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## THE CIRCULAR ECONOMY IN SOUTH KOREA. THE CASE OF SAMSUNG

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### Abstract

This research applied a qualitative research approach in order to define the level of involvement of South Korea in the circular economy. As a case study, a strategy toward the circular economy of Samsung, one of the largest Korean multinational companies, was considered. The research results concluded that the country puts significant effort in order to achieve its goals in sustainable development. The main players are the government and private companies. The main means that help the country to implement the circular economy are government policies and technological development. However, the results show that it is hard to say that South Korea lives in the circular economy.

### Keywords

Circular economy, South Korea, Samsung

### 1. Introduction

Through the years our economy and the environment have undergone enormous changes. As a result of changes, we are faced with problems that make us rethink our actions. For a long time, our economy has followed a linear economy model, which means producing a product and throwing it away after use. The linear economy is also referred to as “take-make-use-dispose” [7]. The last step is disposal, in other words, the product becomes waste. One of the traditional methods of waste management is landfilling. The landfill has a direct impact on the environment, as it pollutes the soil and, for example, toxic materials from waste are absorbed by groundwater and pollute them [6].

Circular economy is a regenerative system where resource input and waste, as well as emissions and energy leakage are minimized by aiming towards closed material loops [15]. Consequently, a circular economy produces significantly less waste than a linear economy. The products can be restorative thus the whole economy is able to be regenerative [7]. To simplify, the “dispose” phase in the linear economy will be replaced by the “take” phase in the cyclical economy. Ultimately, the circular economy aims to remove non-recyclable waste and recycle waste as raw materials. For the development of a circular economy, the foundation should be long-term design, maintenance, reuse and recycling [2].

Many countries seek to develop circular economy. According to OECD, in 2013 South Korea (hereinafter - Korea) had the second highest recycling rate country in OECD countries [8]. The linear approach to industrialization has been successful in Korea for decades. Korean Gross Domestic Product (GDP) currently holds a relatively high place in the world. It also has a very high Human Development Index (HDI), which is used as a general indicator of the quality of life in the world. However, since Korea faces limited natural resources, it needs to replace the linear approach to industrialization with a circular economy, a new economic model [4].

This brief research tries to define how deep Korea is involved in the circular economy. Due to the nature of the study a qualitative research approach was chosen, because this method allows to have a deeper understanding of the research area.

### 2. The circular economy policy in South Korea

Various policy instruments have been adopted by Korea to turn the linear economy into a circular one.

Although each tool seems to be independent of each other, all tools are emphasized by common motivation.

Recognizing that climate change is affecting the whole world, Korea has taken significant steps to move towards a circular economy. According Jin [4] selected examples of historical, legislative, and country-specific actions can be classified into

- Target Management System (TMS);
- Resource Efficiency Program (REP);
- Energy Recovery Program (ERP);
- Recycling Technology Program (RTP);
- Emissions Trading System (ETS).

Target Management System is closely linked to the reduction of GHG (greenhouse gas) emissions per capita and, thus, is the basis for overall mitigation efforts. The TMS workflow is governed by the Low Carbon Growth Fundamental Law and the Goal Management Framework. The sectors that account for most of the emissions are identified as a starting point. Then controlled entities are designated for such sectors. They report previous emissions to supervisory departments. Supervisory departments and the Greenhouse Gas Inventory and Research Center of Korea (GIR) review reports for double counting or omissions. They set GHG emissions targets for a particular facility. Controlled entities then submit implementation reports to achieve mitigation goals. They also submit emission reports to show annual emissions. Both emission reports and implementation reports are first checked by third-party inspection institutes and then checked by supervisory departments. Finally, these reports are submitted to the GIR. If their implementation reports do not comply with audit report verification standards, corrective measures can be applied to controlled entities. The whole process takes place through the national GHG management system. This system collects data related to GHG emission statistics for a specific facility. Through the system, supervisory departments can access GHG emissions data reported by controlled entities. Since TMS was created only in 2012, it may take several years to confirm that TMS is effective in achieving the medium-term goal of mitigation [4].

Resource Efficiency Program is trying to control the amount of raw materials used to convert energy to GDP. Reducing the use of resources can reduce greenhouse gas emissions. In this sense, REP corresponds to a reduction in the energy intensity of the economy. To this end, REP is trying to implement a more efficient manufacturing process and /or recycle resources. REP seeks to facilitate products embodying less resource input. For example, energy

savings can lead to lower energy costs, but will be accompanied by additional costs for the implementation of an energy-efficient process. Savings in financial costs for energy consumers can be achieved when the former more than compensates for the latter. To fulfil this condition, REP provides incentives to manufacturers to increase the efficiency of their products. REP also encourages consumers to buy more energy-efficient products on the market [4].

One of examples of recycling resources can be Repaper Inc. Repaper is a Korean company, which design and develop paper cups [10]. In 2018 the company invented a new paper cup which can be recycled. According to the Repaper [10], generally a paper cup is not biodegradable because it is coated with polyethylene which is plastic. Therefore, it cannot be recycled as paper or cardboard, nor composted. Paper cups cause a huge amount of non-recyclable waste. Repaper has developed a technology to coat the cup without plastic. This new paper cup has received several patents in e.g. South Korea, U.S.A and Europe. In addition to the cup, the technology can be applied to the other disposable products [10].

As a part of REP, the Energy Efficiency Standards and Labelling Program has been in use since 1992. Marking at seven target positions shows the energy efficiency level of the model from one to five. The Certification of High Efficiency Energy-using Appliance Program was implemented, where energy-consuming products with a relatively high level of energy efficiency were certified. Government organizations must use certified products. An energy-saving program for office equipment and consumer electronics, a voluntary partnership between the government and manufacturers, has also been used since 1999. Energy-saving products are certified if they comply with the Korea Energy Management Corporation (KEMCO) energy efficiency guidelines. One standard is to automatically switch to power-saving mode when not in use. Warning labels apply to products that do not comply with the standard [4].

Another program highlighted by Jin [4] is Energy Recovery Program which closely related to the carbon intensity of the energy mix. Carbon intensity can be reduced when energy is recovered from waste. The goal of ERP is to increase the demand and supply of energy from waste. With an energy mix dominated by fossil fuels, Korea's greenhouse gas emissions rose by 39% from 2000 to 2013, the second-highest growth rate of OECD countries over the period. Korea now ranks as the OECD area's fifth-largest GHG emitter, up from ninth place in 2000, and if current trends continue GHG emissions will have

tripled by 2030 from 1990 levels [9]. Therefore, the deployment of energy recovery is one of the key priorities for achieving a circular economy. Expanding the use of energy from waste is the most effective strategy for going beyond oil. The national green growth strategy aims to increase the share of renewable energy.

The Republic of Korea is a resource-limited country, accounting for 94% of energy consumption from imports from abroad, and yet it is the 9th largest energy consumer in the world. This internal problem of the structure of energy supply and demand in Korea makes it vulnerable to external environmental changes, such as rising oil prices. Against this challenge, the Korean government has set a priority energy on renewable energy. To replace nuclear and coal energy, the government announced a higher renewable energy generation goal, from 7% today to 20% by 2030. To achieve this, Korea must install an additional 53 GW of renewable energy, mainly solar PV and offshore wind energy by 2030, which together will total 68 GW [5].

Recycling Technology Program focuses on developing advanced recycling technologies. Smart litter bins in Seoul can be mentioned as example of successful implementation of the program. Seoul is the capital and largest city in South Korea with population around 10.29 million people. Therefore, litter bins fill up very quickly at all time of the day, which makes it difficult to keep the streets clean. A local company, Ecube Labs, found the solution: an innovative litter bin that compacts its contents with a solar-powered compressor. This technology allows containers to store up to four times as much waste before emptying it. Unlike the traditional method of collecting general waste and recycling materials, this method allows to control containers thanks to technologies such as IoT (Internet of Things), which allowed Seoul to reduce waste collection costs by 83% and eliminate the problem of overfilled containers. It also reduced the frequency of waste collection tasks by 66%, and the degree of recycling increased by 46%. Reducing traffic with fewer collection visits helps reduce carbon emissions and other emissions. And this, in turn, raises public awareness about the use of renewable energy sources. In addition, the recycling bins have reduced food waste by about 10% in the capital. Some food waste containers also have the special function of converting organic waste into compost. This material is then used in public gardens or transferred to farmers [13].

The main objective of the Emissions Trading System is to achieve the goal of greenhouse gas emissions in a cost-effective manner. ETS is a

distinguishable market policy tool. If a company needs a higher cost for voluntary mitigation, it can buy emission permits in the market. On the other hand, if a company requires relatively lower mitigation costs, it can sell additional emission permits for profit. Thus, ETS helps to more effectively achieve the national goal of reducing greenhouse gas emissions. Companies provide strategic choices through the ETS: direct easing, trade permits, external easing and/or borrowing permits. The company can strategically choose the most profitable way with the least cost. Thus, companies within the ETS can flexibly respond to changes in the global carbon market [4].

Even before the introduction of the mandatory ETS, Korea actively used trade mechanisms, and since 2005 it has been participating in the Clean Development Mechanism (CDM). CDM allows emission reduction projects in developing countries to receive certified emission reduction credits (CER). Each CER is equivalent to 1 ton of CO<sub>2</sub>. Korean investment companies own CERs and sell them to other country on the market. In addition, the Korea Certified Emissions Reduction (KCER) was introduced in 2005. The KCER market is open to firms that have reduced their CO<sub>2</sub> emissions by more than 500 tons per year. KCER can also be sold on the market [4].

Government support toward sustainable development by its regulations and policies lets the country improve its position in term of environmental issues. For better understanding of circular economy of South Korea SWOT analysis was applied.

#### **Strengths:**

- Economic development of the country which facilitates capital accumulation to invest into a circular economy;
- One of the highest rates of state investments in science and R&D;
- Governmental control and regulation;
- Excellent level of industry-academia partnership. Often Korean companies and universities work together on R&D projects.
- High level of technological development.

#### **Weaknesses:**

- Lack of natural resources;
- Strict regulations might hurt business or push companies to move their activities abroad;
- Usually activities related to circular economy are capital intensive;
- Sustainability requires time.

### ***Opportunities:***

- Government’s policy for encouraging IT investment and R&D;
- Emerging environmental awareness and long-term plans;
- Advanced technology;
- Existing organizations and initiatives in maximization of resource efficiency and minimization waste generation.

### **Threats:**

- Rapid changes in environment, therefore further reinforcement of environmental policies in the world;
- Deception of companies in terms of meeting government requirements.

### **3. Samsung in the circular economy**

Samsung Group is a South Korean group of companies, one of the largest chaebols, founded in 1938. Known in the world market as a manufacturer of high-tech components, including full-cycle production of integrated circuits, telecommunications equipment, household appliances, audio and video devices. The main office of the company is located in Suwon [14].

Samsung is a major player in outward FDI in South Korea, and also the largest exporter of goods from South Korea, accounting for about one sixth of the total value of exports, which exceeds all exports from midsize emerging economies such as South Africa, Argentina or Chile [1].

As one of the main players of Korean economy Samsung Electronics is working towards moving to a circular economy to protect the environment and make more efficient use of resources. Going beyond the practice of single-use resources and throwing them away, Samsung is working to ensure that resources are reused through recovery, reuse and recycle at the end of the product’s life [12].

Samsung has made great strides in reducing e-waste and achieving a circular economy. The company conducted at least a couple of recycling promotion campaigns and established Samsung’s Galaxy Upcycling program. Recycling and upcycling are two different concepts. The first is aimed at the processing of raw materials from old products and the use of these materials in new devices. The latter aims to reprofile existing products, such as Galaxy smartphones, and use this processing power in various ways [11].

According Mark Newton, head of corporate sustainability at Samsung Electronics America, a medical device built from an old Galaxy smartphone,

capable of screening for eye diseases, is a prime example of how old hardware can be repurposed with the help of custom software. If a real product based on this concept would exist, it could prove useful in countries with emerging economies, where healthcare diagnostic tools may be in short supply [3].

The company abandons the previous structure of resource consumption when resources were thrown away after a single use, and performs various actions, that consider closed-loop recycling, which recovers, recycles, and then reuses used resources. One example of Samsung's recycling efforts is the Asan Recycling Center, which was created and operated by Samsung. All base metal and plastic that comes from the recycling center is reused in the electronics industry. Since its founding in 1998, the Asana Waste Recycling Center has been engaged in the recycling of electronic waste. In 2018 369,000 units of refrigerators, air conditioners, washing machines and IT devices were recycled, as a result of which 25,207 tons of base metals (steel, copper, aluminum, etc.) and plastics were recycled. Plastic from electronic waste, sorted at the Asan Waste Recycling Center, is supplied to plastics manufacturers who reformulate them for reuse. Using a jointly developed technology, Asan Recycling Center has created a closed-loop recycling system that allows the use of renewed plastic in Samsung products. 2,743 tons of renewed plastic produced using this reuse system in 2018 were used in Samsung production. Copper is separated from the main components (wires, compressors, etc.). It is recycled and used to manufacture other electronics. Another example is cobalt, which is one of the main resources used in mobile phone batteries [12].

The amount of waste generated during product development during the manufacturing process is significant. For complex electronic devices with many components, even packaging is thrown away for each piece. At the end of the project, many of the pilot products used to improve the product go to waste. If all of them are burnt or buried, the environment will be polluted, and resources depleted. Samsung is one of the biggest e-waste collectors in the world — it has taken back more than 1 billion pounds cumulatively in the United States since 2008, although it needs to be mentioned that these are not just mobile phones. Samsung makes everything from refrigerators to televisions, which are far heavier although getting lighter with each new model. Its long-term goal is to take back more than 15 billion pounds of electronics globally by 2030 [3].

Nowadays pollution of marine by plastics, microplastics, and other problems associated with

plastics have become a hot topic of discussion around the world. Therefore, Samsung Electronics has established a policy for environmentally friendly packaging and is replacing the disposable plastic materials used in product packaging with paper, bioplastics or other environmental materials. Bioplastics are environmentally friendly plastics with a lower fossil fuel content using starch, sugarcane and other biomaterials [12].

Also, in response to the increasingly serious global water crisis and as part of company's efforts to protect the environment, Samsung Electronics has launched the 3R (Reduce, Reuse, Recycle) strategy for water. They prevented wasted water by replacing old valves to prevent leaks and developed sophisticated control units that use only the right amount. In addition, the company reformed its processes so that it can reuse water and reduce water consumption. Previously, water used in one process could not be reused in another, since each process required water with different standards. However, by standardizing water, Samsung can now reuse water in several processes. Thanks to such efforts, the company was able to reuse 60 609 tons of water in 2018, which is 8% more than a year earlier, and water reuse amounted to 45.1% of the total volume of water used [12].

Thus, it can be said that the company is working on its goals of achieving a circular economy. By minimizing the type of materials used and optimizing the assembly method, Samsung has developed manufacturing methods that minimize resource use. Samsung recovers valuable materials by collecting products that reached the end of their life span. With this circular economy, Samsung is reducing the amount of natural resources it needs for production, reducing greenhouse gas and pollutant emissions from waste incineration, and preventing soil and groundwater pollution from landfills

#### 4. Conclusion

The completion of the national medium-term goal shows that South Korea is pursuing an active strategy of transition to a circular economy. The country has undertaken intensive efforts to develop an integrated strategy at the national level. In 2008, low carbon / green growth was announced by the country, which should guide its development over the next 50 years. In 2009, the first five-year (2008–2013) Green Growth Plan was announced along with the National Strategy for Green Growth to accelerate central government policy implementation. In addition, an interim goal was announced to reduce greenhouse gas emissions at the national level. In 2010, the Framework Act on Low Carbon/ Green Growth was

adopted covering economies, industries, national territories, the environment and public conduct. In 2011, the Act on the Creation and Facilitation of Use of Smart Grids was adopted as the legal basis for the creation of intelligent networks. In 2012, the Act on the Allocation and Trading of Greenhouse-Gas Emission Permits was passed to create the institutional framework for the Emissions Trading System. In 2014, it was announced that in the second five-year (2014–2018) Green Growth Plan, the institutional framework created over the past 5 years will be actively used [4].

According to OECD Environment Director Simon Upton, “Korea has been a champion in framing ambitious green growth policies. It now needs to turn its vision into action by making progress towards its climate goals”, said [9].

Although the level of recycling in South Korea is high, this does not mean that Koreans live in a circular economy. In order to develop towards a circular economy, South Korea must consider this concept in a holistic way. This includes the development of circular product designs, such as reducing the use of plastic and the use of more biodegradable and bio-products. Consumers are more interested in types of materials than before, and they are trying to find new environmentally friendly products for use.

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