person in Stockholm generated around 480 kg of MSW per year, which 59% was incinerated, 31% was recycled, 1% was composted and 9% was landfilled.

Plastics, especially from packaging, have gained increasing attention in waste management, driving many policy initiatives to improve the circularity of these materials in the economy to increase resource efficiency. In this context, the EU has proposed the circular economy concept, which foresees a production and consumption system where materials are circulated as wastes are re-used, recycled and recovered. Plastics are considered as one of the five priority areas in the EU action plan for the circular economy.

However, despite the efforts which have been made, overall waste volumes are growing. Management of plastics waste remains a problem. The observed increased plastics consumption throughout the world makes it necessary the development of more recyclable and/or biodegradable plastics to reduce the amount of plastic to landfill. According to amendment to European Directive on packaging and packaging waste recovery and recycling of packaging waste should be further increased to reduce its environmental impact.

Compostable polymers which have been designed to be disposed after their useful life by means of organic recycling, i.e. composting are one of the strategic options available for the management of plastic waste. Composting is an attractive alternative for reducing solid waste and is especially suitable for those segments of conventional plastics in which recycling is difficult or economically non feasible.

The growing environmental awareness and new rules and regulations, as well as new trends in solid waste management have led scientists to increase activities on the design of compostable polymer materials that easily degrade under well-defined environmental conditions.

The production of plastics increased by more than twenty-fold between 1964 and 2015, with an annual output of 322 million metric tonnes (Mt), and is expected to double by 2035, and almost quadruple by 2050. Plastics contribute to economic growth, but their current production and use pattern, on a linear model of 'take, make, use, and dispose', is a primary driver of natural resource depletion, waste, environmental degradation, climate change, and has adverse human health effects.

Conventional plastic production is highly dependent on virgin fossil feedstocks (mainly natural gas and oil) as well as other resources, including water – it takes about 185 litres of water to make a kilogram of plastic. Plastic production uses up to 6% of global oil production, and this is expected to increase to 20% by 2050, when plastic-related greenhouse gas emissions may represent 15% of the global annual carbon budget.

Some plastics contain toxic chemical additives, including persistent organic pollutants (POPs), which have been linked to health issues such as cancer, mental, reproductive, and developmental diseases. It is difficult to recycle some plastics without perpetuating these chemicals.

About 4900 Mt of the estimated 6300 Mt total of plastics ever produced have been discarded either in landfills or elsewhere in the environment. This is expected to increase to 12,000 Mt by 2050 unless action is taken. The ocean is estimated to already contain over 150 Mt of plastics; or more than 5 trillion micro (less than 5mm) and macroplastic particles. The amount of oceans plastic could triple by 2025 without further intervention. By 2050, there will be more plastics, by weight, in the oceans than fish, if the current 'take, make, use, and dispose' model continues.

Plastics stay in the environment for a long time; some take up to 500 years to break down; this causes damage, harms biodiversity, and depletes the ecosystem services needed to support life. In the marine environment, plastics are broken down into tiny pieces (microplastics) which threaten marine biodiversity. Furthermore, microplastics can end up in the food chain, with potentially damaging effects, because they may accumulate high concentrations of POPs and other toxic chemicals.

We are living in the era of plastics. Since the 1950s, plastics have been commonplace in our daily lives. It has been estimated that 8,300 million metric tonnes (Mt) of virgin plastics have been produced globally to date<sup>1</sup>. Annual global production of plastics has increased twentyfold since the 1960s, reached 322 million tonnes in 2015, and is predicted to double again over the next 20 years.

In Europe, the largest use of plastics is for packaging, which accounted for almost 40% of the 49 Mt of plastics demand in 2015 (around 42% globally). This is followed by building and construction related applications (almost 20%), automotive applications (around 9%) and electronics (almost 6%<sup>4</sup>).

The wealth of different types of modern plastics have many useful characteristics, including being convenient, cheap, often lightweight, flexible and durable. Despite their usefulness, however, plastics create sustainability issues not merely due to the volume being used, but also by virtue of the range of uses, as well as the diversity of polymers and additives which can hamper recycling. In short, the current relationship of producers, retailers and consumers with plastics is unsustainable in both socioeconomic and environmental terms.

The single use nature of many plastic products means that most of the plastics produced globally have already become waste (6,300 Mt by 2015). Of this only 9% has been recycled, 12% incinerated and 79% sent to landfills or leaking – one way or another – into the natural environment. In Europe, almost 26 Mt of plastic waste are generated annually, 59% of which is packaging, and less than 30% of which is collected for recycling, with 31% landfilled and 39% incinerated.

Estimates suggest that globally, between 4 and 12 million Mt of plastic waste entered the marine environment in 2010<sup>9</sup>, and that around 150,000 to 500,000 tonnes of plastic waste enters the oceans from the EU annually<sup>10</sup>. Plastics account for an estimated 80% of marine litter, with 50% of beach litter consisting of single-use plastic (SUP) items. Plastics, including microplastics, also now contaminate terrestrial habitats, soils and freshwater. And it has been estimated, based on 2012 data, that the production of plastics and incineration of plastic waste generates around 400 Mt of CO<sub>2</sub> globally per year.

Extrapolating these production, waste and waste management trends, there could be approximately 12,000 Mt of plastic waste in landfills or the natural environment by 2050<sup>15</sup>. This represents not only a loss of non-renewable resources (i.e. the fossil fuels that around 90% of plastics are made from<sup>16</sup>), but also a loss of potentially valuable secondary raw material, and associated loss of value to the global economy. Around 95% of the value of plastic packaging material (between EUR 70 and 105 billion per year) is estimated to be lost to the economy after one very short-lived use.

### **3. Experience for Vietnam**

#### ***3.1. The status of plastic product consumption in Vietnam***

Plastic pollution is nothing new in Vietnam, though not until this year have government and businesses alike taken the problem seriously.

Vietnam's large-scale fight against plastic commenced in April with a series of supermarkets and stores across the nation ditching common veggie packaging for traditional banana leaves.

Several operators said the move formed part of a plan to up the use of a diverse range of environment-friendly products.

Previously, some cafés and restaurants had already encouraged the reduction of plastic by offering straws made of more environmentally friendly materials such as metal, rice and grass. Supermarket chain Saigon Co.op, the biggest in HCMC, had stopped selling plastic straws.

Central Thua Thien-Hue was one of the first provinces to require government employees not to use plastic at work. Offices and agencies across the region are now required to avoid disposable bottles smaller than 20 liters, as well as plastic bags and one-time wipes. The municipal finance department, meanwhile, is not allowed to pay for disposable plastic products.

In June, Vietnam's escape from plastic took a sharp turn when Prime Minister Nguyen Xuan Phuc launched a campaign targeting zero disposable plastic use in urban shops, markets and supermarkets by 2021, extended nationwide by 2025.



Phuc acknowledged limitations remain, including personal and business mindsets regarding plastic waste. "Vietnam needs to take practical, specific action to control and prevent plastic waste generation, ensuring current and future generations can live in a clean, safe, and sustainable environment."

According to Food and Agriculture Organization, Vietnam discards over 1.8 million tons of plastic waste, with only 27 percent recycled.

United Nations Environment Program confirmed Vietnam as the world's fourth largest marine plastic polluter after China, Indonesia and the Philippines. It has been estimated the country dumps an average of 300,000-700,000 tons of plastic waste into the ocean per year, accounting for 6 percent of the world's marine plastics.

To improve the campaign's appeal, the Ministry of Natural Resources and Environment appointed the increasingly popular Vietnamese national men's football team and its coach as ambassadors.

Responding to the PM's call, a number of businesses and organizations have joined the race in taking responsibility for their environmental footprint.

HCMC Open University and HCMC Medicine and Pharmacy University announced a ban on plastic straws and bottled water on campus. Teachers and students have to bring their own bottles or use recyclable ones provided by the university.

In June, nine corporate biggies joined hands to recycle packaging materials, most of which are plastic, aiming at 100 percent recycling by 2030. The founding members of PRO Vietnam include nine major multinationals and local giants, some competitors: TH Group that runs popular TH True Milk brand, Coca-Cola Vietnam, Friesland Campina Vietnam, La Vie, Nestle, Nutifood, Suntory PepsiCo Vietnam, Tetra Pak and Universal Robina Corporation.

The alliance, now at 12 members, will endeavor to increase recycling rates and minimize the amount of used packaging dumped into the environment. The environment ministry in September signed a Memorandum of Understanding to aid the alliance when needed.

In the same month, Vietnam Airlines, Bamboo Airways, VietJet Air and Jetstar Pacific confirmed they are planning to phase out single-use plastics, saying the long-term change would be permanent.

In late July, the Ministry of Health requested all clinics, hospitals and medical centers to enhance the use of environmentally-friendly materials and work towards putting an end to all single-use plastic products and persistent plastic bags.

One after another, major hospitals across the nation rushed to replace single-use plastic cups with glass and ceramic alternatives, and plastic bags with paper equivalents.

Friendship Hospital in Hanoi has gone as far as ditching plastic films produced by imaging tools such as X-rays, computed tomography (CT) scans and magnetic resonance imaging (MRI), switching to storing data digitally.

Vietnam's biggest bookstore chain Fahasa in July announced it would cease using single-use plastic and shift to biodegradable bags and paper wrappings, using paper bands to tie books purchased at their shops. For stationery items like pens, pencils and cases, it would provide bags and wrappers made of recycled newspapers and magazines.

Late that month, HCMC authorities followed in Thua Thien Hue's footsteps to require its offices and agencies not to use bottled water, including at conferences, and limit the use of plastic bags, straws and one-time wipes. From 2020, the municipal finance department would not allocate funds to government agencies for buying disposable plastic products.

Starting August, 15 local firms operating tourist boats, kayaks and high-speed vessels across world-renowned Ha Long Bay embarked on a pilot program banning the use of all plastic products.

Boat owners will replace bottled water with large, fixed water jars with passengers supplied with environmentally friendly glasses. Wet paper towels will be replaced with cloth towels collected after use. Currently, an estimated 5,000 wet napkins and as many plastic bottles are used and discarded daily in the UNESCO heritage site, contributing to the several thousand tons of trash collected from its waters each day.

Also in August, National Assembly, Vietnam's legislative body, announced ditching plastic water bottles in all its meetings, replaced by water served in crystal bottles or glasses.

Not to miss out, authorities in northern port city Hai Phong started replacing one-time plastic products, including bottles, cups and straws with multiple-use or environment-friendly choices.

Just as it seemed the entire nation had joined the battle, it was announced by Ipsos Business Consulting, a global growth strategy consulting firm based in Paris, that Vietnamese per capita plastic waste was the third highest in Southeast Asia after increasing more than 10-fold over the past three decades.

Every Vietnamese consumed only 3.8 kg of plastic in 1990, though 28 years later, this had risen to 41.3 kg. In Southeast Asia, only Malaysia (75.4 kg) and Thailand (66.4 kg) generate more.

The report released in September added Vietnam's plastic waste discharge is among the highest in the world, without revealing a specific ranking. Such figures make the fight against plastic even more urgent.

Vietnam Buddhist Sangha that same month asked followers not to use any plastic in floral lanterns floated on rivers as a form of prayer "to avoid causing pollution and destroying the environment."

The statement came in response to many Buddhists who used plastic materials to create flower lanterns or placed small plastic cups holding a candle inside.

Vietnam's largest metropolis HCMC in October made a progressive step to free itself from plastic: it required all local supermarkets, shopping malls, convenience stores and bookstores to replace plastic bags with environmentally friendly options by next year.

Two weeks into November, ancient town Hoi An, a popular tourist destination in central Vietnam, issued a directive on reducing and controlling the use of plastic products.

All government offices and agencies in the town were ordered to cease using single-use plastic products at meetings and events by the year-end. By the end of 2021, plastic bags and other single-use plastic items would not be used at traditional markets and supermarkets in Hoi An, while the old town must ensure a complete end to single-use plastic items by 2025, according to the directive.

Shortly after, Deputy Minister of Environment and Natural Resources Vo Tuan Nhan told an online government conference that plastic bags should be made more expensive, suggesting a consumption tax aside from the current commercial tax rate of up to VND50,000 (around \$2) per kilo at the highest, to dissuade their use.

He argued plastic bags were not only convenient but really cheap in Vietnam, many vendors readily supplying them before purchases are even finalized.

Though the observation is true for nearly every market across Vietnam, Nhon Market is an exception.

Starting December, the market in northern Bac Ninh Province became the first to say no to plastic bags, encouraging customers to supply their own baskets. Unmut Weeks into 2020, the central government gave the

anti-plastic campaign a boost by issuing a national action plan on the management of plastic ocean waste until 2030.

Vietnam will cut down 75 percent of its marine plastics and stop generating plastic waste in coastal tourist areas by 2030, the government stated.

Accordingly, by 2030, the country would have reduced its amount of plastic waste dumped into the ocean and collected 100 percent of lost or discarded fishing equipment. Additionally, 100 percent of coastal tourism service providers would stop using disposable plastic products and non-degradable plastic bags, while 100 percent of marine protected areas would be free of plastic waste.

The government has tasked the Ministry of Natural Resources and Environment to expand annual monitoring activities and evaluate the current status of marine plastics at river mouths and across 12 island districts every five years.

To achieve its goals, the government would work to promote and raise public awareness on the issue of plastic waste; change public behavior and treatment of plastic products and marine plastics; collect, sort, store, transport and treat plastic waste generated by activities in coastal areas and on the seas.

The environment ministry has been assigned to work with coastal authorities and municipalities to develop and pilot models for managing, reducing and eventually ceasing the use of disposable plastic products and hard-to-degrade plastic bags.

As PM Phuc put it, the fight against plastic has now become more urgent than ever. "It requires specific and feasible actions with participation of all parties in the society, from the administration to businesses and local people, and must not be stopped at mere propaganda."

#### **4. Conclusion**

Examining the Possibility of Applying Circular Economy at Firm Level: Application of PEST tool

##### **Introduction to PEST Tool and its Application**

Political, Economic, Social, and Technological (PEST) analysis is an important tool used for market and environmental analysis and to support the strategic decision-making of a company. It is very useful for understanding market growth or decline, business position, and potential and direction for operations (Narayanan, 2001). PEST analysis describes the framework of macro- environmental factors used in the environmental scanning component of strategic management. The different macroenvironmental overviews provided by the PEST analysis are important inputs that a company must take into consideration when conducting business strategy and planning. It is regarded as effective in long-term strategic planning and works from a macroeconomic perspective. The political, economic, social, and technological factors allow firms to get a deeper understanding of the market trends (FME team, 2013).

In applying the PEST tool, we examined the external factors in Viet Nam's business environment to see if they encourage or discourage Vietnamese firms to implement circular economy in Viet Nam.

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##### **Political factors**

Political factors are basically how the government intervenes in the economy. Specifically, in this chapter, political factors will cover the stability of the Vietnamese political environment, focusing on the existing policy framework relating to green growth as well as environmental laws and trade policies, to see if the Vietnamese



government commits to sustainable economic development. Hence, it will examine if the convergence of political factors in Viet Nam is good for the implementation of circular economy in Viet Nam or not.

### **Economic factors**

Economic factors include economic growth, interest rates, exchange rates, inflation rate, and market prices of raw materials and energy, which greatly affect how businesses operate and make decisions. These factors will reflect if the circular economy concept is applicable for Vietnamese firms to apply at firm level. It also examines if the circular economy concept would increase the risks for applied firms or vice-versa by considering the transaction cost for circular economy.

### **Social factors**

Social factors involve trends in population, domestic markets, culture, and demographics to see if the market is ready for the application of circular economy with new sustainable consumption habits. The service industry in Viet Nam will also be examined. The circular economy concept will be considered to see the benefits it can bring to the Vietnamese society, including both local wealth creation and environmental benefits.

### **Technological factors**

Technology is a crucial component of any business as it determines whether it can increase productivity and compete in the market. In this chapter, the analysis will focus on research and development as well as technology transferring activities to develop better sustainable technologies. Existing types of current technology and innovation systems will be considered to find their benefits to apply the circular economy concept at firm level.

### **Examining External Factors that Affect the Application of the Circular Economy at Firm Level**

Viet Nam has advantageous conditions in terms of its policy, economy, society (available market), and technology to develop the circular economy concept. The policy framework of Viet Nam has covered many important target groups of green growth such as resource efficiency, renewable energy, sustainable consumption, and CP. All its supporting policies aim to contribute to economic restructuring for the transformation of the growth model towards better sustainability by improving the productivity, efficiency, and competitiveness at company level. Although the political system is still weak, causing different policies that overwhelm each other, and the implementation/enforcement efforts become complicated and ineffective, the economic, social, and technological factors seem to positively respond to the green development pathway with remarkable results. The PEST analysis below shows that Viet Nam's business environment and market are quite ready and attractive for enterprises to implement the circular economy concept at firm level. Political factors Political factors are basically how the government intervenes in the economy. Specifically, in this chapter, political factors will cover the stability of the Vietnamese political environment, focusing on the existing policy framework relating to green growth as well as environmental laws and trade policies, to see if the Vietnamese government commits to sustainable economic development. Hence, it will examine if the convergence of political factors in Viet Nam is good for the implementation of circular economy in Viet Nam or not. Economic factors Economic factors include economic growth, interest rates, exchange rates, inflation rate, and market prices of raw materials and energy, which greatly affect how businesses operate and make decisions. These factors will reflect if the circular economy concept is applicable for Vietnamese firms to apply at firm level. It also examines if the circular economy concept would increase the risks for applied firms or vice-versa by considering the transaction cost for circular economy. Social factors Social factors involve trends in population, domestic markets, culture, and demographics to see if the market is ready for the application of circular economy with new sustainable consumption habits. The service industry in Viet Nam will also be examined. The circular economy concept will be considered to see the benefits it can bring to the Vietnamese society, including both local wealth creation and environmental benefits. Technological factors Technology is a crucial

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