

Transition to the circular economy in Egypt

Karim Ali



Author(s)	
Karim Nasser Khairy Ali	
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<p>Circular economy is more than a trend, it is a key to achieving sustainable development. Resources scarcity, population growth, plastic waste, climate change and many issues facing the inhabitants of the earth needs a radical solution. Circular economy also is a driver for innovation and economic growth.</p> <p>This research is about circular economy opportunities and challenges in Egypt. Before going into researching the topic in Egypt, the author will research the concept in general and the concept in Finland.</p> <p>Finland is considered a leading country for circular economy. It was the first country to have a circular economy roadmap. Therefore, the researcher will highlight the takeout from the roadmap.</p> <p>In this research, the author used inductive research approach. Qualitative methods were applied in order to answer research questions. Both primary and secondary data were used in this thesis. Secondary data are collected from published reports and online sources.</p> <p>The empirical part of the study includes observations from different circular economy events in Helsinki. The author has also interviewed companies and experts from Egypt and Finland</p>	

Keywords

Circular economy, Egypt, Finland, Sustainable development, environment

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1 Introduction

Circular Economy (CE) is receiving increasing attention in recent years. Benefits of implementing such approach have become clearer. It is a mean to overcome unsustainable production and consumption patterns, while allowing economic growth and efficient use of resources.

Although the evolution of CE scientific knowledge has been predominately based in the political and economic geographies of developed countries/regions, it is suggested that CE provides an opportunity to many emerging economies to improve their waste management and makes substantial efforts in their supply chains for effective resource use (IC. 2015)

Lower-income countries are in many ways more 'circular' than their developed countries. Much economic activity in lower-income countries revolves around sorting and reusing waste. However, higher-value, employment generating opportunities for reuse and remanufacturing are yet to be captured.

Circular economy replaces traditional linear economy, in which products are made from raw material, using labour and energy, delivered to end customer by logistics, then disposed after using the product. Most of these products end up as waste, this waste represents an economical and environmental burden.

Our world has several problems which needs an immediate action and solutions such as plastic waste, population growth, resources scarcity, pollution and climate change. Circular economy is a key to tackle these issues and to achieve several of the United Nations Sustainable development goals.

In this thesis, author will explain the circular economy concept and why we need to adopt it now. The author will also write about how Finland became a forerunner of circular economy and how that impacted the Finnish economy.

Egypt is one of the biggest markets in the Middle East and North African region and the recent economic reforms in the country has been fruitful. The author will discuss circular economy in Egypt and what are the challenges and opportunities of adopting it.

The theoretical part of this thesis is based on literature review. Author will be using secondary literature and grey literature. Secondary literature such as formally published journals and books. Grey literature is an indispensable source for accessing prevailing information on trending topics (Bonato. 2018). Grey literature sources such as corporate reports, government publications and academic publications. Author will use academic literature and books about circular economy and how different it is from linear economy. Literature from other researchers and institutions such as Sitra (The Finnish innovation fund) and Ellen MacArthur foundation will be used.

1.1 Thesis objectives and Research questions

The purpose of this thesis is to explore strengths, weaknesses, opportunities and threats of implementing circular economy in Egypt. Before getting into the circular economy in Egypt, circular economy concept will be explained. The author will also research the circular economy in Finland since Finland is a leading country for circular economy. In fact, it is the first country to have a circular economy roadmap.

The research question is “what are the obstacles and opportunities in Egypt in the transition process to circular economy?”

The question might be difficult to answer. Therefore, for a better understanding, the main question is complemented with the following sub-questions:

- What is circular economy?

Defining what is circular economy and the difference between circular and linear economy, benefits of circular economy, and new circular economy business models.

- How is the concept of circular economy understood in Egypt?

Exploring circular economy in Egypt and researching the infrastructure needed to foster implementing the circular economy.

- What are the advantages of circular economy in Egypt?

Advantages of circular economy in Egypt and how it would affect companies, citizens and the economy. Also, the disadvantages of circular economy and exploring if it is the right time or not.

- How can Egypt benefit from Finnish experience of circular economy?

Since Finland is one of the leading countries for circular economy, so it is important to learn how did the Finns succeed, and the key lessons learned.

- What are the strengths, weaknesses, opportunities and threats of circular economy in Egypt?

Finding out strengths, weaknesses, opportunities and threats for implementing circular economy for companies, government and citizens

1.2 Research background

Earth's natural resources are being used up fast due to the rising of global population which is estimated to be 9 billion by 2050. Resources such as water, soil, clean air and ecosystem are vital for our health and quality of life, but we have only one planet and the resources are limited. Growing competition for certain resources has created scarcity and rising prices. (European Commission 2011, 1)

Since the industrial revolution companies and consumers have been acquiring natural resources in a depleted manner using linear model of consumption. Resources are processed using labour and energy and sold as goods. Consumer discard it after using it and companies make new products. (World economic forum 2014, 13)

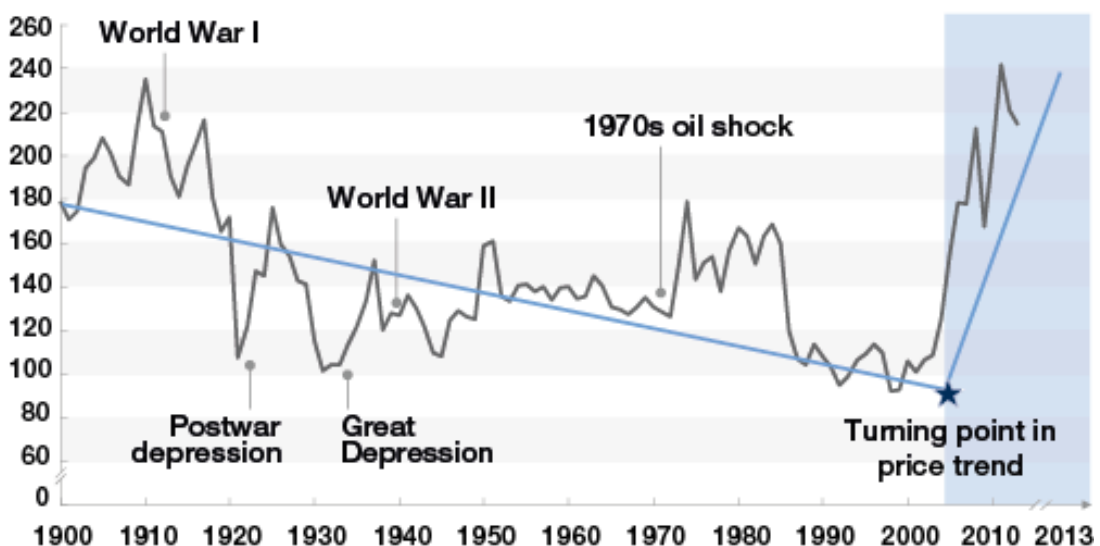


Figure 1. Sharp price increases in commodities since 2000 have erased all the real price declines of the 20th century (World economic forum 2014)

As figure1 shows, the price index of commodity has been increasing rapidly since 2000 due to the growing demand. Prices will increase more since the middle-income class is growing and their demand of primary commodity is increasing.

Various attempts have been made to reduce the environmental impacts of this linear model through the implementation of eco-efficiency measures, with the goal of reducing the amount of resources and fossil energy consumed per unit of manufacturing output. In a world of finite resources, evidence for absolute decoupling, when the gains in efficiency outstrip the growth in consumption, is however hard to find (Jackson, 2009)

According to the Global Footprint Network, humanity have used nature's budget for the entire year on the second of August 2018. That means that we would need 1.7 earths to replenish the natural resources we have used.

(Global Footprint network 2019.)

Circular economy is the answer not only to the problem of natural resources scarcity but also it has been expected to benefit companies and municipalities since applying circular economy reduce waste and make efficient use of resources. Further, the Circular economy has potential to create social and economic benefits. (Ellen McArthur Foundation 2015,16.)

The circular economy concept was born several decades ago. However, the real popularity and awareness of it was raised only several years ago with the help of the Ellen MacArthur Foundation that published its own study about the circular economy topic. (Geissdoerfer et al.2017)

It has been estimated that, in Europe alone, the circular economy could create direct primary-resource benefits worth 600 billion euros by 2030 (McKinsey 2015).

According to a survey conducted by Finnish innovation agency Sitra, a circular economy represents an opportunity for Finland worth 1.5 to 2.5 billion euros. If Finland is in a good position to thrive in the face of global competition with factors such as high education level, solid technological expertise and a strong reputation as a clean-tech operator, much remains to be done: currently only 54 per cent of all waste in Finland is recycled or reused in any way, and, similarly, few innovative service concepts concerning the maintenance, reuse or remanufacturing of equipment have emerged (Sitra, 2015).

Circular economy is more than just a hype. In today's world, circular economy is necessary for preserving next generations resources and reduce the harm we have caused to our mother earth.

Egypt is one of the most populous countries in the Middle East and Africa. The country suffers from population growth crisis. According to the Egyptian institute of national planning, the population will reach 114 million in 2030 and 125.9 million in year 2050. This growth will still increase due to the higher percentages of children and young people in Egypt.

This growth will decrease water supply, agriculture land per capita and will increase the demand of imported products such as food. This increase will also lead to high pollution and traffic problems will be more challenging. (Youm7 2018.)

The United nations World Water Development Report for 2018 warns that Egypt is currently below the U.N.'s threshold of water poverty. It is currently 1000 cubic meters per capita and it will reach 500 cubic meters per capita which is absolute scarcity. (UNESCO. 2018)

There are several reasons for the water scarcity, such as the inefficient irrigation and water pollution. The Great Ethiopian Renaissance Dam GERD is another threat to the water scarcity in Egypt. GERD will be Africa's largest Dam and it is crucial to the Ethiopian energy security. The Nile river provides about 85 percent of Egypt's fresh water and such a project threatens the water security in Egypt. (Middle East Eye. 2018)

2 Circular economy

This chapter will explain what circular economy is and what the roots are for the concept. Before getting deeper in explaining what circular economy is, the author will explain the opposite concept, which is linear economy and its limits. Circular economy has also led to new innovative business models, examples of these new business models will be explained in this chapter.

2.1 Limits of Linear economy

In our world if we observe what happens in the nature, we will see that there is no landfill, materials flow and new materials are created. One species waste is another's food, energy is provided by the sun, things grow then die and nutrients return to the soil safely. But we humans have adopted a linear approach; we take, we make, and we dispose. If our mobile

phone or washing machine break, we throw away the old one and buy a new one. Each time we do this, we use a lot of resources and increase toxic waste.

The linear 'take, make, dispose' economic model relies on cheap and easily accessible large quantity of materials and energy and it is reaching its limits. Businesses are exploring today an alternative model which is circular economy. (Ellen MacArthur 2011)

There are three crisis that make the linear growth model incompatible with our economic development aspirations. First is the finite nature and increase scarcity. Demand for non-renewable like fossil fuel, minerals and metal grew by 50 percent between 1980 and 2000. Construction materials also grew by 74 percent. Between 2000 and 2014, non-renewable materials grew 80 percent. The growth between 1960 and 2014 is 450 percent. This is a strong sign that the growth will still continue.

Second crisis is the increasing stress on renewables. Global water demand is projected to increase by 55 percent between 2000 and 2050. It is expected that in 2050 about 40 percent of population which is nearly 4 billion people will live in areas under severe water distress. The third crisis is the transgression of key planetary boundaries. In 2009, a group of scientists identified a set of nine planetary boundaries which will lead to irreversible environmental changes. Global warming from the increase in greenhouse is a major concern (Lacy & Rutqvist 2015, 6)

2.2 Circular economy roots

Circular economy thinking is not new, it has been mentioned by several economists. In 1798, Thomas Malthus has published "An essay on the Principle of Population". He argued that the world's mushrooming population would eventually diminish the world's ability to feed itself. Other influential figures in these early days included John Stuart Mill and Hans Carl von Carlowitz who advanced theories around responsible management of natural resources. (Lacy & Rutqvist 2015, 6) In 1966, The economist Keneth Boulding in his book "The economics of the coming spaceship earth" used a metaphor of a spaceship to portray earth as a closed system. This metaphor has raised the issue of using natural resources more wisely. In 1990 circular economy term was first used by economists Pearce and Turner. (De Angelis. 2018)

In the last two decades, an extensive review of the literature indicated that circular economy origins are mainly rooted in ecological and environmental economics and industrial ecology.

According to (MacArthur. 2012, 26) more recent theories such as blue economy, performance economy, cradle to cradle, and biomimicry have contributed to further refine and develop the circular economy concept. These concepts will be explained in the following section.

2.3 Contemporary related schools of thoughts

Circular economy has been mainly theorized in the last two decades. There are schools of thoughts which are associated with circular economy and its principles. These schools of thoughts are Industrial Ecology, Cradle to Cradle, Biomimicry, Performance economy and blue economy.

Industrial ecology is the study of materials and energy flows through industrial systems. The Industrial ecology neologism has been promoted by Frosh and Gallopoulos in 1989. The authors call for transforming the traditional model of industrial activity into more integrated one. (Ellen MacArthur Foundation 2015). This approach aims at creating closed loop processes in which waste serves as an input, thus eliminating the notion of an undesirable by product. Industrial ecology encompasses a systematic, comprehensive and integrated view of all components of the industrial economy and their relations with the biosphere.

Cradle to Cradle concept was developed by German chemist Michael Braungart and American architect Bill McDonough. Cradle to Cradle philosophy considers all material involved in industrial and commercial processes to be nutrients, these nutrients are categorized into technical and biological. In Cradle to Cradle there is no place for unused waste. Waste is raw material for new material. It makes the transition from recycling to upcycling. (Braungart et al. 2002)

Biomimicry concept was popularized by Janine Benyus. Author of *Biomimic: Innovation inspired by nature*. Janine defines her approach as a new discipline that studies nature's best ideas and then imitates these designs and processes to solve human problems. Biomimicry relies on the three key principles: nature as a model, nature as measure, nature as mentor.

Closely associated with cradle to cradle principles is the notion of performance economy. How can we create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible? As a response to the environmental challenges of high waste volumes related to mass consumption, and in order to address the structural issues of rising public debt, persistent unemployment and slow economic

growth, Walter Stahel – often labelled as the father of circular economy- challenged businesses to operate a shift from traditional manufacturing to what he calls the Functional Service Economy (Stahel. 2010)

Blue economy was initiated by Belgian businessman Gunter Pauli. Pauli introduces the blue economy as a new way of designing business using the resources available in cascading systems, where the waste of one product becomes the input to create a new cash flow. In this economy, progress is measured in cash and companies depends on banks in order to invest in production. The approach relies extensively on the inappropriate use of natural resources and bears strong environmental and social consequences (Pauli. 2010)

2.4 The definition and concept of circular economy

Since the appearance of circular economy there has been many attempts to define the concept, yet there is no clearly accepted definition. These attempts have been mainly done by consultancy reports and public policy publications. The common thing between these definitions is that they highlight the principles of circular economy. These definitions are either resource or economy oriented.

Resource oriented definitions focus on how materials and resources are managed. World resource forum (WRF. 2012) define circular economy as an industrial economy in which materials flows keep circulating at a high rate without the materials entering the biosphere, unless they are biological nutrients. According to (Hislop and Hill. 2011), the circular economy represents a development strategy that maximises resource efficiency and minimise waste production within the context of sustainable economic and social development.

Economy oriented definitions focus on the economic dimensions and the value creation of redesigning the economy. The European commission defines the concept as a development strategy that enables economic growth while optimising consumption of resources, deeply transforms production chains and consumption patterns, and redesigns industrial systems at the system level.

MacArthur defines circular economy as “*A circular economy is an industrial economy that is restorative by intention; aims to rely on renewable energy; minimises, track and eliminates the use of toxic chemicals; and eradicates waste through careful design*” (Ellen MacArthur 2013, 22)

The circular economy is based on the sustainable use of resources. In circular economy, products will be designed to enable their reuse and recycling, renewable resources will be favoured, services will replace products, and energy production will be based on renewable energy sources. (Sitra studies)

Circular economy is based on three simple principles. First principle is preserving and enhancing natural capital by controlling finite stocks and balancing renewable sources flow. Second principle is optimising resource yields by circulating products, components, and materials at the highest utility at all times in both technical and biological cycles. Third principle is fostering system effectiveness by revealing and designing out negative externalities. (Ellen MacArthur Foundation 2015, 25)

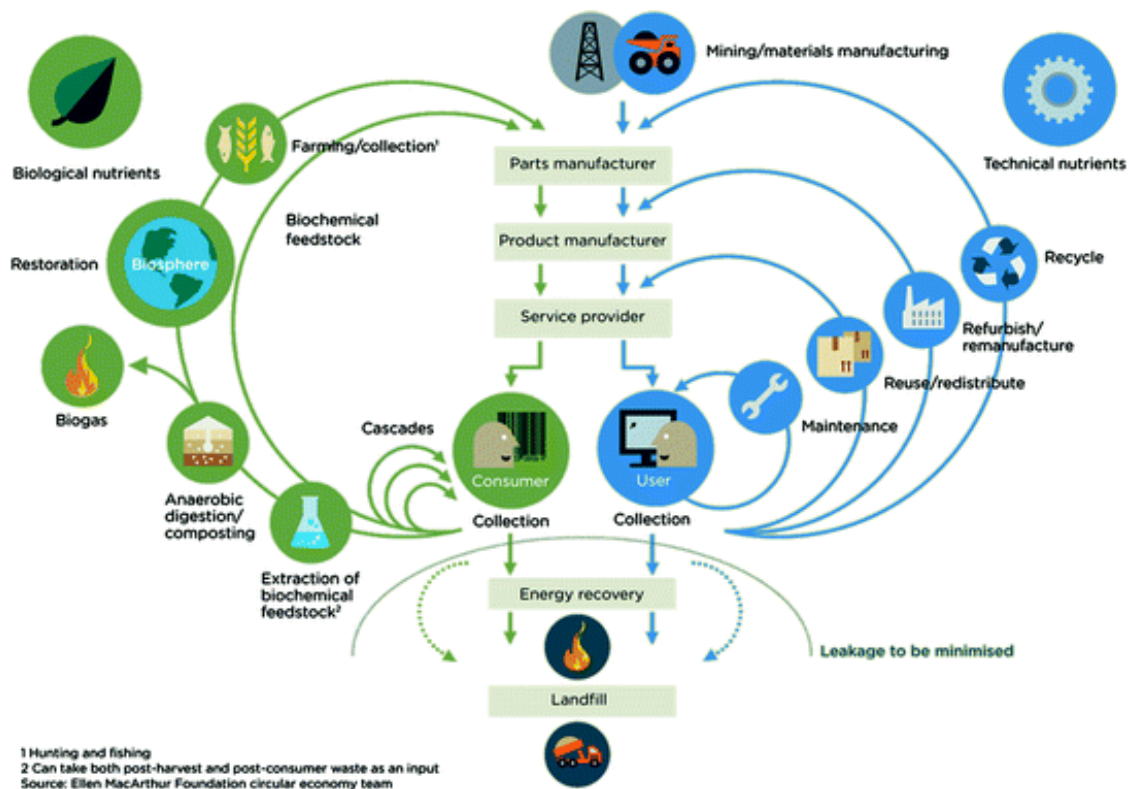


Figure2: Outline of a circular economy (Ellen MacArthur Foundation 2013)

Figure2 explains the outline of a circular economy. A circular economy keeps products, materials and components in use at their highest value at all times. It does so by distinguishing two types of cycles. In the technical cycles; products, components and materials are kept in circulation in the economy for as long as possible. In the biological cycles; the strategy is to restore nutrients into the biosphere where we are building natural capital. Technical cycles

are usually for non-biodegradable materials such as metals. The most effective technical cycles in both maintaining and reusing products. This way value of the products is preserved, and its usage is increased.

Once a product can no longer be used as is, most of its value can still be retained by refurbishing or remanufacture it. If it is impossible to reuse, refurbish or remanufacture a product, the materials in that product can be recycled. When recycled, the value of the product itself is lost but the value of materials is preserved.

Bio degradable materials can be cycled in biological cycles, these materials are renewable by nature, but further value can be created by cascading them for additional applications in different value streams. In a bio refinery conversion processes can produce high value chemicals and fuels. Organic materials that can't be used further can be composted or anaerobically digested to extract valuable nutrients.

By applying the principles of a circular economy to how they approach their processes, products, services and business models, organizations can more effectively manage their resources. This enables them to capitalize on cost savings; unlock new revenue streams; and make themselves more resilient to external shocks and disruption. (Ellen MacArthur Foundation 2013)

Circular economy has a lot of value to economies, companies and consumers. Economies will benefit from material savings, reduction of volatility and supply risks, employment benefits and long-term resilience if economy. Companies will benefit from material bills and warranty risks, improved customer interaction and loyalty, mitigation of product complexity. Consumer will benefit from finding long lasting products, having more variety of products and products that could have secondary benefits. (MacArthur. 2013, 11)

2.5 Circular Economy business models

The emerge of circular economy led to the creation of new innovative business models. These new business models serve to reduce the extraction of natural resources and generating waste. These business models rely on usage of existing materials an input therefore, the environmental footprint is relatively small compared to traditional business models. Some of the new business models employ new technologies to boost the circular economy model. (OECD. 2018)

According to Accenture, there are five circular business models. The first one is circular supplies model. In this model, the focus is on using renewable energy, bio based or potentially completely recycable materials to replace single lifecycle inputs. The second model is called resource recovery model. In this model, waste is recycled into secondary raw material. It is based on innovative recycling to recover almost any type of resource output at a level of value equivalent or even above. The third model is product life extension. It extends the use period of existing products, slow the flow of materials through the economy, reduce extraction of virgin raw materials and reduce waste generation. The fourth model is sharing platforms. Sharing model facilitates the sharing of under-utilized products and can therefore, reduce demand for new products. The fifth model is product as a service. In this model the functionality and use of the product will be offered to customers but the customer will not own the product. (Accenture. 2014)

3 Finland is leading the way to a circular economy

The circular economy topic has been popular in Finland since Sitra has published its report on the topic in November 2014. (Sitra 2015, 1)

Sitra, the Finnish Innovation Fund, is an independent public foundation which operates under the supervision of the Finnish parliament. Sitra was a present given by parliament to Finland on the country's 50th birthday anniversary. The independent fund has been commissioning with the task of probing the future and promoting qualitative and quantitative economic growth. (Sitra 2018)

Sitra has played a key role in establishing the circular economy concept in Finnish society. Juha Sipilä's government has also played a vital role in establishing the concept and set a goal to make Finland a global circular economy leader. (Sitra 2015, 1)

It was estimated that by 2030, the circular economy will have value creation potential of Eur 2-3 billion for Finland's national economy in the following areas: the machinery and equipment and forest industries, food waste reduction, altering the use of real state, private consumption and second-hand trade, and nutrient recycling. The added value potential for the entire national economy is much higher. (Sitra 2015, 3)

The Finnish government has a target to make Finland a global leader in the circular economy by 2025. (Sitra 2016, 1)

3.1 Finland circular economy road map

Finland circular economy road map describes the concrete actions that can foster the transition to a competitive circular economy in Finland. (Sitra 2016, 1)

The motivation for circular economy road map was to turn circular economy into a driver of growth, investment and export for Finland. (Sitra 2016, 1)

In spring 2016 Sitra has launched an initiative to build a circular economy road map for Finland. Experts have been invited to identify best pilots, trial ideas and practices. Participants came from many different sectors including trade unions, ministries, organisations, consumers, and other stakeholders. Hundreds of ideas and inputs were gathered from over 1000 participants at stakeholder events and a prestigious 48-person core group. (Sitra 2016, 1)

The road map has been developed in an open process with stakeholders and under the direction of Sitra. Policy measures, key projects and pilots have been created based on the stakeholder inputs and consultation.

The roadmap is designed to be agile and develop over time focusing in practical actions and continuous systematic change is addition to assessing the actions in relation to the road map's aim to make Finland a global circular economy leader. (Sitra 2016, 9)



Figure 3: Planning the circular economy roadmap

Figure 3 shows the process of planning Finland's circular economy roadmap. At first stakeholders put the goal which is making Finland a leading circular economy country by 2025. Guiding principles has been set for the roadmap. Five focus areas have been identified. These are a sustainable food system, forest-based loops, technical loops, transport and logistics and joint national actions.

Three levels of actions for each focus area have been put; policy action, key projects and pilots. Post implementation assessment of the road map's impact on competitiveness, growth and jobs, including assessment of the impact of the policy actions, key projects, and pilot will be carried out in 2025. An intermediate assessment will be performed at the end of 2018 to ensure the right direction of the road map. (Sitra 2016, 10)

3.2 Common actions for fostering circular economy

In order to achieve the target goals, set by the circular economy road map, Finland has identified the following key policy actions for the focus areas

- A circular economy will be accelerated by means of funding, export promotion, and cooperation between private and public sector,
- Public procurement will focus on purchasing solutions and products that support the circular economy,
- An Education and research policy that enables a circular economy,
- Eliminating regulation barrier and creating incentives,

- Changing the focus of taxation,
- Guidelines and synergies with initiatives in other parts of administration,
- A digital and service centred circular economy,
- Circular economy indicators.

In addition to the policy actions, project actions were identified. The six key projects are;

- Regional cooperation project, it aims to provide sustainable locally produced food in the daily life of Finns,
- A demo plant for the new techniques to process electronic waste,
- Helsinki Metropolitan smart&clean foundation project for acceleration concrete actions,
- Development of bioproducts to replace fossil materials,
- An extensive cooperation model for the ecosystem of Arctic industry,
- Hosting and organizing the World Circular Economy Forum. (Sitra. 2017)

3.3 Circular Economy innovations from Finland

Several companies from Finland saw the potential from circular economy. Here are some examples of companies categorized by different circular economy business models:

Circular supplies: Honkajoki Oy processes by products from slaughterhouses, farms and meat cutting plants and refines them into organic raw materials for various industries. End products can be used for animal or fish feed, biofuel production, soap industry, or soil enhancers. Honkajoki plant uses renewable energy generated by wind mills and water treatment plants clean the water for reusing it. Honkajoki sells their end products as well as the know-how of building the whole plant (Honkajoki. 2019).

Resource recovery: ZenRobotics Oy is a high-tech company for sorting waste using artificial intelligence and robotics system. ZenRobotics Recycler is the first commercially available robotic waste sorting system. The company sells equipment to waste treatment facilities (ZenRobotics. 2019).

Product life extension: Valtra Oy is the leading manufacturer of tractors in Nordic countries. Valtra has managed to remanufacture used gearboxes. Old gearboxes received at the factory are dismantled, cleaned and refitted with new parts to replace worn or damaged ones. This extends the life of old gearboxes and saves the energy, materials required to manufacture new one. Valtra sells the remanufactured gear boxes cheaper than the new one

and they deliver it to the customer without delivery cost and they also provide a warranty (Valtra Oy. 2019).

Sharing platforms: Sharetribe Oy is a market place for underused goods. Sharetribe allows individuals or companies to setup their marketplace website for renting or selling underused goods such as drills or sport equipment. Sharetribe charges founders of platform a monthly fee. Marketplace website founder charges percentage on transaction made through the website. It is a win-win solution, and this promotes the use of resources in the spirit of sharing economy (Sharetribe Oy. 2019).

Product as a service: DriveNow Oy provides a car sharing mobile application which allows users to rent cars in Helsinki region. Through the mobile application users can find nearby cars, after booking the car, the car opens its door when the user approaches the car and unlock it through the app, after putting the pin code, user can drive the car on a pay per minute basis. There is no kilometre limit, but the car has to be parked in certain areas (Drivenow. 2019)

3.4 Finnish citizens role in the transition process

There is no doubt that citizen has a key role in promoting circular economy. Citizen's choices and attitude accelerate the process for companies to commit to circular economy. (Finnish government. 2017)

In (Salonen et al. 2014) research about understanding types of sustainable consumption of Finnish consumers and their future scenarios, more than 30,000 Finnish consumers were interviewed. The study showed that about 53.5 percent of Finnish consumers are extrinsically motivated. These extrinsically motivated consumers represent an enormous potential for social change. All identified consumer groups showed willingness to switch to more sustainable consumption. For some of them sustainable consumption is already a way of life. The research also showed that price has a limited relevance in consumer decisions.

Education is very important in order to create circular economy society. Several circular economy education programs have started in all levels of education in Finland starting from

comprehensive school, high schools, vocational schools, universities and universities of applied science (Sitra. 2019)

In 2017, Sitra has launched Lifestyle Test for anyone to calculate their personal carbon footprint and get tailored tips on how to save money, time and the environment. The test has been done almost 600,000 times. (Sitra. 2019)

3.5 Municipalities role in the transition process

Municipalities have an important role to activate companies and citizens to participate in the circular economy. Finnish municipalities have been very active in promoting circular economy.

In 2017, a regional circular economy roadmap was created for nine municipalities in Päijät-Häme, Finland. The nine municipalities have committed to promote the circular economy in a concrete way. The regional roadmap was recognized as a good practice on Interreg Europe Policy learning platform and European Circular Economy Stakeholder Platform. Päijät-Häme roadmap has five main themes, each them has goals and actions. These themes are closed loops of technical streams to create added value, sustainable business from bio circular economy, towards energy efficiency by sustainable transport and energy solutions, shared economy generates new consumption models and business opportunities, piloting and demonstrating innovative circular economy solutions (Kohtikiertotaloutta. 2019)

4 Circular economy in Egypt

4.1 Egyptian economy

The Egyptian economy has proven resilient and achieved significant economic growth as a result of extensive administrative and economic reforms that expand productivity and achieve sustainable development. This includes administering a strong fiscal policy, cooperative multilateral frameworks for trade. (Egyptian Ministry of International Cooperation. 2019)

The Egyptian authorities have embarked on an ambitious reform program and have taken decisive measures aimed at restoring macroeconomic stability and sustainable public finance. The reform program was launched when its economy faced rising imbalances that led to high public debt, a widening current account deficit and declining official reserves. (International Monetary Fund. 2017)

The implementation of the reforms has led to positive results. In fiscal year 2018, real GDP grew at 5.3%, compared to 4.2% in FY2017. The economic growth is driven by exports of goods and services, public investments, private consumption and the dynamism is seen in the tourism, gas, ICT and construction sectors. (World Bank. 2019)

According to a report published by PWC, the global accounting firm, Egypt was ranked 19th of the most powerful economies in 2030. The report ranks countries by their projected global gross product by purchasing power parity. (Independent 2017.)

4.2 Egypt vision 2030

On Wednesday 24th of February 2016, President Abdel Fattah El Sisi outlined Egypt's progressive sustainable development strategy (SDS), "Egypt Vision 2030". The strategy's goal is to place Egypt among world's top 30 countries in areas of economic and social development. (Egyptian embassy in Washington 2016.)

The preparation for the SDS started already in 2014. several sessions and workshops have been held. Participants from private sector, academia, civil society, government and international development institutions contributed to the development. An electronical portal and social media pages were launched to present the strategy and allow for interactions with all citizens. (Egypt vision 2030)

The SDS consists of 10 pillars categorized in three dimensions social, environmental and economic. For each pillar there are set of key performance indicators for the year 2020 and year 2030.

The energy pillar is aiming at maximizing the efficient use of various renewable resources. The Environment pillar is aiming to preserve natural resources and support their efficient use and investment, while ensuring next generations right. It is also aiming to clean, safe and healthy environment leading to diversified production resources and economic activities.

4.3 Renewable energy outlook in Egypt

Egypt is the most populous country in the Middle East and North Africa region. It is also home to one of the fastest growing population, therefore the demand for energy is rapidly increasing. In 2014 the country has been suffering from regular blackouts due to energy crisis. (Guardian. 2014)

Egypt's economic development hinges on the energy sector which represents 13.1% of overall gross domestic product. Egyptian government has pursued an energy diversification strategy, known as the Integrated Sustainable Energy Strategy ISES to 2035. This strategy involves increasing the development of renewable energy and energy efficiency. (International Renewable Energy Agency. 2018a)

Egypt has the potential to generate up to 53 percent of its electricity from renewable sources by 2030. Pursuing higher shares of renewable energy could reduce the country's energy bill by up to USD 900 million annually in 2030. (International Renewable Energy Agency. 2018b)

Egypt is building one of the world's largest solar parks. Benban solar park is 650 km south of Cairo, it will produce enough energy to power one million homes. This ambitious project is also projected to have a meaningful effect on both the economy and the environment, because Egypt currently relies heavily on fossil fuels. The Benban Solar park which will provide 4,000 jobs, received its major funding of US\$653m from a consortium led by the International Financial Corporation (IFC). Also, the European Bank for Reconstruction and Development (EBRD) and another consortium led by International Development Finance (IDF) together financed the project with US\$500m and US\$335m respectively. (International Finance Corporation. 2017)

4.4 Waste management in Egypt

Waste management in Egypt has become a challenging area legally, technically and commercially. The actual cost of waste is not merely the cost of discarded materials, but the inefficient use of raw materials, excessive use of energy and water, waste disposal and waste treatment. (Waste Management Regulatory Authority. 2019)

An estimated 44.8 percent of Egyptian households dispose their garbage by dumping it into the streets, while 55.2 percent dispose it through private companies and garbage collectors according to the central agency for public mobilization and statistics. (Egypt today. 2018)

Egypt's minister of environment Khaled Fahmy mentioned during his interview on channel "On Life" that 80 million tons of garbage is collected in Egypt each year. He also said that the current garbage collecting system should not continue noting that Egypt is suffering from the problem of solid waste. (ON Live. 2018)

Egypt was ranked one of the top three highest countries in Africa to produce electronic waste in 2017, according to Global e-waste Monitor 2017, produced by the international Telecommunication Union, United Nations University and International Solid Waste Association (ISWA). (Guardian. 2018)

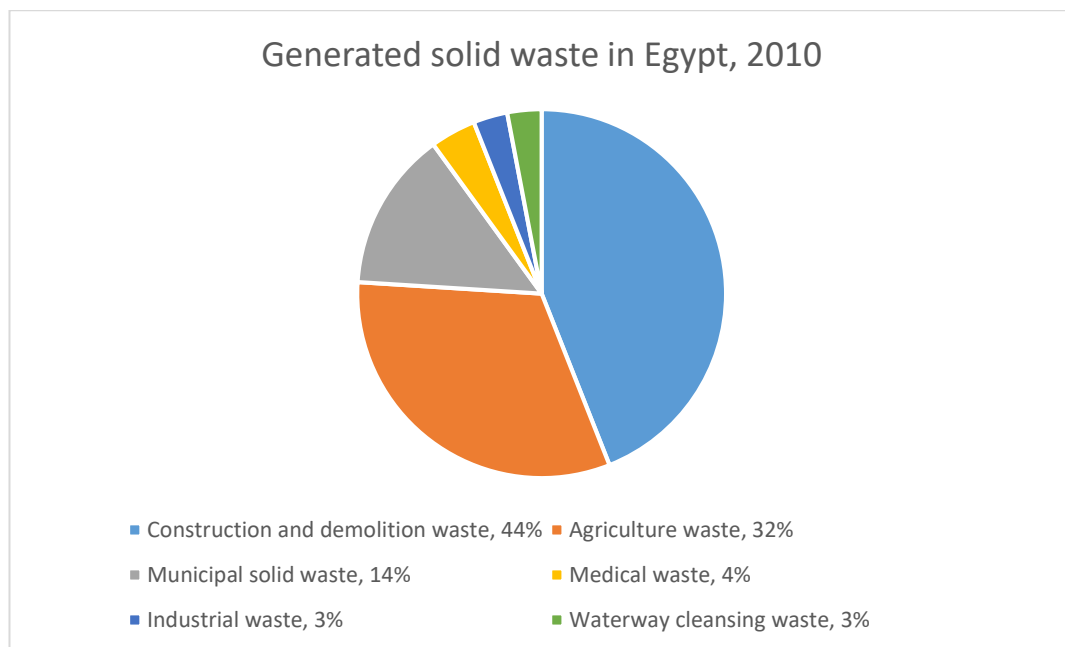


Figure4: Generated solid waste in Egypt in 2010

Source: Central Agency for Public Mobilization and Statistics, CAPMAS, "Solid waste report for the year 2010"

Egypt is undergoing increasing population, vast urbanization and changing consumption patterns that resulted in the generation of huge amount of solid waste which is considered one of the most environmental problem in the region. Figure 4 shows the estimated percentage of solid waste generated in 2010. No wonder construction waste has the largest share, since the construction sector is booming every day and new cities are being built away from the river Nile.

4.5 Environment and renewable energy regulations in Egypt

In September 2014, the Egyptian Ministry of Electricity and Energy has announced feed-in tariffs (FIT) for electricity generated by solar and wind sources as part of the government's efforts to increase the share of renewables in the country's power mix. In October 2016, the Egyptian ministry of Electricity and Renewable energy has announced a second phase of the feed in tariff programme. (New and Renewable Energy Authority. 2019)

Feed in Tariff is a mechanism to encourage electricity generation from renewable energy sources. The Egyptian Electricity Transmission company and distributed electricity companies shall buy generated electricity from producers in a preannounced price. (New and Renewable Energy Authority. 2019)

In January 2019 Egyptian Environment Minister Yasmin Fouad announced that the government has prepared a tariff for the sale of energy from waste (EfW), in cooperation with the Electricity Ministry. Fouad mentioned that the government is implementing a national program in four governates over the next six years for waste management. (Egypt today. 2019)

4.6 Entrepreneurship in Egypt

Most Egyptians are interested in entrepreneurship and are willing to start their own businesses. According to the national report published by Global Entrepreneurship Monitor (GEM) Egypt, more than 73 percent of Egyptians think entrepreneurship is a good career choice. While more than 30 percent are afraid of business failure, 46 percent of Egypt's adult population can recognize good market opportunities for new businesses and more people have the capability and knowledge to be entrepreneurs. (Global entrepreneurship monitor. 2016) Forbes identified Cairo as one of the top ten cities to launch a start-up. (Forbes. 2015)

Entrepreneurship influence is strong among Egyptian youth who are overcoming all challenges to sustain business models that can improve the economy and decrease unemployment. Egypt's core asset is its youth. Young median age in Egypt is 23.8 years compared to 37.9 in the United States and 46.8 in Germany. Cairo is also home to some of the best engineering talent in the Middle East and North African region, and that has to do with the quality of universities they have there. (The Washington times. 2017)

4.7 Circular Economy in Middle East and Africa

As more and more countries adopt circular economy principles and as the Middle East faces the challenges posed by low oil prices and environmental issues such as water shortages, a regional shift towards the circular approach seems to be inevitable.

According to a new report published at the World Government Summit held in Dubai an, The Gulf Cooperation Council (GCC) region can save up to about 138 billion US dollars by 2030 by adopting circular economic approach, corresponding to about 1 percent of the region's cumulative gross domestic product from 2020to 2030.

Recycling and waste treatment targets also play a key part in the GCC national visions, with the UAE aiming for 75% treatment of municipal solid waste by 2021, and Saudi Arabia and Oman targeting 85% and 80% recycling rate, respectively by 2030. (Abdulwahab. 2018)

African countries need to adopt the circular economy to reduce waste production and pollution whilst promoting environmentally friendly and sustainable growth. According to the second Next Einstein Forum held in Rwanda in 2018, Circular economy can help the continent solve environmental challenges.

4.8 Applying circular economy in Egypt

Economic analysis and assistant professor at the faculty of Economic and political Science Alaa Adel-rahman has been sharing his thoughts about applying circular economy in Egypt with Egypt business directory. Mr Alaa believes that circular economy can be applied in Egypt but the dynamics that will govern such concept will be quite different than on paper. Circular economy is aiming to increase the lifecycle of the product and that is different than what Egyptian consumers are used to.

Mr Alaa has mentioned that due to the economic conditions Egypt is going through, such as flotation of the pound and declining purchasing power, Egyptian consumers will be in favour of applying such a concept. For example, repairing or refurbishing their mobile phones and laptops instead of buying new ones. However, spreading the cultural acceptance of using recycled products is important.

He has mentioned that the concept is not that widespread. Major manufacturers and producers will be on board, if the right business environment and regulations are given. (Egypt Business Directory. 2018)

5 Empirical Research and methods

Research is a systematic inquiry that is designed to collect, analyse, interpret and use data. It is one of many ways of knowing or understanding. Research is conducted for many reasons such as understanding, describing, predicting or controlling an educational or psychological phenomenon or to empower individuals (Mertens. 2010)

In this research, the author used inductive research approach. This approach relies in the empirical verification of a general conclusion from a finite number of observations. Inductive method operates from the specific to the general. (Adams et al. 2007)

5.1 Research methods

Research approaches are plans and procedures for research that span the steps from broad assumption to detailed methods of data collection, analysis, and interpretation. Research methods are often divided into three categories: qualitative, quantitative, and mixed methods. (Creswell. 2014)

The distinction between qualitative and quantitative methods is often framed in terms of using words in the qualitative method and using numbers in quantitative method. (Creswell. 2014)

Thesis subject, research question, and theoretical framework influence the decision of the research method. In this thesis, author has chosen qualitative research method.

5.2 Qualitative research

Qualitative research uses a number of methodological approaches based on diverse and theoretical principles. It employs non-quantitative data aims to explore social relations and describes reality experienced by respondents. (Adams et al. 2007)

Both primary and secondary data were used in this thesis. The author has used different kinds of qualitative methods for collecting the data. These methods are observation, interviews, and experience.

Observation method includes TV interviews which were published online, attending circular economy seminars organised by Sitra and field trips to Egypt. Interviews were done in an open conversational manner over the phone and in person during Africa 2018 forum which was held in Sharm Elsheikh, Egypt. The author has been helping a Finnish company specialized in circular economy to enter the Egyptian market. During the past two years, the author made several visits to Egypt together with the Finnish company to explore the opportunities for the company in Egypt. During these visits, the author has been meeting officials, companies, and community organizations. The company wishes not to be mentioned since the information is not public.

5.3 Participant observation method

There are two main ways in which researchers observe direct observation and participant observation. Direct observation tends to be used in areas such as health and psychology. It involves the observation of a subject in a certain situation. In participant observation, however, the researcher becomes much more involved in the lives of the people being observed.

Participant observation is a popular method among anthropologists and sociologists who wish to study and understand another community, culture or context. Participant observation as a research method received bad press when a number of researchers became covert participant observers. Overt participant observation, where everyone knows who the researcher is and what she/he is doing, can be a valuable and rewarding method for qualitative inquiry.

The author has been using this observation method in circular economy happenings in Helsinki. The Speakers at “Circular Economy 2.0” seminar organized by Sitra and French Institute in Finland at Sitra’s premises in October 2018 and “Bio and Circular Finland” program Launch event held on the 27th of February 2019 in Helsinki were:

1. **Mari Pantsar**, director of carbon neutral circular economy at Sitra. Pantsar leads the Carbon-neutral circular economy theme. She steers the strategy of the theme and is responsible for ensuring that all activities related to it direct Finland towards a more ecologically sustainable and competitive society.
2. **Riina Antikainen** director of the program for sustainable circular economy at Finnish environment institute SYKE. She is responsible of researching and finding solutions for the sustainable circular economy and green economy, transition process towards sustainable solutions and use of natural resources.
3. **Pekka Soini**, director general of business Finland and former director general of TEKES.

4. **Jussi Manninen**, executive vice president of solutions for natural resources and environment at VTT.
5. **Laura Juvonen**, executive director of growth and education at Technology Industries of Finland.
6. **Kari Herlevi**, project director of circular economy at Sitra.

5.4 In-depth interviews

In-depth interviews are useful when you want detailed information about a person's thoughts and behaviours or want to explore new issues in depth. Interviews are often used to provide context to other data (such as outcome data), offering a more complete picture of what happened in the program and why. The primary advantage of in-depth interviews is that they provide much more detailed information than what is available through other data collection methods, such as surveys (Boyce. 2006).

In this research, the author conducted in-depth interviews on the phone with following experts:

1. **Dr. Mahmoud Ali**, Environmental manager at Misr Cement Qena
2. **Dr. Atef Elshabrawy**, Contracted expert at UNDP Bahrain
3. **Saied Ashraf**, Sustainability manager
4. **Ismael Hamed**, Environmental engineer
5. **Egyptian Ministry of Environment** expert

6 Empirical research results and data analysis

Empirical research is based on the observable and measurable facts. Empirical data can be gained from the experience and observations, rather than from beliefs, theory and opinions. Empirical data aims to answer the research questions and helps to develop ideas for further research (Punch. 2016)

In this chapter, the empirical results from the interviews and observation will be presented and analysed.

6.1 Views from policy makers and public organisations

All interviewees and speakers have highlighted the importance of circular economy as an economic driver, a key to solve resources scarcity and environmental challenges.

Some of the benefits mentioned were the economic benefits. Circular economy creates job opportunities and new business models. Pekka Soini said " *Saving the world is a good business*". It refers to that circular economy is a great business opportunity but at the same time it does good for the society. It solves environmental and scarcity challenges.

There are some challenges that create the immediate need for implementing the circular economy. Pantsar said " *The global sustainability crisis has three dimensions, climate crisis, bio diversity and over use of natural resources and we should not only treat the consequences, but we must cure the root cause*"

That means that we should neither wait until it is too late nor curing the consequences of these challenges, but we should rather treat the root and cause of the crisis. Riina Antikainen said that world is only 9 percent circular therefore, there is so much work from all of us to do to increase this number.

Some of the speakers have mentioned the success case of Finnish circular economy roadmap and other actions which has been taken in Finland. The good news is many countries have already prepared their own circular economy road map and actions according to Mari Pantsar. Another success case that shows the importance of citizens involvement in Finland is Sitra's lifestyle tests. Kari Herlevi mentioned that more than 600,000 citizens has made the test.

There are many things to do to foster that circular economy implementation. Collaboration between countries is very important starting point. Pantsar said that Finland and Japan agreed to advance global circular economy specially that Finland will have its presidency of the European union in July and Japan will also have the G20 presidency. Investing in education and innovation is very important. Soini said, " *Finland has invested in the last 150 years in education and innovation and Finland today is result of these investments*". According to Kari Herlevi, one of the key success factors is the cross parliamentary support and government support.

Both Jussi Manninen and Pekka Soini have stressed the importance of ecosystems. An ecosystem where companies, research organisations and consumers should work together. Pekka Soini said " *majority of innovations are created in ecosystems*". In these ecosystems

there should be cross sectorial collaboration, open innovation, joint experimentation and value creation. (Circular economy event. 2018)

6.2 Views from Private sector

Some of the companies interviewed were very optimistic about circular economy opportunities and some others were either not having enough understanding of the concept or even confusing it with recycling.

All companies have mentioned that they would be very interesting in adopting circular economy if it has win-win economic value. Some said that the problem is that the change needs financial and legal support from the government.

According to Laura Juvonen, some of the private capital firms has already started considering investing in companies when they have a sustainable strategy. This means that companies should have strategy that outlines how the company create value in a sustainable way for long term.

Egyptian companies and expert had similar opinions about challenges of circular economy in Egypt. Mr. Mahmoud Ali and Dr. Atef Elshabrawy both told that one of the weaknesses of implementing circular economy in Egypt is the lack of know how. Companies don't have enough knowledge of what to do with the waste. Another weakness is the lack of research and development and innovation.

Mr. Mahmoud mentioned that one challenge is that there is no ecosystem where companies can collaborate together. It is impossible for companies to implement circular economy if they can't sell their waste to another near by company that can buy that waste. There should be an ecosystem where companies, universities, government work together. The good news is that the Egyptian government has started gathering companies in industrial areas. Another challenge is supply chain of waste collection. Since it is fragmented, the collection process of waste can be expensive.

6.3 Views from Citizens

In interviews with citizens in Egypt and in Finland, it shows how culture has a big role in the transition process. For example, in Finland, people are aware of the environmental challenges. Finnish interviewees seemed responsible in consumption. They buy only what they need, in fact some buy their fruits and vegetables per cut. Most of Finnish interviewees are sorting out their trash at home.

Egyptian interviewees were the opposite. They buy their fruits and vegetables per kilos. They said that it is shameful to buy second hand cloth, and they don't sort out trash at home.

This shows the importance of citizens when implementing circular economy. For example, active Finnish citizens made the transition process easy in Finland. When it comes to Egypt there should be more education for consumers and financial incentives.

6.4 Views from Finnish companies working in Egypt

The author has been on a field trip with a Finnish company exporting their know-how to Egypt to build a recycling plant. The company had a good impression during the visit. Authorities were collaborative and very much welcoming investors and foreign companies. The governmental bodies have promised that they will provide all the necessary support.

Some of the obstacles that faced the company were the legalities regarding waste collection and waste treatment. The good thing is that the regulations are very well published, but the informal sector is big in Egypt. It is very important to know the role of the informal sector in Egypt. Cultural differences are indeed very important to study before conducting any visit or work abroad.

7 Conclusion

The purpose of this thesis was to research the strengths, weaknesses, opportunities and threats of implementing circular economy in Egypt and what are the learning from the Finnish journey of leading the world in circular economy.

The author has gained a lot of knowledge as well as practical examples. Therefore, it is time to answer the research questions

- **What is circular economy?**

Circular economy is an industrial economy that is restorative by intention. In circular economy renewable energy is used as a source of energy, waste is minimised, chemicals and materials which would affect recycling are minimised. Circular economy is a key to solving scarcity of natural resources crisis and environmental crisis.

- **How is the concept of circular economy understood in Egypt?**

Circular economy as a concept is not very popular in Egypt. People usually think that circular economy is recycling. Circular economy elements are popular in Egypt. Renewable energy is widely used in Egypt and there are several mega projects for wind energy and solar energy. Bio energy and waste to Energy are starting to gain popularity, but still there is not many projects and there is a lack of know how. Recycling is well known in Egypt, but it is limited to some industries.

- **What are the advantages of circular economy in Egypt?**

Circular economy is a key to solve many issues in Egypt. Egypt has garbage and waste problems and by implementing circular economy, waste would be minimised. Egypt has a very ambitious vision for 2030 and most of the goals are very relevant to circular economy. Circular economy has an economic value, it can be a competitive advantage for Egypt in the MENA region. It would also create new jobs and reduce imports.

This is the right time for investors to invest in circular economy in Egypt. The shift is starting, and early investors would have many advantages of what the government is offering from incentives and investment laws.

- **How can Egypt benefit from Finnish experience of circular economy?**

Finland is a global forerunner in circular economy. Collaboration between Egypt and Finland is very beneficial for both countries. Finland is a small market, but it has a lot of innovative

companies with innovative solutions. For example, water treatment solutions, waste management solutions, waste to energy solutions. The demand for these solutions is much higher in Egypt and it is critical situation when it comes for example to clean water sources.

This year 2019, Finland is collaborating with Japan to foster circular economy globally. Finland will have its presidency of European commission in the summer of 2019 and Japan will also have the G20 presidency. Earlier in 2019, Egypt has begun its term for African union presidency, so collaboration between Egypt, Finland, and Japan is very crucial.

<p style="text-align: center;">Strength</p> <ul style="list-style-type: none"> • Environmental benefits • New supportive environmental and renewable energy laws • Economic reforms • Egypt vision 2030 • Growing entrepreneurship 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Lack of know how • Waste management regulations • Supply chain of waste collection • Non-cooperation between companies • Cultural perception of recycled products • Innovation support • Regional competition
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Solid waste problems in Egypt • Growing population • Changes in taxes • New investment laws 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Political instability • Economic crisis

Figure 5: SWOT analysis of circular economy in Egypt

- **What are the strengths, weaknesses, opportunities and threats of circular economy in Egypt?**

Figure 5 shows the key findings for the answer of the main research question of this thesis. Egypt has a lot of strengths for circular economy. These strengths are: the economic reforms, Egypt vision 2030, new supportive energy laws and incentives. Growing entrepreneurship and the young population are also needed for the circular economy innovations.

Despite the several strengths that Egypt has to implement circular economy, there are also several weaknesses which can be solved. Lack of know how has been mentioned in many interviews and sources. Companies don't have enough knowledge on waste management and how to separate and reuse the materials. Circular economy should be also taught in schools and universities in order to have circular economy natives.

Another key weakness is non-cooperation and non-transparency between companies. Ecosystem should bring together companies, government bodies, academia and research institutes. There is still a gap in innovation support in Egypt. Regulation is also another weakness, for example waste collection regulations.

Culture acceptance of recycled materials and public perception is another weakness. There should be more campaigns to educate people about key benefits and also to tell them about the environmental crisis and natural resources scarcity crisis.

There is a lot of opportunities for circular economy in Egypt. The population is growing. The middle-income class is also growing which leads to higher consumption and generation of more waste. New investment laws and tax incentives are very good opportunities.

Threats in Egypt are economic crisis which could be due to political instability. The country had a revolution in 2011 and in 2013. Currently the country is politically stable, and economy is recovering.

8 Summary

The aim of this thesis was to research the strengths, weaknesses, opportunities and threats of implementing circular economy in Egypt and how can Egypt benefit from the Finnish experience.

In conclusion, Circular economy is a key for achieving the united nations sustainable development goals and Egypt vision 2030. Egypt is already suffering from scarcity of water and other resources. Instead of treating the problems of scarcity and environmental challenges, it is more important to treat the roots and prevent such challenges.

Finland is a forerunner in circular economy, and it is very important to learn from Finns and adopt what they have done. Circular economy had impacted the Finnish economy positively by creating new job opportunities and new businesses. In fact, Finnish companies are using circular economy as a new value proposition to export new innovations and solutions to the rest of the world.

It is very important to realise that there is a difference between recycling and circular economy. Circular economy aims to minimise the waste that could occur while manufacturing products.

Some of the key learning from Finland are, importance of interparliamentary and governmental support, investing in education and innovation, ecosystems and collaboration between companies, research institutions, citizens, and municipalities.

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