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**"Sustainable supply chains and circular economy practices."**

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Firma dello studente



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## Acknowledgment

*I would like to thank my family and especially my mom for  
always supporting and believing in me*

*Yours sincerely Always*

*“Alua”*

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## **Abstract**

The world does not stand in one place. We live in a reality where the world is developing at a very high speed. Industrial and technological development has led to significant economic growth. Population growth causes an increase in material consumption. This almost certainly has a negative impact on the environment and society as a whole, such as a lack of natural resources, environmental issues, and natural disasters. Implementing Circular Economy practices and a Sustainable supply chain can significantly decrease the company's environmental impact.

The master thesis aims to demonstrate the Circular Economy and Sustainable supply chain opportunities in Kazakhstan. Apply empirical settings and case study approach by analyzing Kazakhstan and Almaty city as platforms for CE and SSC implementation. Provide theoretical background related to CE and SSC. Moreover, the thesis demonstrates the analysis of Kazakhstani companies, by providing primary quantitative research. Based on quantitative research, the thesis suggests the policy and managerial implications for effective SSC and CE implementation to Kazakhstani government and companies.

Keywords: Circular economy, Sustainable supply chain, Sustainability, Kazakhstan, Almaty.

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## List of Abbreviations

SSC Sustainable supply chain

CE Circular Economy

EU European Union

UN United Nations

SC Supply chain



# 1. Introduction

“We do not inherit the Earth from our ancestors,  
we borrow it from our children.”

---

## Native American Proverb

A large amount of disposal and garbage have a negative impact on our planet, it clogs our oceans with plastics and other wastes, animals are suffering from pollution, and different diseases may be provoked by chemicals (Green Living Ideas, 2013).

Companies should pay increasing attention to the environment and maintain *sustainability* by using various mechanisms to reduce harmful emissions into the atmosphere.

One of these mechanisms is the implementation of *sustainable supply chains* and *circular economy* practices. The usage of these mechanisms not only prevents a negative impact on the environment from the company's activities but also maintains a competitive advantage and it can significantly reduce production costs.

Unfortunately, we are still seeing a trend when companies tend to use the traditional linear *take-make-consume-dispose* production model. The application of this traditional model not only harms the environment but is also ineffective in terms of economic aspects.

Every aspect of the *take-make-waste* system should be transformed, including the way companies allocate resources, how they make and use products, and what they do with the materials afterward (EMF, 2022). Only then we can build a circular economy that rewards everyone within the planet's boundaries (EMF, 2022).

Companies should apply a transition to *circularity* in order to maintain their sustainability. Ellen Macarthur Foundation (2020), suggests the *Circular economy* as a framework for systemic solutions to global issues such as climate change, species extinction, waste, and environmental damage.

Unfortunately, the implementation of *sustainable supply chains* and the transition to a *circular economy* is not an easy process. There is a big probability that companies can meet a lot of barriers and obstacles in their transition way.

However, today, there is a trend that a growing number of multinational corporations have committed in recent years to only work with suppliers who adhere to social and environmental standards (HBR, 2020).

According to one of the leading audit and consulting British companies Ernst & Young (2022), the new frontier of sustainability – is supply chain. They serve as key activators for the organization's overall sustainability goals and pledges (Ernst & Young, 2022).

Concerning the globalization of SSC and CE, it should be noted that global organizations are increasingly focusing their attention on these issues. For example, in March 2020, the European Commission approved a new Circular economy action plan (CEAP). It is a key component of the European Green Deal, Europe's new agenda for long-term growth (EU, 2020).

The innovative strategic plan announces initiatives spanning the entire product life cycle. It focuses on different aspects such as product design, circular economy processes, and sustainable consumption, with the goal of preventing waste and keeping resources in the EU economy for as long as possible (EU, 2020).

Such big companies like Philips, Renault, and Nike have already implemented SSC and CE principles, which significantly helped them to achieve sustainability and improve their economic performance. SSC and CE must become more than just a trendy concept, but also a way of life in the operations of any company, regardless of size, location, or field of business.

### **1.1 Purpose formulation**

The purpose of the Master Thesis is to show the Circular Economy and Sustainable supply chain opportunities in Kazakhstan. Analyze the readiness and openness of Kazakhstani companies for adopting CE and SSC mechanisms, to develop and suggest policy and managerial implications for effective CE and SSC practices implementation for Kazakhstani government and companies.

To achieve these goals, the thesis sets the following tasks:

- Provide the theoretical framework related to CE and SSC;
- Provide examples of world-leading companies, that successfully implemented CE and SSC;
- Analyze Kazakhstan and Almaty city as new and potential platforms for CE and SSC practices implementation;
- Analyze the current situation in Almaty related to resource consumption by 3 main sectors (agriculture & food production, construction, and light industry);
- Demonstrate Kazakhstani companies' examples with successful CE and SSC practices implementation and the tools which were used for achieving these concepts;

- Provide primary data about companies in Kazakhstan related to CE and SSC analysis, which was gathered during the survey conduction process;
- Formulate suggestions and recommendations to Kazakhstani companies and government for a CE and SSC practices implementation.

## **1.2 Thesis organization**

- The first & second parts explain what sustainable supply chain and circular economy concepts include; reports the definitions of SSC and CE. Moreover, the second part explores the sustainability concept; sustainable supply chain management; supply chain models. Although, the second part provides the advantages of CE, barriers, and examples of world companies with successful CE implementation. The second part is concluding by analyzing Kazakhstan and Almaty as platforms for CE and SSC practices implementation.
- The third part analyses Almaty city's resource consumption by three main sectors: agriculture & food production, construction, and the light industry. Moreover, it provides Kazakhstani companies examples with successful SSC and CE implementation.
- The fourth part analyses the primary data which was gathered by me within the master thesis framework. The fourth part includes methodology, independent variables, bar charts, and cross-tabulation analysis.
- The final part concludes the master thesis and provides recommendations for Kazakhstani companies and the government for effective CE and SSC implementation.

## 2. Literature review

### 2.1 Sustainable Supply Chain: definition and importance. Sustainable and green supply chain management

#### 2.1.1 The definition of Supply chain

Today, in a rapidly developing economy and with increasing competition among various companies, creating an efficient and sustainable supply chain is one of the key points for ensuring sustainable development and maintaining the level of competitiveness of any business.

Most companies put a lot of effort in order to optimize their supply chain and make it as efficient as possible. The reason is that the major amount of companies put revenue growth as the main goal, instead of perceiving the concept of cost reduction (AMR, 1997).

The definitions of the *supply chain* from different years are provided below:

The first and very basic definition is that a *supply chain* is a group of firms that provide products or services to the market (Lambert et al., 1998).

Another definition was provided by Ganeshan and Harrison (1995) who claimed that supply chain is the network which unites distribution and facilities, that may provide different functions such as procurement, production of goods from these materials, and delivering of these goods to the final customer. The given explanation can be considered the classic definition of the supply chain, which originates from the end of the last millennium.

However, professors Sunil Chopra and Peter Meindl (2001) offered their *supply chain* definition. They defined the *supply chain* as a network that consists of all the stages, which are aimed to satisfy the customer's requests. Moreover, the *supply chain* not only includes manufacturing or supplying activities, but also includes logistics, retailers, customers and etc.

It is important to note that Chopra and Meindl (2001) viewed the supply chain as a cyclical one. This point of view is considered traditional. Supply chain processes, according to Chopra and Meindl (2001), are split into a series of loops, each loop is performed at the interface of two subsequent phases of a supply chain. Each cycle is separated from the others through a stock, allowing it to act independently, optimize its own processes, and not be hampered by "problems" in other cycles.

As for a contemporary concept of the *supply chain*. Adam Hayek, a professor at The Hebrew University of Jerusalem, in his article "The Supply Chain: From Raw Materials to Order Fulfillment" (2022), proposed the supply chain as a network which is composed by

individuals and organizations who are engaged in product manufacturing and delivering processes.

Figure 1, illustrates a typical supply chain model. The model starts with the extraction of the raw materials and finishes with the product delivery to the final customer:



Figure 1: Supply chain's main stages diagram

Source: TechTarget (2019)

### 2.1.2 Supply chain models.

The Institute for Defense and Business (2020), provided 6 different models that can be implemented in order to manage the supply chain:

- *The Continuous Model.*

A continuous model is a supply chain that is designed to deliver goods on a regular basis. The above model ensures a consistent flow of products and resources. It can only exist in organizations with stable supply and demand. Companies with a strong brand and stable production activity can become a great platform for this model implementation. These organizations tend to have low volatility in demand, as a rule, the demand for products of such brands is stable. A good example of a company that successfully implemented a

continuous supply chain model is PepsiCo. Regardless of the season or market conditions, the company maintains a large customer base with low volatility in demand. PepsiCo has configured its delivery system to receive ingredients for its products on a continuous and regular basis (IDB, 2020).

- *The Fast Model.*

This supply chain model is normally used by companies that produce short-market lifecycle products. Companies that regularly change their products tend to apply this model. The idea of the model is to deliver the product to the market, until it will lose its trendiness. Nike is a good example of an organization that actively applies this model in its production activities. Whenever there is a fashion trend for certain clothes or shoes, Nike quickly adapts and creates its own fast supply chain for the production of a product until the fashion for that product passes (IDB, 2020).

- *The Efficient Model.*

The efficient supply chain model is frequently used by companies that operate in highly competitive market environments. This model requires too much effort for achieving a high-efficiency level in the delivery logistics sector. The model is focusing mostly on inventory management activities and production efficiency. General Mills applies this model in its production activity. Due to the fact that General Mills operates in a very competitive environment with a significant amount of competitors. The company generates its profit mostly by decreasing the cost amount along the supply chain. In this case the efficient model helps the company to maintain its competitive advantage with the least losses (IDB, 2020).

- *The Agile Model.*

The Agile Model is based on four essential components: *virtual integration*, *process alignment*, *network base*, and *market sensitivity*. Companies should use all of these four components as synergy in order to maintain the Agile model. The *virtual integration* is based on the idea that each business should track the market changes. *Process alignment* as a component means, that the company should distribute the supply chain responsibilities across the whole business. The component *network base* means that every performer in the supply chain makes an equal contribution. The last component *market sensitivity* helps the company to switch the production rate according to the demand changes in the market (IDB, 2020).

- *The Custom-Configured Model.*

This model is a perfect fit for companies that provide customization services to their customers. The custom-configured model is the synergy between agile and continuous flow models. L.L. Bean - is a company that successfully applied this model. L.L. Bean used this

supply chain model in backpack production, by providing the option of backpack customization individually for each customer, this strategy significantly helped the company to maintain its competitive advantage in the market (IDB, 2020).

- *The Flexible model.*

The last supply chain model is based on 3 components: *part separation*, *accurate algorithms for stockpiling*, and *flexible planning*. The flexible model enables businesses to meet high-demand peaks as well as long periods of low demand. The flexible model requires the usage of supplier diversification and production process automation. Staples company uses this model in producing and delivering stationaries. During the back-to-school season, Staples anticipates high demand and stocks its stores with extra stationary. The company gained this “flexible” approach by having a significant amount of suppliers (IDB, 2020).

### 2.1.3 Sustainability. The importance of a sustainable supply chain

In (1987) the World Commission on Environment and Development provided its explanation of *sustainability* which is currently used in literature and scientific papers. They defined the concept of *sustainability* as “a development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

According to Lysons and Farrington (2006), the concept of *sustainability* is based on 3 main sectors economy, environment, and sociality:

*Economic sustainability* is concerned with the preservation of natural resources that are critical to ensuring economic growth and further development. These resources can be both renewable and non-renewable.

*Environmental sustainability* is focused on the systems which support vital activity, such as soil and natural resources, moreover, they are necessary for production activities that maintain an economic level.

The last concept *social sustainability* has a focal point on the human effects which influence economic systems, such as the abolishment of poverty and hunger in regions with a low standard of living, healthcare availability, civil rights, racial discrimination, etc (Lysons & Farrington, 2006).

It is also worth noting that the United Nations is considering the issues of spreading and maintaining the principles of sustainability. They developed a list of goals which is aimed to achieve Sustainable Development. The goals are demonstrated in Figure 2:



Figure 2: Sustainable Development Goals

Source: UN (2022)

In the contemporary world supply chains have become highly complicated and strategically effective. Constant work for improving supply chain functionality and maintaining its sustainability is one of the key success factors for every company regardless of the size or scope.

Moreover, it is worth adding that initially, professionals were maximally focused on such criteria of the supply chain as Quality, Cost, and Reliability, but taking into account the trend of growing intra-industry competition and a rapidly developing economy, the Sustainability of the supply chain was added to the above criteria (Harvard Business Review, 2018).

Supply chain sustainability is closely connected to the management of social and environmental activities. It has an impact on the goods or services which the company produces, during its whole lifecycle.

According to the Harvard Business Review (2018), the idea of a sustainable supply chain is to create a waterfall of sustainable practices that flows throughout the whole supply chain, from the very initial phase to the last one.

Mark Nutburn (2019) in his article “Five benefits of a sustainable supply chain” provided the advantages, which sustainable supply chain can bring to the organization:

- *Sustainable supply chain decrease an amount of environmental influence.*

It is a popular misunderstanding that reducing a company's negative environmental impact is expensive. However, the company can accomplish the environmental impact



reduction by simply saving natural resources. Companies can observe returns by decreasing the amount of waste and increasing the efficiency of buildings, transport and equipment.

- *Sustainable supply chain improves supply's continuity.*

According to Nutburn (2019), companies should apply the diversification to their supply chains in order to avoid dependency on chain's links. One of the best strategies that a company is able to implement in order to achieve supply chain sustainability, is to have multiple suppliers.

- *Protects companies from harming their image*

Sustainability improves the lives of all workers along the supply chain. It has a positive impact by guarantying good working conditions and the amount of payment to the employees.

- *A sustainable supply chain opens partnership opportunities*

Company with a sustainable supply chain is appealing to other companies looking to partner with it. The companies environmental attitudes may align with other companies. As a result, new opportunities for collaboration arise.

- *New business opportunities.*

A sustainable supply chain can help in gaining more business while demonstrating environmental credentials, companies may supplement this by integrating different environmental standards. (Nutburn, 2019).

Within the framework of today's realities, organizations from all over the world are implementing the principles of sustainable development in almost every business process, whether it is the use of environmentally friendly materials, or a constant desire to create the most favorable working conditions for their employees.

#### **2.1.4 The difference between Circular and Linear SC**

The Circular idea is based on free-waste production. This approach can significantly reduce the amount of waste and have a positive impact on the environment. It is not a secret that the world's natural resources are limited, and their irrational usage can lead to negative consequences such as shortages, natural disasters, and other climate issues. Each organization should be responsible for the rational usage and distribution of resources. A circular supply chain implementation is considered the first step in achieving sustainable development of any kind of business.

The circular supply chain refers to the transition from a linear to a circular pattern, i.e. instead of transferring the raw materials to waste, alternatively company can recycle or repair them (Banker, 2018).

Circular supply chain implementation helps the company not only reduce the negative impact on the environment but also to save a significant amount of financial expenses, by reusing raw materials, the company frees itself from purchasing new ones (Banker, 2018).

Moreover, the circular supply chain helps the company to take from the product as many benefits as it can, which also provides great growth opportunities for the firm. Today, the disposal of raw materials after the expiration of their life cycle tends to be considered irrational, since the company misses the opportunity to turn waste into profit by recycling them.

A good example of Circular Supply Chain usage – is the Nike company. Nike launched a “Reuse-A-Shoe” program, which encouraged its customers to bring their old shoes to the local Nike stores for recycling. After that, the old shoes were used as raw material for producing the new ones. This approach helped Nike not only improve its Sustainability level but also significantly enhance its financial performance (Nike, 2022).

Harvard Business Review (2021), provided another example of a company that gathered benefits by implementing the circular supply chain. The UK’s Rype Office decided to use the high-quality part from second-hand furniture, in order to produce the new furniture. The company was actively searching for second-hand furniture with the aim to use its part in future production. By using an effective sales strategy, and adding value to this kind of produced furniture company could succeed in its niche. Nowadays office brand is offering their furniture to large companies in the UK. This sustainable approach helped UK’s Rype Office to completely succeed with new business model implementation (Soufani & Loch, 2021).

The idea of the linear supply chain can be identified as the simplest one, it is based on the concept of transferring the raw material into the product, and finally, dispose of it. In accordance with EMF (2013), the linear approach “take-make-dispose” is not efficient in today’s realities, moreover, it makes the economy scarcer, more volatile, and high-priced.

From an economic point of view, this kind of approach cannot be considered a cost-effective one. The issue is that the product is disposed of by the end user after its use, absolutely the same thing happens directly with the raw materials that were used for that product manufacturing. It is important to say that such an approach directly harms the environment by increasing the level of pollution in the atmosphere. Figure 3 demonstrates the difference between Circular and Linear Supply Chains:

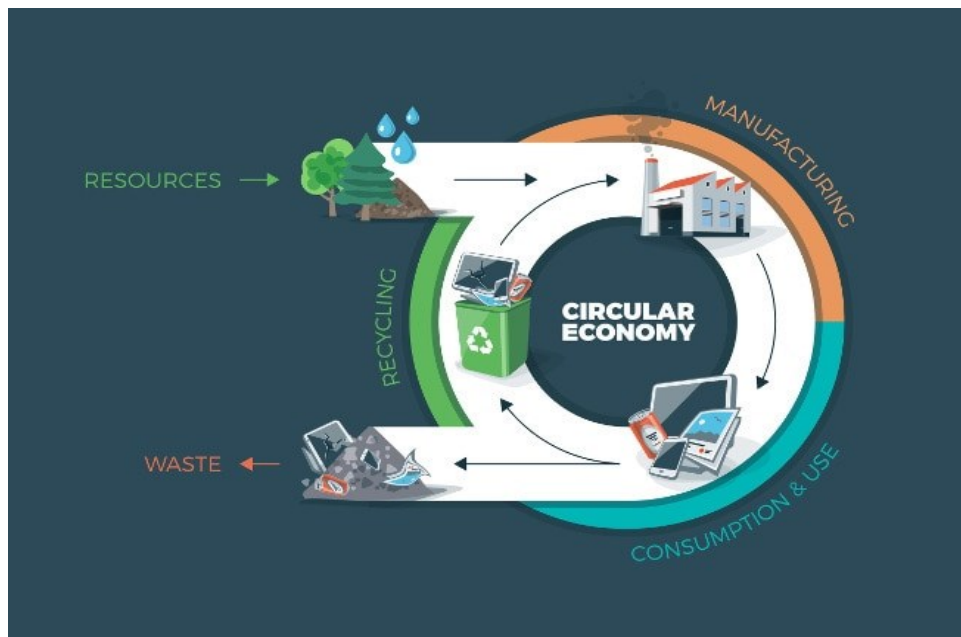


Figure 3: The difference between Circular and Linear Supply chain

Source: Robinson (2016)

Implementing a circular supply chain allows the company to maintain and even increase its competitive advantage. When natural resources are strictly limited, the world's top companies make every attempt to implement the circular concept as much as possible, and these types of companies are becoming trendy over the years. People are more likely to trust these companies because they have a strong sustainability position, which also leads to an increase in brand awareness.

In addition, it is worth saying that in order to achieve the most visible and tangible effect from the introduction of a circular supply chain, firms should digitalize the processes that form the basis of the supply chain as much as possible, one of the best solutions is the introduction of ERP systems such as Cisco, Sap, Oracle, Acumatica, etc.

### 2.1.5 Sustainable supply chain management

It is clear that any supply chain, regardless of whether it is linear or circular, cannot be strategically effective without proper and competent management. Without a well-defined strategy and coordinated management, the supply chain will not be able to bring tangible benefits to any company, regardless of its size or type of activity. Before discussing supply chain management, it is necessary to understand what an organization is and what aspects are inherent in it.

The old-school authors Harold Koontz and Cyril O'Donnell (1968) defined an organization as creating power-based relationships, that ensure proper coordination between employees, both in the vertical and horizontal organizational structure.

Michael Hugos (2018) in his book “Essentials of supply management” provided a very good example of an effective supply chain. In his book, Hugos cited Napoleon as an example of understanding the supply chain and organization concept. The great commander marked: “The army marches on its stomach”, where the army is a company, and the stomach is the supply chain. In other words, it means that the company will never be able to function properly without a sustainable supply chain. It is worth noting that Napoleon was an excellent strategist, his strategic way of thinking allowed him to achieve great results in the military field. His approach suggests that even a hundred years ago, people understood the approximate concept of an effective supply chain.

According to Hugos (2018), Supply chain management is a purposeful activity, which focuses on the coordination of different functions in the company such as production, inventory, and transportation, in order to accomplish efficiency and market responsiveness.

Another definition identifies supply chain management as a business-focused approach, which manages a company's product from beginning to end in the most efficient and transparent possible manner. For example, raw materials are converted into finished goods and delivered to customers in a timely and efficient way (Romaine, 2022).

The final goal of supply chain management is to satisfy both customers and stakeholders at the same time (Romaine, 2022).

According to Ed Romaine (2022), supply chain management includes five steps:

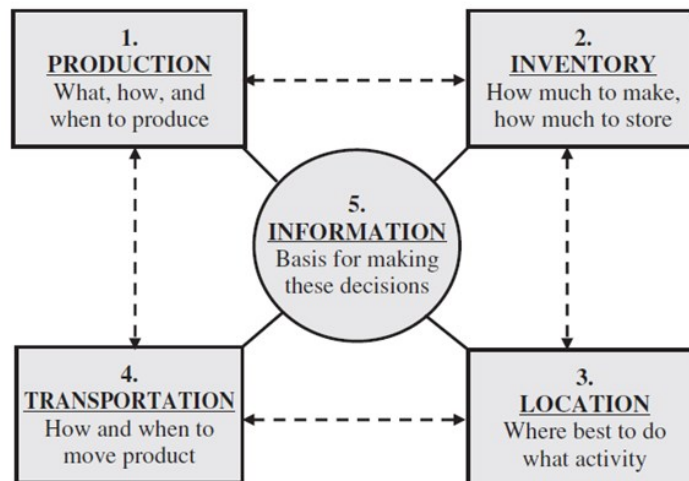
- **Designing.** This step includes the process determination and the development of tools and technologies for realizing it.
- **Planning.** Defining the ways of strategy implementation, the investment amount, and performance indicators such as ROI, ROE and etc.
- **Executing.** Establishing supply chain partners and vendors, managing inventory, and optimizing distribution from the first to the last stage.
- **Controlling.** Ensure that the supply chain flows function efficiently and continuously.
- **Monitoring.** Monitoring entails establishing and measuring key performance indicators (KPIs) and ensuring that the operations' performance is in line with the company's goals (Romaine, 2022).

According to Hugos (2018), supply chain management requires continuous improvement in two categories: permanent customer service and internal operational efficiency.

Customer service entails direct interaction with customers, such as high-quality order fulfillment, the delivery process, customer satisfaction through the provision of a specific product or service, and after-sales service (Hugos,2018).

Internal efficiency means that an organization gets a satisfactory rate of return from its investments in the company's assets and main activities. In addition, accomplish synergy which lowers the operating and sales expenditures, and saves some additional financial resources (Hugos,2018).

Hugos identified five major supply chain drivers:



#### RESPONSIVENESS versus EFFICIENCY

Figure 4: Five major supply chain drivers

Source: Hugos (2018)

The synergy between responsiveness and efficiency in each of these sectors will significantly improve the company's supply chain and performance as a whole by decreasing the operating and inventory expenses.

One of the largest wholesale and retail chains, Walmart, is an excellent example of a company with the most strategically efficient supply chain. Walmart's success lies in the fact that its supply chain consists of a small number of links. The company buys goods directly from the manufacturers, which allows them to avoid extra charges from intermediaries. The company selects only those suppliers who can guarantee a constant and uninterrupted supply of products at a stable purchase price. Moreover, in order to avoid additional costs associated with the transportation of goods, the company prefers suppliers located in close proximity the Walmart's warehouses (Smartsheet, 2017).



Figure 5: Walmart's Supply Chain

Source: Smartsheet (2017)

Walmart uses the Big Box type of supply chain. The idea of this type of chain is to choose the strategically selected manufacturers which locate in good strategic positions. The usage of this supply chain gives a great opportunity to achieve economies of scope and increase the company's efficiency (Smartsheet, 2017).

### 2.1.6 The concept of green supply chain management

The green supply chain is becoming increasingly important, especially in today's reality, when preserving natural resources is one of the top world priorities. A green supply chain has similarities with a sustainable supply chain, but the main difference is that a green supply chain is aimed to improve environmental health, whereas a sustainable supply chain is aimed to reduce the impact of their performance on the environment so that industry can continue to function in the future. The idea of the green supply chain is to reduce environmental destruction, and prevent as much as possible water, air, and atmosphere pollution, by implementing "green" practices in business processes. The concept of a green supply chain contributes to the development of the company's sustainability.

Moreover, companies that implement green supply chain practices tend to gain a competitive advantage, by achieving a high level of customer satisfaction (Khan & Qianly, 2017). With new innovations and techniques for environmental sustainability protection, the green idea is becoming popular, as evidenced by the implementation of corporate social responsibility, green production, pollution prevention, recycling, remanufacturing and etc (Khan, 2018).

The idea behind the green supply chain is to introduce sustainable green environmental processes into the main supply chain. Processes such as supplier selection and material

procurement, product development, production, and assembly, can all be included in the business processes (Khan, 2018).

Figure 6 illustrates a green supply chain for child's crib production.

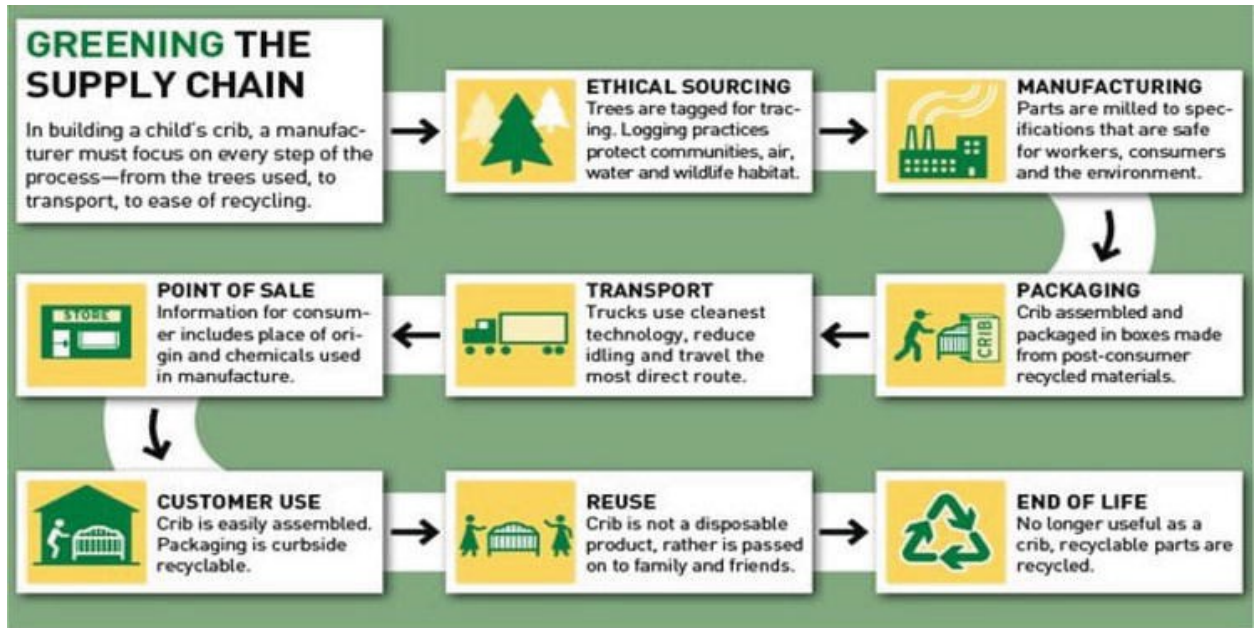


Figure 6: Green supply chain of child's crib manufacturer

Source: Khan (2018)

Syed Abdul Rehman Khan (2018), in his book "Introduction of Green Supply Chain Management", wrote about 6 success factors in green supply chain management:

**1. Ethical leadership/internal management.**

Senior management should provide support and encourage employees for internal environment management. Internal management plays a crucial role in the green practices adoption process (Luthra, et al., 2016).

**2. Customer management.**

Customers play a significant role in green supply chain management concept (Kumar, et al., 2014). Nowadays, it is very important to implement green practices in the supply chain, in order to maintain a competitive advantage and increase the level of demand by satisfying customers (Omkareshwar, 2013). It is necessary to cooperate with customers, in order to gain all the advantages of a green supply chain (Khan, et al., 2016).

**3. Supplier management.**

Strategic supplier collaboration improves motivation systems and accelerates the implementation and development of creative environmentally focused ideas. The implementation of green practices in an economically effective and innovative way can

significantly improve the operative and economic performance of the company (Kaushik et al., 2014).

#### **4. Competitiveness.**

The different studies has demonstrated that competitiveness can play a crucial role in the green supply chain adoption process, due to the fact that it can trigger the protection of environment (Wang et.al., 2013).

#### **5. Social.**

With state governments' increasing attention and customer awareness of environmental issues, businesses should share the information about the influence of their supply chain on people (Shen et.al., 2015).

#### **6. Regulatory.**

Due to the strict environmental regulation of the country's economy, firms have to reduce the negative influence of their supply chain activities on the environment and nature (Mangla et.al., 2014). Companies should conduct eco-friendly strategies in order to prevent harmful influences on the ecosystem.

Khan (2018) suggested green practices which should be adopted in order to make the supply chain more efficient and increase productivity, and gain environmental growth:

The first practice is **green material sourcing**. The idea of this practice is to search for and purchase raw materials which can be transformed into new products after their usage, in other words, can be reused or recycled (Eltayeb et.al., 2011). Carter and Rogers (2008) conducted research in order to identify the measure of green material sourcing on a company's economic performance. They came to the conclusion that by successfully implementing a green procurement strategy, product costs can significantly decrease, firms' financial and environmental performance can be significantly improved, and as the result, their market reputation also will be sustainable.

Moreover, green procurement was divided into five main elements:

- design operation management,
- supply chain management,
- environmental authentication,
- ecological and external environmental management (Yang et al.,2010).

They defined the green procurement process as an efficient instrument that can reduce the amount of atmospheric pollution (Yang et al.,2010).



The second important practice is **green marketing**, this practice includes a variety of marketing activities. These activities promote the product in an eco-friendly and attractive way (Groening et al.,2017).

The idea of **green distribution and warehousing** is to decrease the waste amount, reduce the energy consumption rate, improve the organizational performance itself, and add value to the green products by performing the warehousing process (Khan et.al., 2016).

The next step is to adopt **green management** in order to increase the efficiency of business processes, significantly save the costs, and achieve sustainability and other environmental goals (Kang et.al., 2010).

The green supply chain can not be imagined without **green manufacturing** implementation. This way of manufacturing can improve production efficiency by applying green resources, reducing the number of production costs, and enhance the quality of the product (Zailani et al., 2015).

The **ecological design implementation** includes the active usage of eco-friendly technology processes, and green raw materials in the product development area, in other words, green design is aimed to reduce the harmful environmental influence of the future produced product (Luthra et.al, 2016).

The next green supply chain practice is **green transportation and reverses logistics** implementation. Logistics expenditures can be reduced by improving transportation system efficiency, and increasing the customer's loyalty level (Govindan et al., 2015).

The last but not least important practice which was suggested by Khan (2018), is the usage of **renewable energy and biofuels**. Without a doubt, worldwide logistics activities and supply chain operations rely primarily on energy, particularly fossil fuels, which can trigger some negative consequences like climate change for example. (Khan, 2018).

According to (Anable et.al, 2015), operations related to logistics require the consumption of a large energy amount. The application of renewable energy and bio-based fuels can significantly enhance the company's performance, and transfer the company to the eco-friendly one (Gold et.al., 2010).

## 2.2 Circular economy: definition, importance, and benefits

### 2.2.1 The definition of Circular economy

For the time being, our planet is suffering from a wide range of negative consequences, including high levels of air, water, and soil pollution. These climatic issues are caused by the irrational use of natural resources and improper disposal methods of human wastes or emissions associated with production.

The concept of Circular economy can be defined as one of the proper solutions that can significantly help provide the rational usage of natural resources and decrease the harmful impact on the environment.

According to Hislop and Hill (2011) The CE can be considered as a strategy which increase the efficiency of resources, reduce the amount of waste, and develop the economy towards sustainability.

Ellen MacArthur Foundations (2013) identified the CE as a regenerative activity that substitutes the end-of-life concept with the usage of renewable energy and the removal of waste through the restoration of the design of materials, systems, products, or business models.

The Circular Economy can actually decrease the investment risk and significantly punch the risk-adjusted returns (EMF, 2020). The CE can reduce the risk, and increase the sustainability of the company, by integrating the diversification models, separating the economic growth from economic and environmental aspects, and making attempts to forecast stricter regulations from the government and changes in customer preferences (EMF, 2020).

According to Ellen MacArthur Foundations (2013). The circular economy is based on three principles:

- The elimination of waste and pollution;
- The circulation of products and materials;
- The implementation of the natural regeneration process (EMF, 2020).

The circular economy is based on the ideology of a gradual transition to renewable energy sources, which will certainly positively impact people and the environment (EMF, 2020).

There are 3 principles the CE is focused on: *Reduce-Reuse-Recycle*, mostly known as the 3R principle.

*Reduce* – is the process of decreasing the volume of materials which is used in production and consumption (Ying & Jun, 2012) (Ghisellini et al., 2015).

The second principle, *Reuse* focuses on increasing the product's value by improving the time strength of the product (Ying & Jun, 2012) (Ghisellini et al., 2015).

Last but not least is *Recycle* which recreates and renews the resources after their usage (Ying & Jun, 2012) (Ghisellini et al., 2015).

Figure 7 known as a Butterfly diagram clearly visualizes the principle of Circular Economy work:

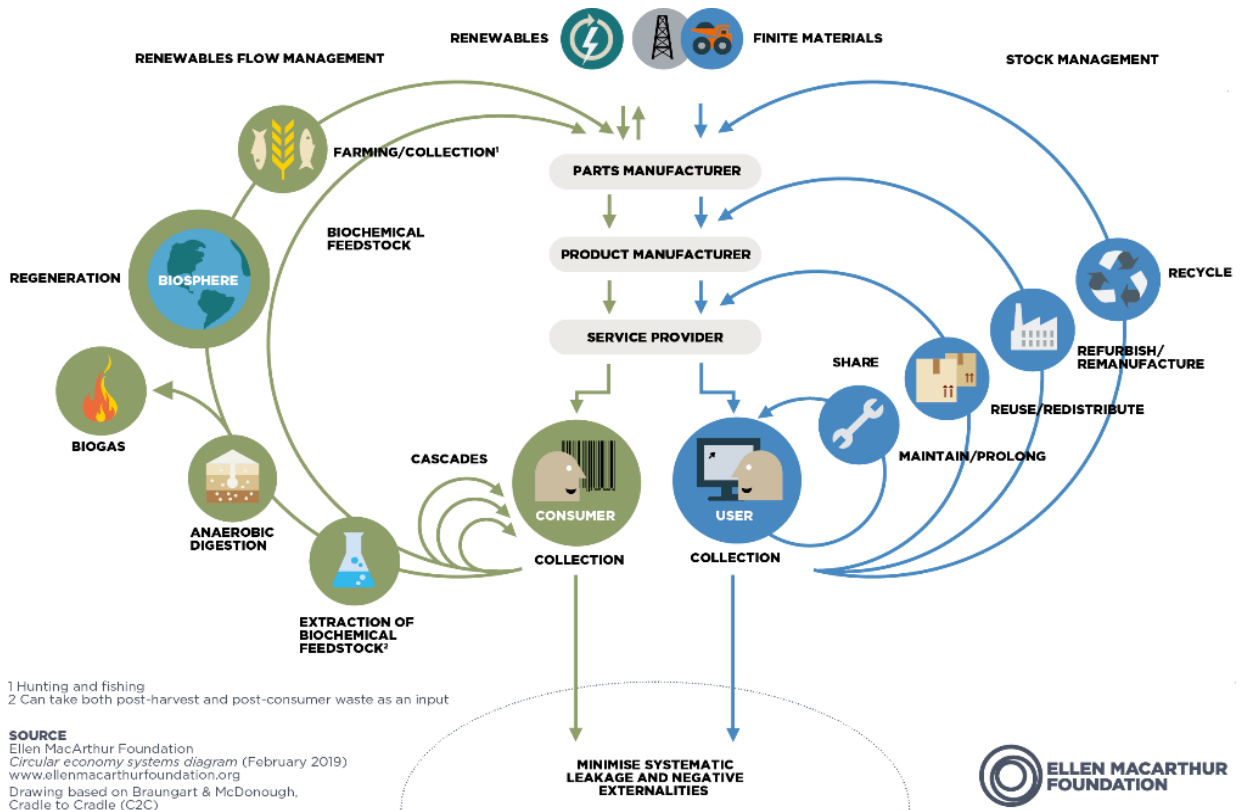


Figure 7: The butterfly diagram

Source: Ellen MacArthur Foundation (2019)

The Butterfly diagram shows the continuous flow of materials in the circular economy. The diagram consists of two main cycles the first one is the *technical cycle*, and the second is the *biological one* (EMF, 2019).

The *technical cycle* consists of products and materials which circulate through 4 main processes: reuse, repair, remanufacture, and recycling (EMF, 2019).

The *biological cycle* is based on nutrients consisting of biodegradable materials that are returned to the Earth for the purpose of its natural restoration (EMF, 2019).

## 2.2.2 The Circular economy advantages. Barriers to shifting to a CE

The Circular economy can be considered a good alternative to the traditional linear economy, which gives a great opportunity to extract as much value as possible from the product, and also it is an effective tool that has a positive influence on people and the environment. According to McKinsey Research (2017), the CE is able to increase the firm profitability by reducing its dependence on natural resources.

Ellen MacArthur and McKinsey published research in 2015 that clearly demonstrated that the Circular Economy approach can increase resource productivity in Europe on 3% by 2030, saving approximately €600 billion per year and €1.8 trillion in total by 2030 (cited in McKinsey Research, 2017).

McKinsey during their Research activities studied around 28 industries where the CE can be implemented, and research results clearly demonstrated that almost every industry can adopt approximately three or four of six potential circular-economy activities, which are able to significantly improve the company's performance and moreover reduce the costs (McKinsey Research, 2017).

There are 6 activities:

- *Regenerate*: The process of switching to energy and materials which can be considered renewable;
- *Share*: Providing the maintenance and design activities that will help extend the lifetime of the product;
- *Optimize*: Product efficiency improvement and waste reduction process;
- *Loop*: The process of "Closing the loop" by keeping the products always remanufactured and recycled;
- *Virtualize*: Delivering goods and providing the services in virtual space;
- *Exchange*: Applying the new technologies in the production process and replacing the old material with the ones (McKinsey Research, 2017).

Another great advantage of CE, which was provided by McKinsey Research is that a Circular economy has an opportunity to create a business from waste. It is not a secret that economic growth due to the introduction of active production can be defined as a trigger that increases the standard of living. However, such rapid growth has negative consequences in the form of an increase in the volume of consumer and industrial waste.

The issue of waste disposal is critical, and businesses typically spend a significant amount of money just to manage it. The circular economy plays a role as a proper solution to

this problem, and it can become an “engine” that is able to convert disposals into financial streams.

Plastic news (2015), from the United Nations University, demonstrated the value creation opportunities which can be benefited by the Circular economy, for different types of products on three aggregation levels. Figure 8 demonstrates three opportunities and three value creation levels.

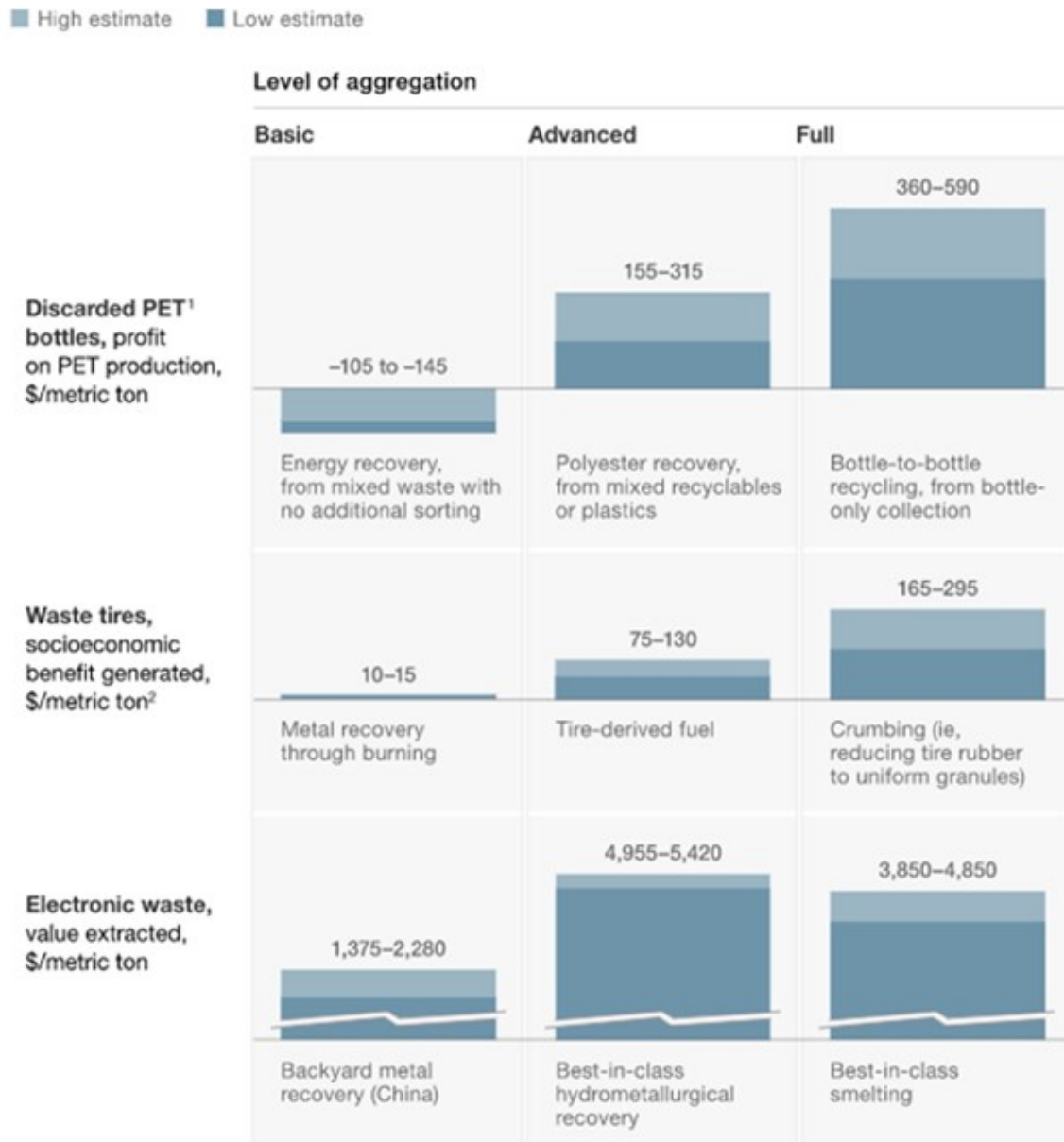


Figure 8: Three opportunities and three levels of value by Circular economy

Source: United Nations University (2015)

For an instance, Polyethylene terephthalate bottles in the mixed waste can be burned. This approach is considered the simplest one, but the economic return from the energy will not be high enough (McKinsey Research, 2017).

However, recycling or recovering activities with the same bottles will bring more financial benefits (McKinsey Research, 2017).

Another example is taken from the tire production industry, commonly the metals are extracted from tires by burning them in open backyard fires, but this approach tends to bring negative consequences for human health, and become the cause of climate issues. On the other hand, crumbling the tires or deriving the fuel from them, will be more economically beneficial (McKinsey Research, 2017). The same principle works with electronic waste (see Figure 8).

Mathy Stanislaus (2018) in his article published on the World Resource Institute web page, clearly identified the barriers that can significantly slow down the transition to a circular economy:

The first barrier focuses on the idea that the transition to CE cannot be considered convenient for customers. The author of “Zero Waste Home” Bea Johnson in her bestseller book teaches people to live without any waste. In her book, she suggests to people change their normal habits to circular ones, like bringing their own bags to the supermarket or using organically degradable bio packaging. Of course, such measures will significantly reduce the amount of waste. However, there would be a question of whether people are really ready to change their habits and break out of their comfort zone or not (Stanislaus, 2018).

The second barrier is that, in some countries, especially in developing ones, there is no waste recycling system or it is poorly developed, specifically in the case of plastic. The world’s statistics show that nearly one-third of plastics are not collected by a waste management system, which leads to pollution of the ocean, rivers, lakes, and other natural sources (Stanislaus, 2018).

The majority of the waste is deposited in Far Eastern countries such as China, Indonesia, Vietnam, the Philippines, etc. To overcome this barrier, it is necessary to implement quality management aimed at proper waste recycling and introduce waste-free production principles. (Stanislaus, 2018).

Another barrier is related to the lack of innovative recycling technologies. Unfortunately, the majority part of plastics is recycled or remanufactured into lower-value applications. The statistics show that only two percent of plastics are recycled into a product of approximately the same quality. In order to overcome this barrier, governments and companies should invest in contemporary innovative recycling technologies, which will be helpful to the CE transition process (Stanislaus, 2018).

All of these barriers are easily overcome with a competent and serious approach to waste recycling and the implementation of Circular economy principles.

### 2.2.3 The examples of companies leading in the Circular economy

Nowadays, some of the largest companies in the world found a Circular economy as a great opportunity to extract value, build sustainability, and succeed in social and environmental aspects. These companies can be defined as companies with a high level of responsibility. Ellen Macarthur Foundation provided great examples of multinational companies, which succeed in the Circular economy.

EMF provided an excellent example of Philips company, which was founded in 1891. Now this company is one of the largest producers of not only household appliances but also medical equipment.

Philips is clearly focused on the introduction and dissemination of the CE principles into the all company's areas. In order to effectively achieve this approach, Philips integrated the principle of CE into its DNA and encouraged all the employees to follow this idea (EMF, n.d). Now Philips applies effective management and tries to implement the Circular economy approach as the main company's philosophy (EMF, n.d.).

The company's management applies several actions which are aimed to transfer the company into a circular one:

- The company requests medical institutions to give their old equipment to Philips. Philips, in turn, can repair it, extend its life, or convert large medical equipment, such as an MRI, into smaller medical equipment.
- Philips has its own, "Philips Circular Edition" system. This system helps to gradually transfer the company to the circular one. The idea of this refurbished system is to prolong the lifetime of medical equipment. The system plays a key role in reducing the usage of virgin raw materials;
- It is also important to note, that company switched to a new more effective business model. The idea of this model is to provide service contracts instead of ordinary one-way transactions. This approach clearly shows that the company is more than ready to take full responsibility for its products (EMF, n.d.).

Figure 9 shows the Circular Economy practice in Philips:

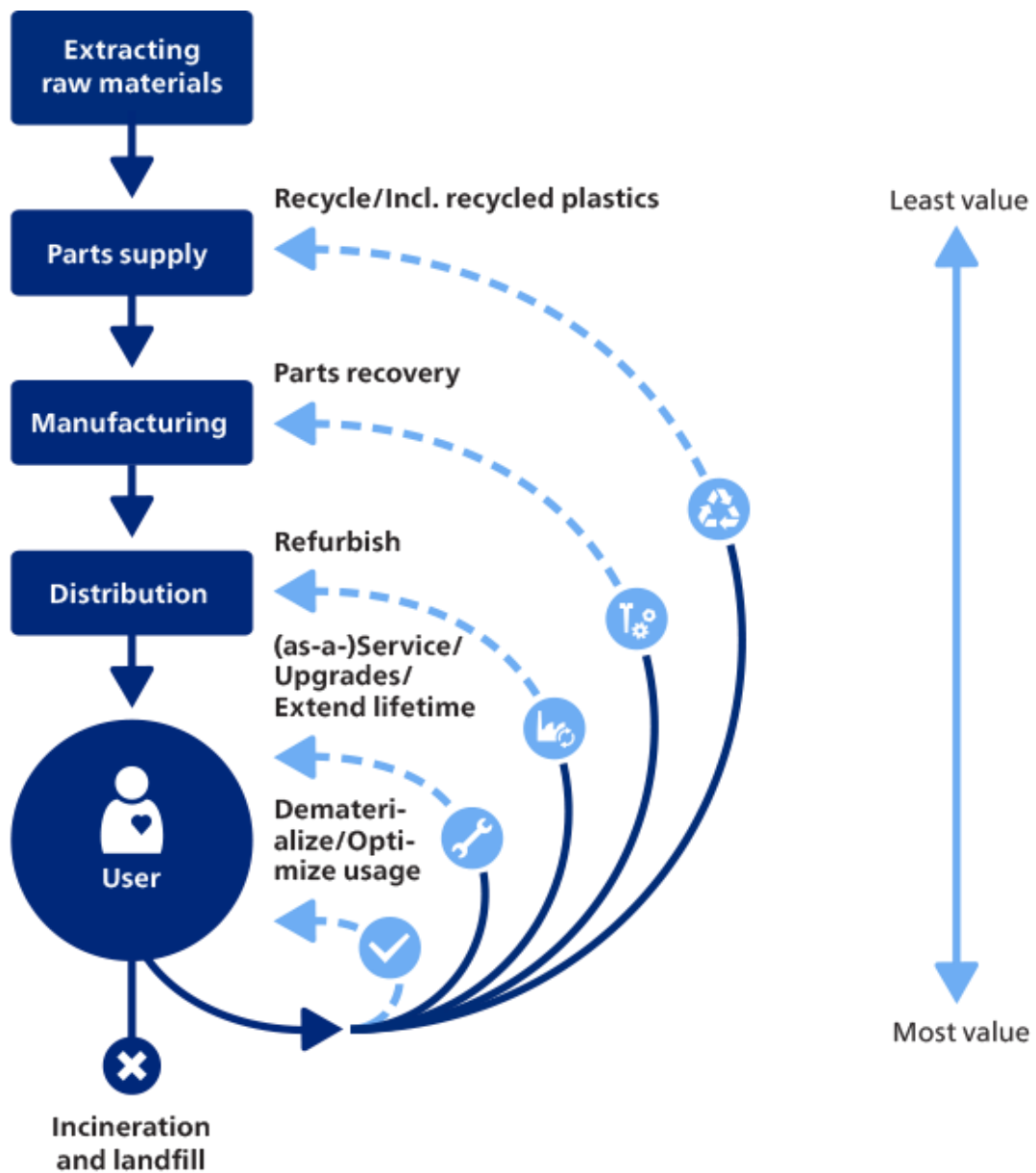


Figure 9: Circular economy in Philips

Source: Philips's official web page (n.d.)

Philips switched from the linear model *Take-Make-Dispose* to the circular one *Make-Use-Return*, by using the 5 returning loops: dematerialize/optimize, service, refurbish, parts recovery, and recycle.

The transition to CE helped Philips build an effective strategy, become the leader in the technology industry, and make a Circular Economy the main philosophy of the company.



In addition, Philips set CE ambitious goals which they are planning to achieve by 2025:

- 25 % of total revenue will be generated from circular products and activities;
- close the loop by accepting professional medical equipment trade-ins and handling responsible repurposing;
- integrate CE into their areas and send zero waste to landfill (Philips web page, 2022).

Another great example that was provided by the Ellen Macarthur Foundation (n.d) is the Renault company, which can be identified as a pioneer who adopted the principles of CE into its production process. The French company was founded in 1899, and nowadays Renault is one of the leading companies in the automotive industry (Renault Group's official web page, n.d.).

Renault's main motivation for adopting a circular economy is to extend the life of vehicles and components and to reuse materials with the aim to reduce the use of virgin materials (Renault Group's official web page, n.d.).

The company provided several Circular economy actions:

- Remanufacturing the vehicle components;
- Plastic recycling activities;
- Extending the life of electric batteries (EMF, n.d.).

In 2020 Company successfully established the Re-Factory, which can be considered the first Circular Automotive factory in Europe. The Re-Factory is located in the western part of Paris, and this factory is planned to be the headquarter where the circular activities will take place (EMF, n.d.).

Re-Factory is an ecosystem that consists of four interconnected and complementary areas:

- The company launched the special program "Retrofit". The program's idea is to extend the lifetime of vehicles. The vehicles are planning to be converted from thermic vehicles to fewer carbon ones, which will help to reduce pollution levels and provide a positive impact on the environment;
- The introduction of the Re-energy concept. The concept's goal is to give a second life to batteries and explore new energy sources;
- Re-cycle, the integration of resources optimization processes to support the ecosystem and environment;
- Re-start the innovation and knowledge-sharing campaign. The idea is to provide deep research about the circular economy (EMF, n.d.).

Renault company is one of the best examples of a company, which could build an effective and sustainable Circular economy system. According to the company's CEO Luca de Maio, Renault company is one of the most CE-engaged car manufacturers in the world (Renault Group, 2020).

## **2.3 Sustainable supply chain and Circular Economy opportunities in Kazakhstan**

### **2.3.1 Kazakhstan. The new platform for SSC and CE practices implementation**

The Republic of Kazakhstan is a unitary state which is governed by president. Kazakhstan is one of the largest countries in the world, it is in 9<sup>th</sup> place, and the territory's total area is 2.724 million square kilometers (Official President web page, n.d.). The population amount is around 19 million of people.

The country the border with Russia (7,591 km in the North and West); China (1,783 km in the East), Kyrgyzstan (1,242 km in the East), also with Uzbekistan and Turkmenistan in the South (2,351 km and (426 km); the cumulative amount of border km with other countries is 13,200 km (Official President web page, n.d.).

Moreover, Kazakhstan is one of the largest countries in the world which does not have direct access to the World Ocean, most of the country's territory is covered by desert (44%); semi-deserts (14 %); steppes and forests occupy 26% and 5.5% (Official President web page, n.d.).

The country also includes the Caspian Sea and the Aral Sea. There are also a large number of different rivers and lakes in the territory of the state (Official President web page, n.d.).

The Republic of Kazakhstan has a very rich mineral resource base. It obtains more than five thousand deposits, and the estimated value of those deposits is tens of trillion dollars, which makes the country very attractive to potential investors (Official President web page, n.d.).

Kazakhstan is one of the top countries with a large margin of zinc, tungsten, barite, silver, lead chromite and etc (Official President web page, n.d.). It is also very essential to say that the country, obtains a significant amount of oil and gas. The country is in the 9<sup>th</sup> place in the world with oil reserves, and the major part of oil and gas resources is located in the West part of the country (Official President web page, n.d.).

Due to the fact that Kazakhstan is an oil-rich state, the country can be considered the most economically developed country in the region of Central Asia. In addition, the Republic of Kazakhstan is the leader in terms of GDP and purchasing power, moreover country links

China and Europe in terms of business and logistics (The Hong Kong Trade Development Council, 2021).

Figure 10 demonstrates the real GDP and inflation in Kazakhstan from 2017-2021:

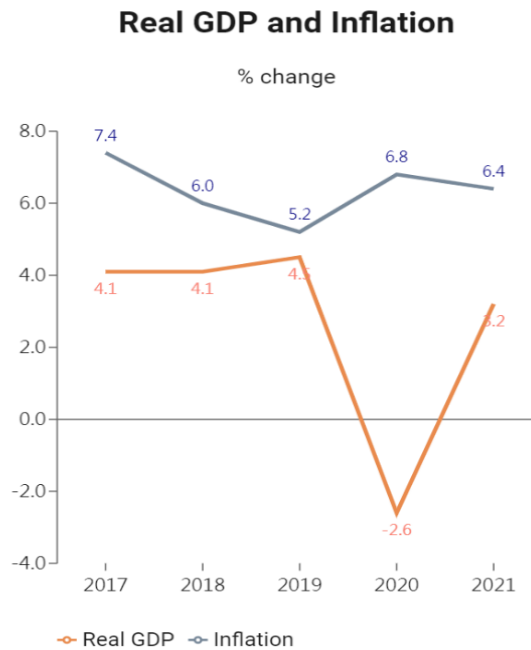


Figure 10: Kazakhstan's Real GDP and Inflation rate

Source: World Economic Outlook Database (2021)

Figure 10 demonstrates that from 2017 to 2019 the Real GDP was more or less stable with a small fluctuation rate, however, in 2020 you can observe a sharp jump down, almost twice, due to the Covid-19 pandemic. The inflation rate was fluctuating, with a significant decrease in 2019. Figure 11 demonstrates the GDP by sector dated 2020.

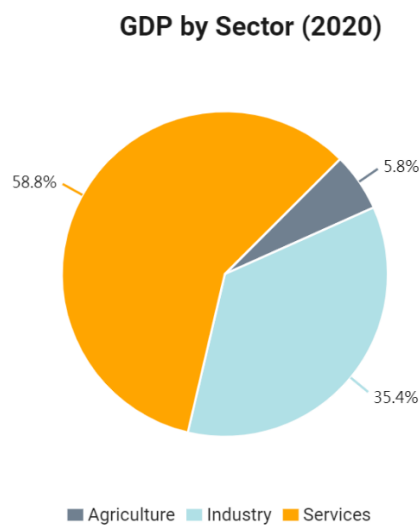


Figure 11: Kazakhstan's GDP by sector 2020

Source: UNCTAD (2022)

From Figure 11 we can see that the services sector accounts for the majority of GDP 58.8%, the next sector is industry 34.4 %, and agriculture is in minority 5.8 %.

Nowadays, many Asian and Central Asian countries have risen from poverty as a result of rapid economic growth. The large number usage of natural resources provoked negative impacts on the environment such as high levels of carbon emissions and an increasing amount of waste.

In June 2022, the government of Kazakhstan and representatives of the European Union gathered in the capital city of Kazakhstan – Astana, in order to discuss the launch of the National Action Plan on Sustainable Consumption and Production (SCP) (EU, 2022). The goal of this project is to help Kazakhstan in switching to a Circular economy, become resource-efficient, and decrease the level of carbon effect and pollution (EU, 2022).

According to the Head of Cooperation at the EU Delegation - Mr. Johannes Stenbaek Madsen (2022): “SCP plays an essential role in transferring the country to a green economy. By implementing the EU strategy in Central Asia, Kazakhstan could take concrete actions in order to effectively implement the SCP program” (EU, 2022).

In 2013 the government adopted the Strategy Kazakhstan 2050, the political course is focused on providing clear and effective actions that will help Kazakhstan to transit the country to a green and circular economy (Concept for the transition of the Republic of Kazakhstan to Green Economy, 2013). The program’s idea is to significantly improve the standard of living, and create a rational nature resources usage model in order to prevent the possible shortage of resources for the future generation.

According to the estimated forecasts, the transition of the country toward the green economy will have positive several outcomes:

- a GDP increase of 3%;
- the creation of additional 500.000 job positions;
- the significant growth of new industries and etc. (Concept for the transition of the Republic of Kazakhstan to Green Economy, 2013).

In order to resume Strategy Kazakhstan 2050, we created a picture that summarizes the main initiatives and ambitious targets that Kazakhstan's government is planning to implement by 2050:



Figure 12: Strategy Kazakhstan 2050

Source: Elaboration from Concept for the transition of the Republic of Kazakhstan to a Green Economy (2022)

### 2.3.2 Almaty city. The starting point for SSC and CE practices

Almaty can be considered the perfect city from the SSE and CE points of view, due to its advantageous geographical location, the city plays a role as an essential economic hub in the Central Asia region.

Almaty is the largest city in Kazakhstan. Almaty - the city which is highly developed in scientific, industrial, financial, and cultural aspects. The city locates in the South part of the country (Eye on Asia, 2022).

According to recent data, The Republic of Kazakhstan achieved great economic growth (about 4.4 %) in the first quarter of the current year (2022), the trigger for such a significant economic performance was the increasing amount of export (Astana Times, 2022).

In addition, the sectors like service, trade, construction, and agriculture demonstrated great results in terms of economic growth. It is worth noting that Almaty was the key city that accelerated this fast economic growth, the economic indicators increased by 18 % in the first quarter of 2022 (Astana Times, 2022).

Almaty is the commercial and financial heart of Kazakhstan, with roughly one-third of all Kazakhstan's businesses registered in the city (Hoozgard, 2017). Based on the data which was provided in February 2022 by Kazakhstan's Ministry of Trade, it can be examined that the majority part of trade activities took place in Almaty. Trade can be considered the main engine of the city's economic development, in 2021 the retail trade amount exceeded around 9.8 US billion dollars (Devonshire-Ellis, 2022).

First of all, before analyzing the CE opportunities in Almaty, it would be essential to assess the ecological background of the city. Unfortunately, excessive urbanization and rapid economic growth have a significant number of drawbacks, in addition to benefits.

Today, one of the most critical issues for Almaty's citizens is ecology. Almaty is a unique city by its nature. The city is surrounded by mountains, which gives the city amazing views. However, unfortunately, mountains restrict the movement of air masses, which prevents for atmospheric emissions to leave the city (Hoozgard, 2017).

Besides that, the rapid development of light and heavy industries, as well as a large number of transport emissions, hurt the city's ecology and, as a result, the health of its citizens (Carlsen, L., et al., 2013).

Analyzing Almaty as an ideal platform for SSC and CE practices, it is essential to remember the "One belt One road" initiative, which was launched in 2013 by China.

This initiative provided for full-scale investments in the amount of 889 billion euros in such sectors as a port, railway, road, cable, and pipeline infrastructure (Sternberg, T., 2017). The ambitious idea of the project was to connect China with other countries of the Eurasian continent, 60 countries took a participant in the project (Sternberg, T., 2017).

Almaty is the most important hub in terms of cargo routes. It is worth adding that Almaty plays an important role in terms of connecting Europe and China, which is aimed at spreading the principles of the SSC and CE practices (Central Asia Program, 2018).

Based on Europe and China's experience in circular economy and sustainable development, and with proper investments in the economy of Kazakhstan, Almaty has a great chance to create its own model of the circular economy (Hoozgard, 2017).

Figure 13 clearly illustrates the 14 most developed economic sectors in Almaty. The amount of contribution in terms of Gross Regional Product employment is shown on the left side of the diagram, and the resource consumption amount and waste/disposals volume is demonstrated on the right side:

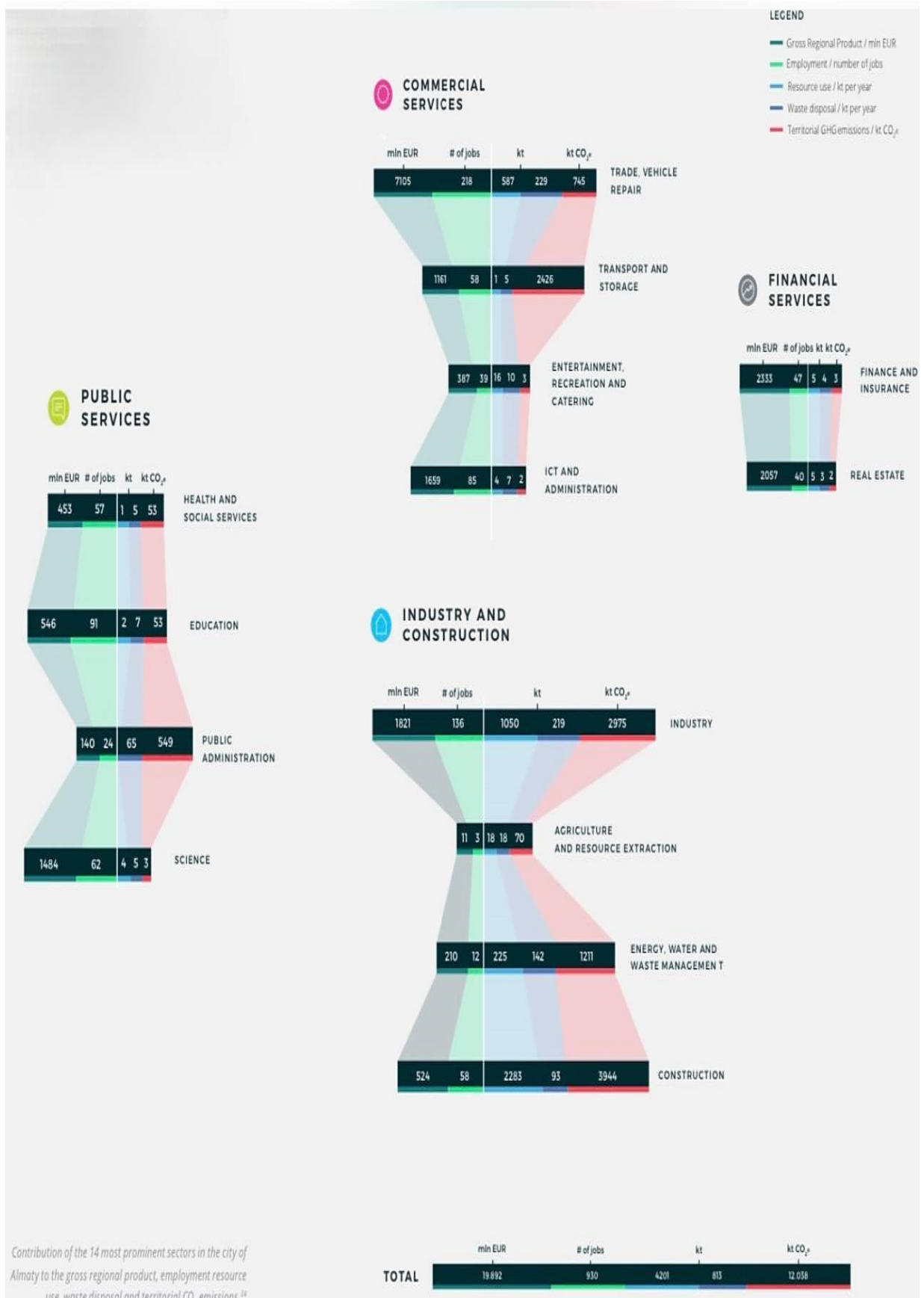


Figure 13: The most developed sectors in Almaty

Source: OECD (2017)

By analyzing Figure 13 it can be seen that organizations that provide governmental, financial, and commercial services can be considered the most effective from the economical point of view, these sectors provide the major amount of job places. The sphere of trade in the city of Almaty plays a significant role in terms of socio-economic importance. However, the industry and construction sectors, despite their economic efficiency, have the most negative impact on the environment, due to the fact that these two sectors produce the largest amount of waste.

The widespread adoption of the SSC and CE principles in Almaty will significantly reduce Kazakhstan's reliance on commodity exports and diversify the economy in the goods and services sectors. Moreover, significantly reduce the carbon footprint and prevent environmental problems in the country (Hoozgard, 2017).



### 3. Empirical setting. Case study approach

#### 3.1 Almaty-resource consumption by 3 main sectors: agriculture & food production, construction, industry

We conducted research using a sectoral analysis which was illustrated in the form of a Sankey diagram. The analysis and Sankey diagram were performed by Jelmer Hoozgard (2017), who is an expert in the field of the Circular economy. The Sankey diagram is based on official statistical data and strategic documents provided by the state of the Republic of Kazakhstan.

As previously mentioned, to visualize all the resource flows used by Almaty's city annually, a Sankey diagram for 3 main sectors: agriculture & food, construction, and industry was used. The Sankey diagram illustrates the full overview of materials and resources used in Almaty by 3 sectors annually, and what happens to them after their usage.

The given Sankey diagrams contain **Input** and **Output** resources. The *input* resources before transferring to *output* ones should go through such stages as **processing, usage, and waste management**.

Based on Figure 14 (provided below the table), we made the summary Table 1, which includes the analysis of each element in the **input** category; the **steps** that each input element goes through (**products, usage, waste management**); and the **output** after all the processes performed:

*\*measured in thousands of tones*

Element	Input	Products	Usage	Waste management	Output
<b>Water</b> 225kt	The city extracts around 225kt, of drinking water from wells and mountain sources.	Drinking water 225kt	Tap water	Usage and losses;  Wastewater treatment	<b>Discharge:</b> At the output, we get the same amount of water 225kt which enters the city sewer. During the processing of sewage water, 48kt silt is formed, which hurts the environment.

<b>Metals</b> 26kt	Around 644kt of food requires approximately 221kt packaging. Metals play the role of the main material for packaging.	Metal cans 26kt	Packaging	Recycled; Digestion; Sewage Sludge; Solid waste	<b>Recycling:</b> Most of the metal canning packages are recycled.
<b>Minerals</b> 83 kt	Around 644kt of food requires approximately 221kt of packaging. Mineral inputs are used for plastic and glass packaging production.	Glass bottles 33kt  Plastics 50kt	Packaging	Recycled; Digestion; Sewage sludge; Solid waste	<b>Recycling:</b> Glass bottles and plastics are recycled.
<b>Biomass</b> 756 kt	Biomass includes food production, as well as the production of organic packaging from recycled materials.	Organic packaging Fruits Vegetables Meat Milk Products	Consumption	Recycled; Digestion; Sewage sludge; Solid waste	<b>Digestion:</b> Around 191kt of biomass is “digested” by the city. <b>Landfill:</b> The rest of the biomass of about 600 kt is disposed of in landfills.
<b>Landfill biogas</b> 35kt	Under anaerobic conditions, the disposal of organic material in a landfill causes decay.	Methane from landfills 35kt	The gas goes into the atmosphere	Emitted	<b>Territorial GHG (greenhouse gases):</b> Organic waste recycling releases methane and produces an unpleasant smell.

Table 1: The summary of the Sankey diagram for Agriculture &amp; Food sectors in Almaty

Source: Elaboration from Hoozgard’s Agriculture &amp; Food sectors Sankey diagram (2017)

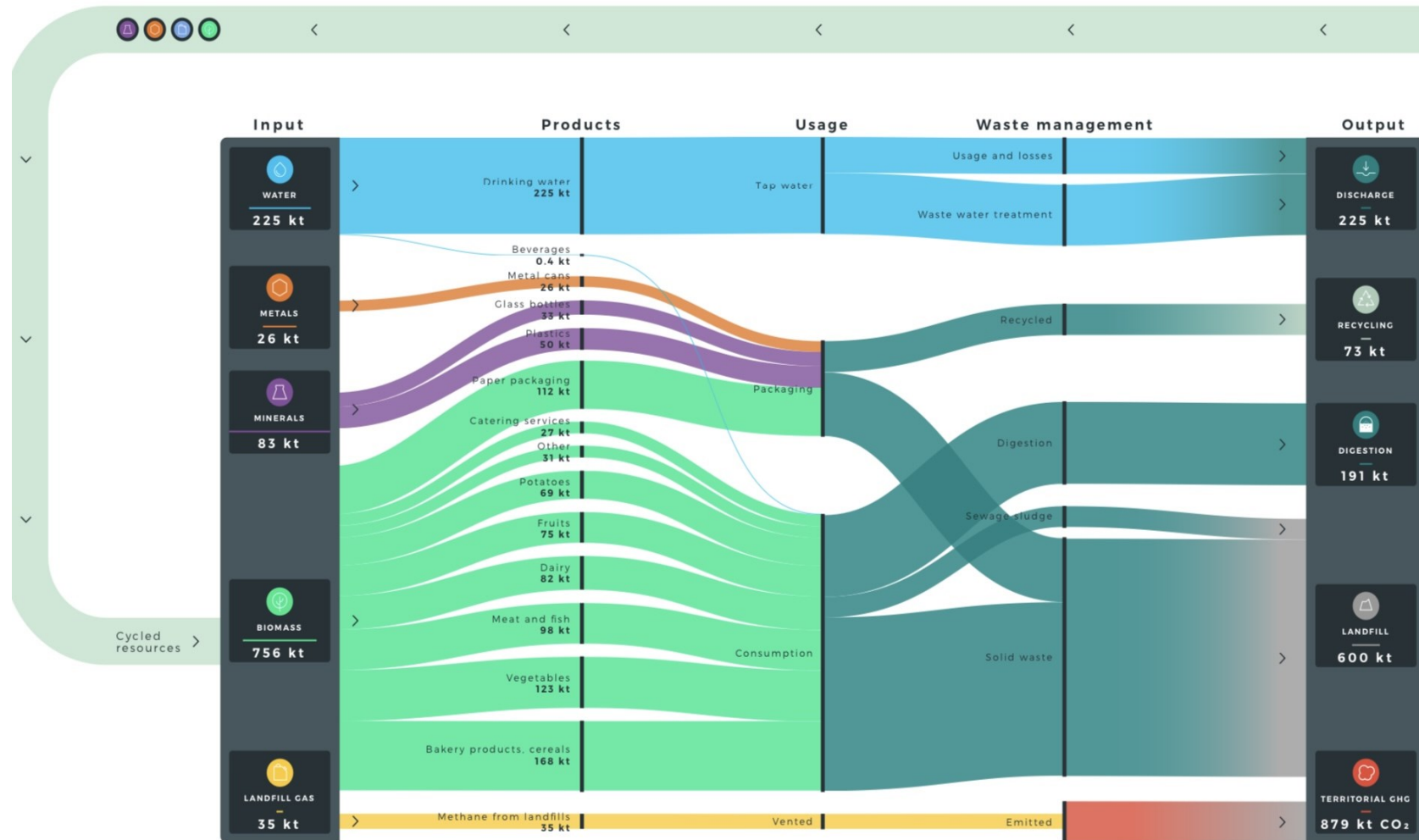


Figure 14: Resource flow Sankey diagram for Agriculture & Food sectors Almaty

Source: Hoozgd (2017)

One of the main tasks of the Republic of Kazakhstan is to increase the level of production in the agricultural sector by 50%, it is also worth noting that Kazakhstan is striving to achieve the maximum level of import substitution (Hoozgard, 2017). Reducing the number of imported products will allow the state to significantly reduce the country's carbon footprint from food consumption, in view of transportation (Hoozgard, 2017).

The next important sector both for Almaty and for the whole of Kazakhstan - is construction. Precisely the construction sector is one of the engines of the country's economy. Almaty's total living area increases by 3% annually, this is stimulated by the active people migrating from rural areas and other countries (RFCA Ratings, 2015). Such a large flow of new population certainly stimulates the active construction of residential and non-residential buildings in Almaty.

Table 2 provides the summary of Figure 15 (provided below table 2), which includes the analysis of each element in the **input** category; the **steps** that each input element goes through (**usage, waste management**); and the **output** which gets after all the processes performed:

*\*measured in thousands of tones*

Elements	Input	Usage	Waste management	Output
<b>Metals</b> 80kt  <b>Biomass</b> 286kt  <b>Minerals</b> 1,456kt	<p>The building construction in Almaty requires metals, biomass, and minerals.</p> <p>Minerals extracted from the Almaty region. Moreover, the sand, gravel, and rocks are extracted for construction goals.</p>	<ul style="list-style-type: none"> <li>- Demolition;</li> <li>- Bitumen/Asphalt;</li> <li>- Railway, metro construction;</li> <li>- New electricity and communication systems;</li> <li>- Installing heat, water, and sewage systems;</li> <li>- Road construction;</li> <li>- Residential and non-residential buildings.</li> </ul>	<ul style="list-style-type: none"> <li>- Road construction;</li> <li>- Solid waste;</li> <li>- New building and infrastructure.</li> </ul>	<p><b>Landfill:</b> Approximately about 79kt of construction materials are <b>landfilled</b>.</p> <p>In the case of demolition or construction repairs, the wastes are disposed of by private waste companies.</p> <p><b>Long-term usage:</b> Materials such as <b>biomass, metals, or minerals</b> have been preserved in the city for decades in the form of</p>

				buildings and other objects of urban infrastructure.
<b>Fossil fuels</b> 2,089 kt	The process of buildings heating requires 39% of fossil fuels and approximately three-quarters coal. A very small amount of fossil fuels is used for road construction.	<b>Gas 511kt</b> <b>Coal 1, 578 kt</b>	Combustion for heat and power;	The process of heating buildings accounts for 3.2 million tons of CO <sub>2</sub> emissions per year. Designing new buildings according to new principles could make it possible to use a large amount of energy used in the city to provide buildings with heat and electricity.
<b>Embedded greenhouse gas emissions in import</b> 6, 283 kt	Approximately 6.3 million tons of emissions in CO <sub>2</sub> equivalent are already included in the imported construction materials going to the growth of the city, which is 73% of all included emissions due to consumption or use of imported goods and materials to Almaty.		Upstream emissions.	Upstream CHG (greenhouse gases) 6,283 kt CO <sub>2</sub>

Table 2: The summary of the Sankey diagram for the construction sector in Almaty city

Source: Elaboration from Hoozgd's construction sector Sankey diagram (2017)

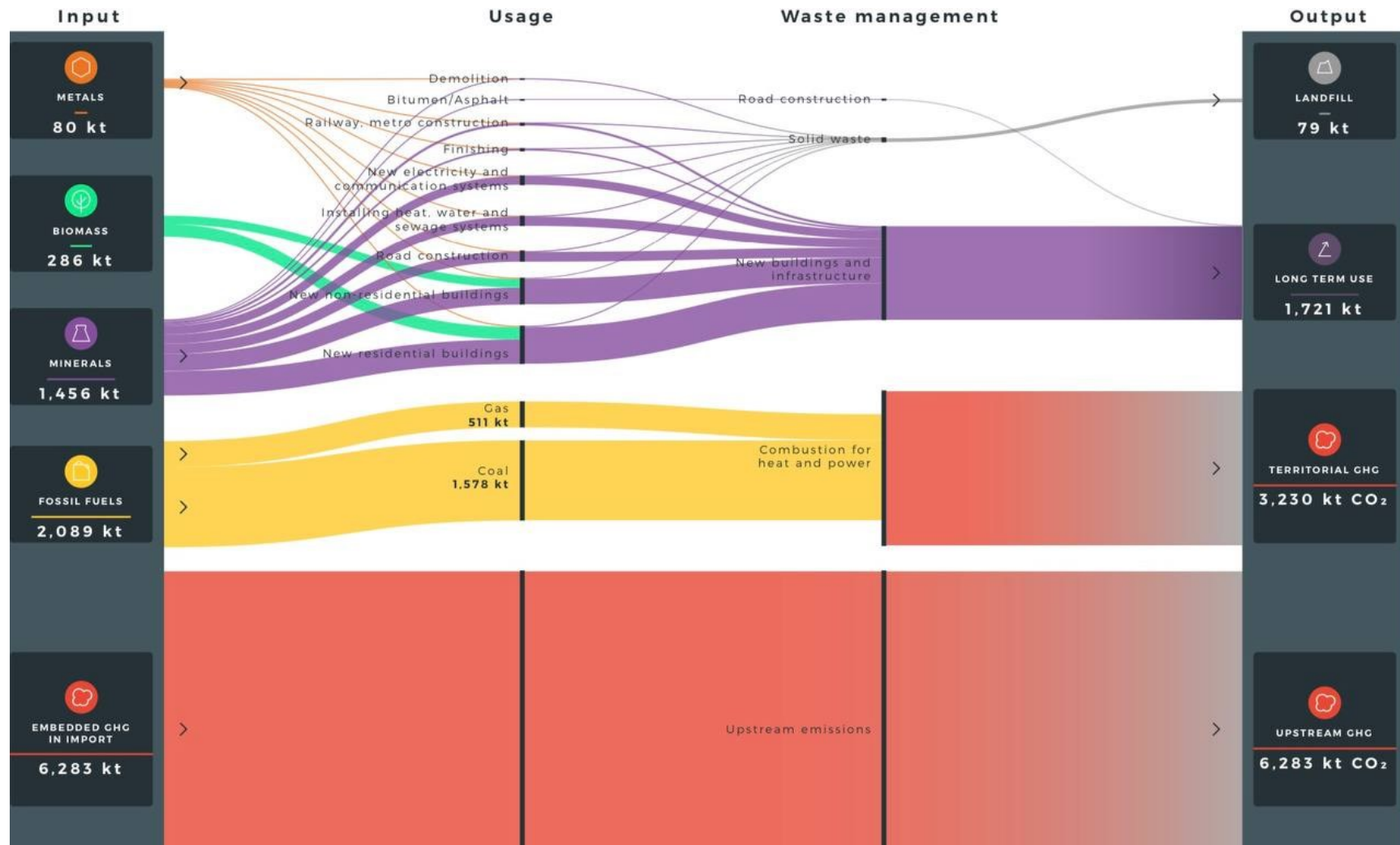


Figure 15: Resource flow Sankey diagram for construction sector Almaty

Source: Hoozgd (2017)

One of the most important sectors of Kazakhstan's economy and Almaty's city is industry. According to the "Industrialization plan", Kazakhstan is actively investing in the development of industries with high-added value (Industrialization concept, 2019).

The investments in the framework of the industrial plan are aimed to incentivize the export of non-primary goods produced at modern factories, in order to meet the needs of more demanding consumers (Industrialization concept, 2019).

The industrial plan includes different industries such as mechanical engineering, the production of building materials, food production, construction materials production and etc (Astana Times, 2018).

Table 3 of Figure 16 provides the summary of resource usage in industrial sector, which includes the analysis of each element in the **input** category; the **steps** that each input element goes through (**processing, usage**); and the **output** which gets after all the processes performed.

*\*measured in thousands of tones*

Element	Input	Processing	Usage	Output
Minerals <b>2,338 kt</b>	Different types of industries require the usage of minerals in their production, and most of the time these produced goods are exported from the city. Additionally, long-lasting minerals can be found in buildings and infrastructure objects in the city.  Industrial enterprises consume 328 kt of metals, also the metals are actively used in construction production.  Industries use wood and paper as biomass, also, some of the biomass accounts for food production.	-Semi-finished products; -Vehicles; -Window frames; -Food; -Isolation materials; -Plastic products; -Chemical products; -Paper; -Stone and tile; -Wood beams; -Concrete products; -Energy.	Consumed; Exported; Combusted;	<p><b>Recycling:</b> The city recycles industrial waste such as paper, glass, metal containers, light bulbs, textiles and etc.</p> <p><b>Digestion:</b> A small amount of industrial waste is <b>digested</b> by the city.</p> <p><b>Landfill:</b> Approximately 291,000 tons of industrial waste in Almaty – including direct industrial waste, as well as waste arising after one-time or short-term use, such as food or packaging is</p>
Metals <b>328 kt</b>				
Biomass <b>1.217 kt</b>				

				<p>exported to <b>landfills.</b></p> <p><b>Long-term usage:</b> More than 1,8 kt of materials are saved for a long time, in the form of buildings, transport facilities, electricity products and etc.</p> <p><b>Export:</b> the half of produced products are exported out of the city.</p>
Fossil fuels <b>968 kt</b>	Industry consumes around 1mln of fossil fuel, which provokes the increase in city waste. 2/3 of the total volume is coal, and 1/3 is natural gas.	-Energy	Combusted	<p><b>Territorial CHG:</b> Direct emissions from fuel combustion in various industries amount to about 3 million tons in the equivalent of CO<sub>2</sub>.</p>
Embedded GHG in import <b>11, 433 kt</b>		-Almaty processed; -Imported materials.	Products consumed; Products exported	<p>5.7 million tons of CO<sub>2</sub> are wastes from goods that are produced and recycled in Almaty, and 5.8 million of upstream emissions are from the products produce in Almaty but these products are for export, not for the city consumption.</p>

Table 3: The summary of the Sankey diagram for industrial sector in Almaty city

Source: Elaboration from Hoozgd's industrial sector Sankey diagram (2017)



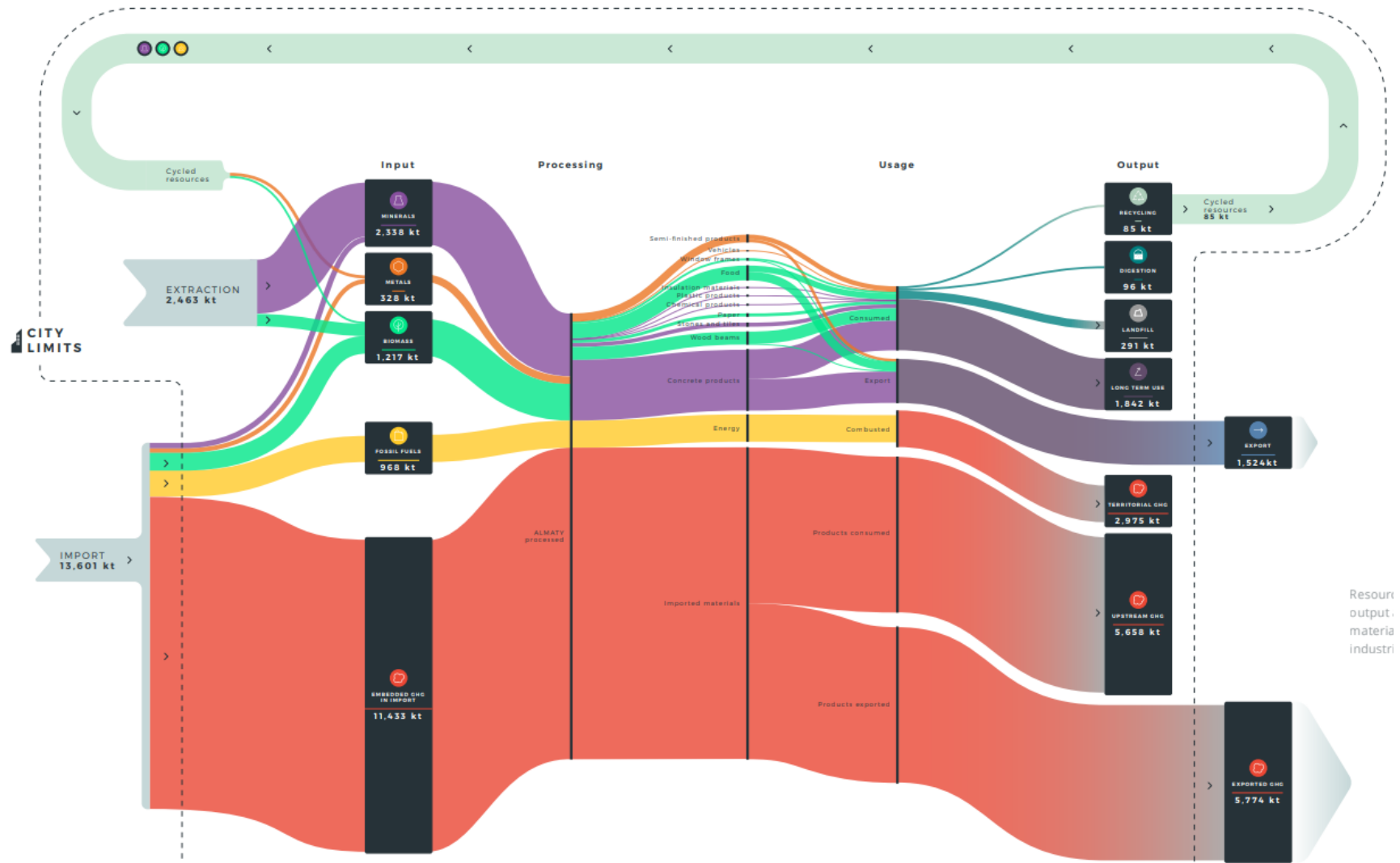


Figure 16: Resource flow Sankey diagram for Almaty's industrial sector.

Source: Hoozad (2017)

### 3.2 Sustainable supply chain in Kazakhstan. Example of a company with successful SSC implementation

Today Kazakhstan is one of the largest importers of food products from the countries of the post-Soviet space. It may be said that Kazakhstan is actively endeavoring to increase the level of productivity of the agricultural sector by about 50% in order to achieve the maximum level of import substitution (FAO, 2018).

Achieving the maximum level of import substitution will allow the country to become more stable in terms of food stocks (FAO, 2018).

The manufacturing of organic products is gaining more popularity in the country. Each year there are more and more new companies that produce organic food products under their own domestic brand (Hoozgard, 2019)

The government is actively investing in the agriculture and food production sector, and the state is also actively attracting foreign investors by demonstrating the potential of Kazakhstan within the framework of various conferences or meetings at the state level (Hoozgard, 2019).

In 2017, approximately 33% of the value created by the industries in Almaty accounted for the food sector (FAO, 2018). Figure 17 demonstrates the planned output from the agriculture and food production sector in Kazakhstan from 2017-2027:

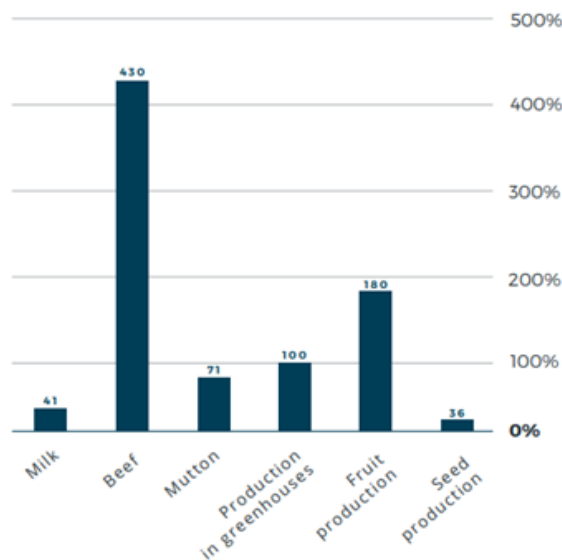


Figure 17: Planned growth in annual output from 2017-2027, measured in tonne/year

Source: Hoozgard (2019)

From Figure 17, it can be noticed that beef and fruit production can be identified as a priority for the agriculture sector in Kazakhstan, these products are planned to be produced in large volumes.

In this chapter, as an example of an organization that has successfully applied the principles of a sustainable supply chain in its practice, I want to cite the company Amiran.

The Kazakhstan Academy of Nutrition Amiran was built on the initiative of Kazakhstan's first President, Nursultan Nazarbayev. The company has been operating since 2010.

The plant locates in Almaty city, the main idea of Amiran - is the production of dairy products from whole absolutely natural milk of the highest quality. The plant positions its products as a “live” product, because they use whole natural milk, not reconstituted one, without the addition of preservatives. In milk production, Amiran uses useful microorganisms which are grown in laboratory conditions, and they add them to the raw materials.

Today, Amiran produces high-quality dairy products for children and adults, and processes about 15 tons of milk per day (Amiran official web page, 2022).

The lack of raw materials, specifically natural high-quality milk, which the company used in the production of each of its products, was the primary reason for the company's sustainable supply chain practices implementation. Prior to the introduction of a sustainable supply chain to its plant, Amiran purchased raw materials for its products, namely milk from the neighboring state – Kyrgyzstan. However, due to the high costs of transporting raw materials and the volatile activity of suppliers, delivering raw materials from a neighboring state has become not only difficult but also quite energy and financially costly.

Moreover, Amiran was faced with the task of independently producing milk for its products. However, in order to produce pure milk rich with vitamins and trace elements, environmentally friendly organic nutrition for cows was required.

This task served as a trigger for the company to create its own large-scale production complex that would control the entire process itself, from the process of animal feed preparation to the release and subsequent processing of milk.

The company's founders decided to build an agricultural complex that includes the Amiran milk processing plant and the Amiran Agro department, which includes:

- 1,870 hectares of irrigated land;
- a mechanized station for complex mechanization of agricultural land processing;

- and a dairy farm for the maintenance and cultivation of cows and milk production of 8,760,000 liters of milk per year or 24,000 liters per day (Amiran official web page, 2022).



Figure 18: Amiran company's agricultural complex

Source: Amiran's official web page (2022)

To ensure organic nutrition for cows, Amiran company purchased expensive agricultural machinery in order to ensure high efficiency and 100 percent environmental friendliness.

The company has also successfully applied the principles of Sustainability when watering the farm. It has purchased special American-made sprinklers that allow the company to irrigate areas with difficult terrain. In addition to performing their main irrigation function, these machines also fertilize the earth with various nutrients and minerals. This approach allows the company to carry out the process of fertilizing the land much faster, which significantly reduces financial costs and significantly saves time. The irrigation process is fully automated, and all sprinklers are controlled by one operator.

Concerning the farm's operations, we can say that the company faced a significant challenge in obtaining natural milk not only in large quantities but also of sufficient quality. To do this, the company purchased 780 Holstein-Friesian cattle. The difference between this breed of cows from others is that this breed is able to give three times more milk than traditional cows, which will also allow the company to significantly increase production volume (Amiran official web page, 2022).

Another important task for Amiran was to provide the most comfortable conditions for the cows to stay in the barn. The company has carried out the construction of special cowsheds using the technology of the American company "Baumatic". This technology allowed the agro-industrial complex to effectively organize a comfortable space for each cow in the barn.

Amiran is one of the very first companies in Kazakhstan which installed an Austrian dung recycling reactor. Recycled dung plays an important role in the design of cow mats, which

are installed in boxes where cows rest. This organic mat allows keep the boxes clean and protects cattle from possible infectious diseases.

According to the company, they are constantly inspired by a foreign experience in agricultural activities. Based on the European experience of using organic fertilizer for soil, Amiran company strives to minimize the usage of chemical fertilizers, and in the future plans to completely replace them with environmentally friendly organic ones.

As for the company's social responsibility, Amiran tries to provide its employees with the most comfortable conditions. The company builds and provides housing for its employees in close proximity to the agro-industrial complex in order to reduce the time spent on transporting workers to their workplaces.

The company was able to achieve a sustainable supply chain, thanks to the full automation of its processes, company automated the herd management process and reduced the human factor by 99% (Amiran official web page, 2022).

In conclusion, I can say that business in Kazakhstan is slowly but surely embarking on the path of sustainable development, “Amiran” company is one of the striking examples of a company that is a pioneer in the field of sustainable supply chain application. The company does not stand in one place, and it is constantly developing in all areas of its activities.

### **3.3 Circular economy initiatives in Almaty city**

Almaty city is one of the most urbanized and economically developed cities in Kazakhstan. Almaty has a very significant goal of shifting from a linear economy to a bright circular future. The city will play a role as a great example for other cities not only in Kazakhstan but also for the cities from Central Asia. That is why the major part of “Circular initiatives” tend to take a place in Almaty.

It can be said that Almaty city - is an experimental platform for Circular economy concept adaptation. In this chapter, we are going to explain the several CE initiatives which take place in Almaty city, and which the government is actively supporting.

One of the most popular waste collection associations in Almaty is KazWaste. KazWaste is an association that includes 50 eco-friendly members. The idea of this association is to support Green economy initiatives and spread the principles of CE and Green management throughout the city and the country in the near future. Based on the information from their official web page we created a summary picture Figure 19 that illustrates their main initiatives:



Figure 19: KazWaste Association’s main initiatives

Source: Elaboration from KazWaste’s official web page (2022)

In addition to the main eco-friendly initiatives, KazWaste has several specific goals and tasks for their accomplishment such as:

**Goal №1: Support business in Almaty in the part of waste management:**

- Provide representation and protection activities for the association member’s interests;
- Provide support for waste recycling activities in the city, and the country itself in the nearest future;
- Implement new projects in order to enhance and optimize business in the field of waste management.

**Goal №2: To enhance the waste management system in Kazakhstan:**

- A separate waste collection system implementation;
- Providing the analysis of eco-friendly and the most relevant technologies in the field of recycling and waste disposal;
- Establish close cooperation with the state in the field of legal regulation in the sphere of waste disposal.

**Goal №3: To establish close cooperation between enterprises in order to effectively solve common problems related to ecology:**

- Coordinate the waste management activities in the waste management field;
- Create special information platforms where companies may exchange their experience (KazWaste web page, 2022).

### **3.4 Examples of companies with successful CE implementation**

Another example of successful CE implementation, is one of the largest producers and distributors of consumer goods in Kazakhstan - Raduga KDR company.

The company provides different activities such as:

- distribution of food and non-food consumer goods;
- production of made in plastic and metal goods;
- production of hygiene products and household chemicals;
- developing the network of retail stores (Raduga KDR official web page, n.d).

Recently, the company has introduced a new field of manufacturing – the production of plastic goods from recycled materials. The Raduga KDR produces plastic goods from both primary and secondary polymer granulates. Secondary raw materials are collected by companies in Almaty and processed into made-in-plastic goods such as hangers, garbage bins, etc (Raduga KDR official web page, n.d).

Previously, the company was purchasing secondary raw materials from third-party organizations. However, at the beginning of 2018, Raduga KDR successfully launched the project which was related to a separate waste collection and sorting process. Company started to produce raw materials for future products by itself. Today, it produces two types of granulated secondary polyethylene, light and dark ones. Figure 20 illustrates the production process of recycled polyethylene:

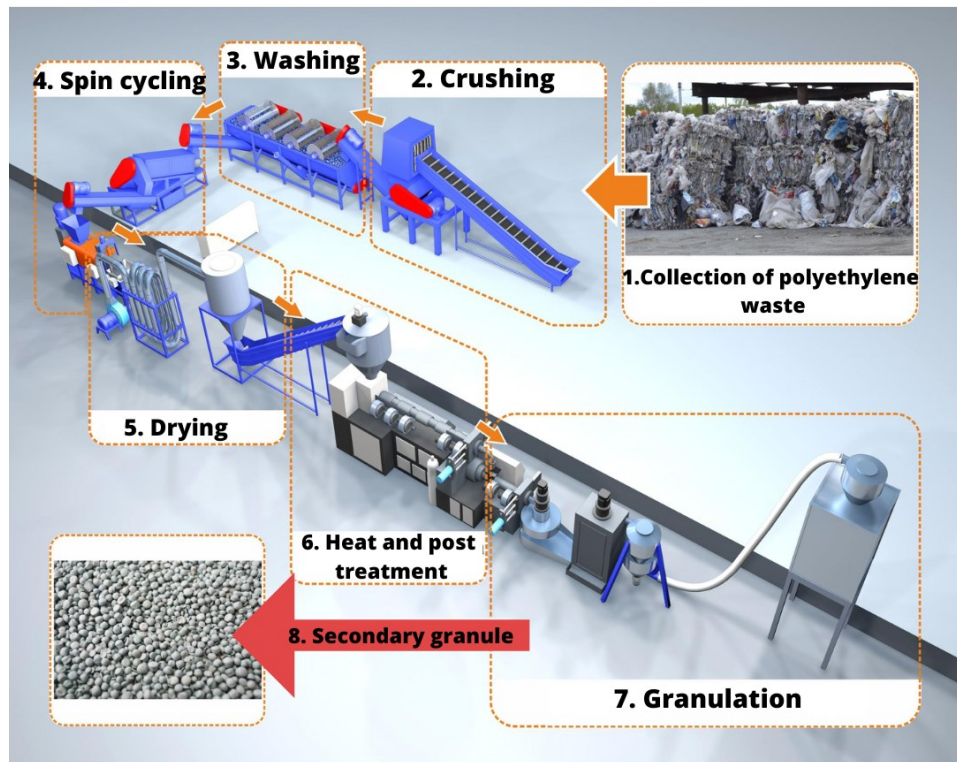


Figure 20: The Raduga KDR company's secondary polyethylene granule production process.

Source: Raduga KDR official web page (n.d)

Moreover, in order to maintain the eco-friendly approach company sets the different tasks:

- instill a culture of separate collection and the level of social responsibility inside and outside of the organization;
- reduce the amount of emission which harm the environment and atmosphere;
- reduce the volume of waste entering landfills and the number of territories that are allocated for them;
- decrease the number of costs associated with the waste sorting process (Raduga KDR official web page, n.d).

To accomplish these tasks, the company actively promotes separate garbage collection among the city's residents. The organization set the platforms with modern garbage containers throughout the city. Raduga KDR intends to build a complex plant in the future for the collection, transportation, sorting, and processing of all types of solid waste, as well as the production of finished products from secondary raw materials (Raduga KDR official web page, n.d).

As another example, I want to cite the company Kagazy Recycling. The company is one of the largest manufacturers of cardboard packaging and paper in Kazakhstan and Central Asia.



*Company's mission* is to become a leading industrial group in Kazakhstan and Central Asia. *Company's goal* is to provide high-quality goods and services while acting in the client's best interests (Kagazy Recycling, 2022).

The uniqueness of Kagazy Recycling paper production lies in the fact that the company uses only recycled waste paper as raw materials. The company, which is vertically integrated and has a full production cycle, collects secondary raw materials through its own extensive collection network before processing and releasing finished products (Kagazy Recycling, 2022).

Kagazy Recycling is the only one domestic company with a network of waste paper collection offices across Kazakhstan and in several Russian cities. Every year, the company collects and processes approximately 50 thousand tons of waste paper, preventing the felling of approximately 500 thousand mature trees. Newspapers, books, magazines, booklets, flat and corrugated cardboard (boxes), and plastic bottles are all actively collected by the company (Kagazy Recycling, 2022).



Figure 21: Kagazy Recycling company's manufacturing process  
Source: Elaboration from Kagazy Recycling's web page (2022)

## 4. Methodology. Data. Summary Statistics

### 4.1 Methodology

The quantitative research was conducted by using “Google Forms” as the main tool for collecting the data. Google Forms is a free online software for creating surveys and questionnaires (Demarest, 2021).

The survey's goal was to determine Kazakhstani companies' perspectives on the Circular Economy and Sustainable Supply Chain, as well as to determine how familiar companies are with the principles of CE and SSC. How companies apply the CE and SSC tools in their practices. Moreover, to identify their attitudes and perception towards CE and SSC. Based on the study's findings, recommendations for the effective implementation of CE and SSC in Kazakhstani enterprises and for the government will be developed.

The survey included 80 companies operating on the territory of the Republic of Kazakhstan. The companies are representatives of such sectors of the economy as *construction, agriculture & food production, and light industry*.

The survey was conducted from November 2022 to January 2023. We sent a questionnaire link to 100 companies in Kazakhstan to their official e-mail addresses, but only 80 companies responded and participated in the survey.

The Google survey was conducted and the answers were collected in the Kazakh language, then they were translated into the English language. The results were analyzed by using Excel as the main tool.

The survey questionnaire consists of 28 questions in total. The questionnaire was divided into two parts, the first part of questionnaire was about the Circular economy, and the second part covered the Sustainable supply chain.

The questionnaire included:

- open questions which focus on describing the main company's characteristics;
- closed questions in the form of multiple-choice questions;
- Yes/No questions;
- multiple-choice questions with only one answer option;
- 7-point Likert scale questions (agreement, importance, and frequency types).

### 4.1.1 Variables

We used a variety of independent variables in order to identify the company's background, company's size, and main characteristics:

1. **Sector:**

the economic sector in which the respondent companies operate, within the framework of the master's thesis the following sectors were proposed: *agriculture & food, construction, and light industry*.

2. **Employees' number:**

full-time equivalent employees were taken into account.

3. **Turnover:** the company's turnover amount for 2021.

Table 4 illustrates the main variables which were used in the survey process, the categories of each variable, the number of companies from each category. The data is given in natural numbers and their % equivalent.

Variable	Categories	Number of companies	Percentage equivalent
<b>Sector</b>	Agriculture & Food production	26	32,5%
	Construction	24	30%
	Light industry	30	37,5%
<b>Total</b>		<b>80</b>	<b>100%</b>
<b>Employees number</b>	1-9	20	25%
	10-49	24	30%
	50-249	25	31,25%
	250+	11	13,75%
<b>Total</b>		<b>80</b>	<b>100%</b>
<b>Turnover 2021 (in euros)</b>	<2 mln	33	41,25%
	2-10 mln	20	25%
	10-50 mln	14	17,5%
	50 mln +	13	16,25%
<b>Total</b>		<b>80</b>	<b>100%</b>

Table 4: Survey's main variables (own creation)

## 4.2 Survey data analysis and summary statistics. Circular economy

The survey included participation from 80 companies that operate in Kazakhstan. The data was ranked based on parameters such as the economic sector of the company's activity, the number of full-time employees, and the turnover for 2021.

The companies were ranked by size (micro-sized, small-sized, medium-sized, large-sized):

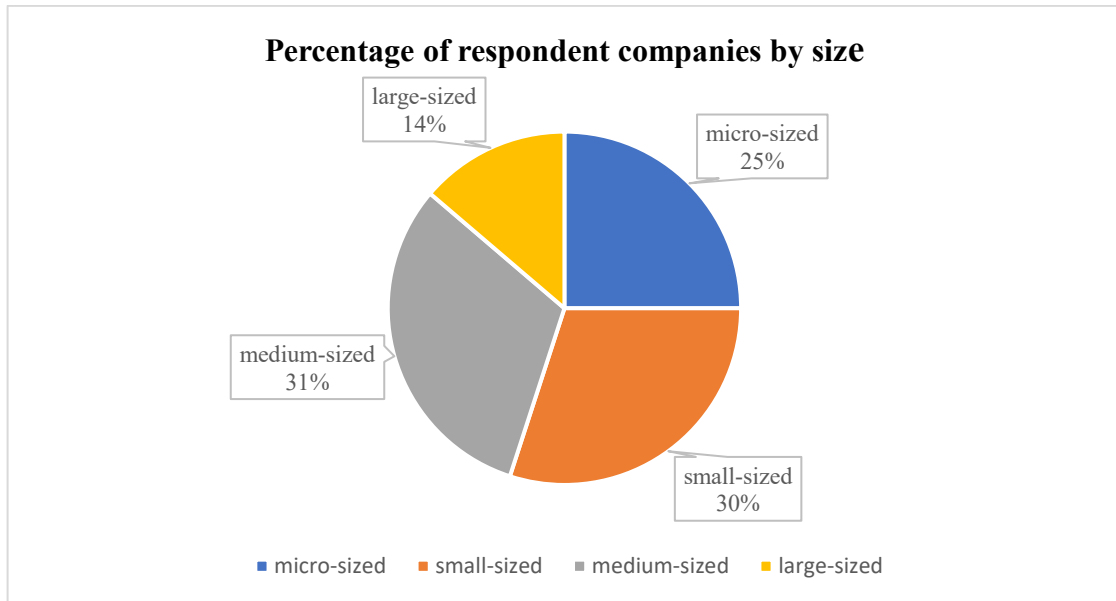


Figure 22: Percentage of respondent companies ranked by size (own creation)

In total, the survey involved 20 micro-sized companies, 24 small-sized, 25 medium-sized, and 11 large-sized companies from 3 economic sectors: *agriculture & food production, construction, and the light industry*.

The next step was to identify the company's beliefs about the measures which the company should apply in order to achieve Circular Economy goals. The companies were asked the question "What measures would help your company to achieve the goals of the Circular economy?". Companies had an opportunity to choose multiple options. The data is provided in natural numbers (how much time companies chose the measure):

The data is demonstrated in Figure 23:

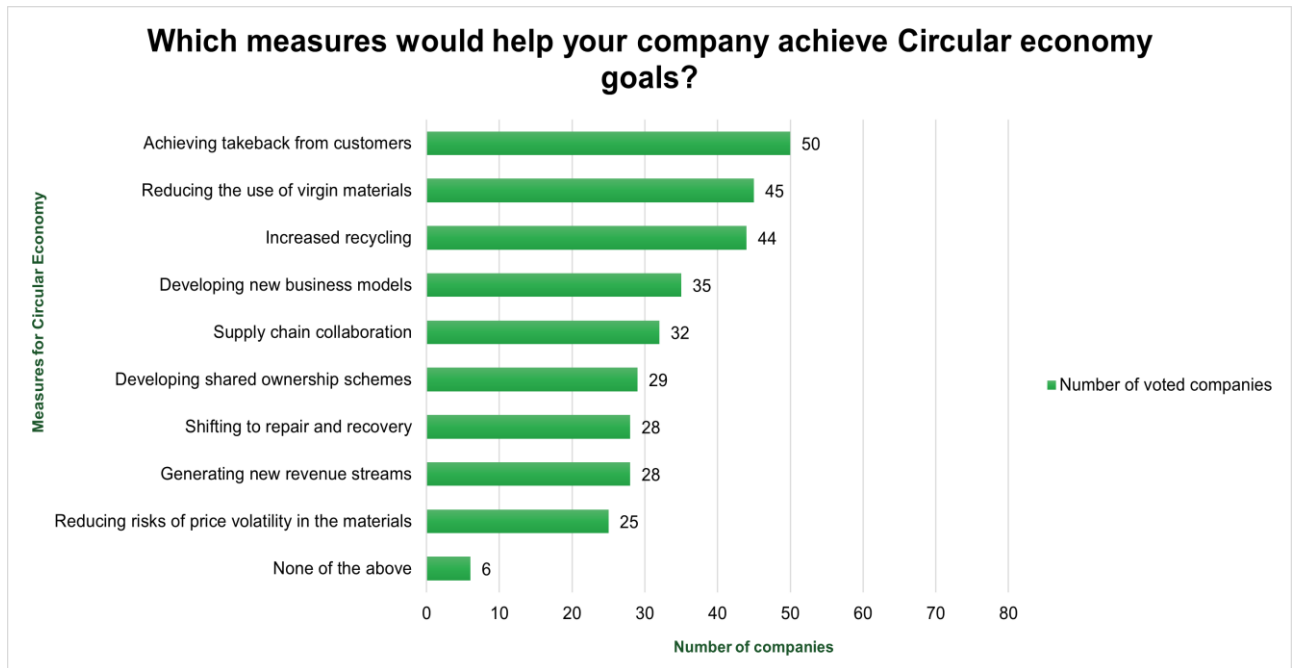


Figure 23: The measures for achieving a Circular economy goals (own creation)

From Figure 23 it can be seen that companies tend to believe that “Achieving takeback from customers” (was chosen 50 times), “Reducing the use of virgin materials” (was chosen 45 times), and “Increased recycling” (was chosen 44 times), “Developing new business models” (35 times); “Supply chain collaboration” (was chosen 32 times) are helpful measures on the way to Circular Economy. However, the measure “Reducing risks of price volatility in the materials” (was chosen 25 times) can be identified as a less effective one according to the respondent companies.

The purpose of the next set of questions was to find out the attitude of companies in various sectors toward the Circular economy.

In this block of questions, a 7 point Likert scale was used. A 7 point Likert scale was the agreement type with 7 options from *1-Strongly disagree* to *7 Strongly agree*. The cross-tabulation technique was provided in order to analyze the results, the total amount of respondent companies was divided by 3 sectors. The data is provided in natural numbers (the number of voted companies) and their % equivalent. The results are illustrated in Table 5.

Statement	7 points Likert scale	Agriculture & Food		Construction		Light industry		Total	%
The circular economy is only about recycling	1-Strongly disagree	7	27%	3	12,5%	12	40%	22	27%
	2-Disagree	7	27%	2	8,3%	2	7%	11	13,75%
	3-Somewhat disagree	4	15,4%	2	8,3%	4	13,3%	10	12,5%
	4-Neither agree nor disagree	0	0	5	20,8%	4	13,3%	9	11,25%
	5-Somewhat agree	2	7,7%	4	16,7%	1	3,3%	7	8,75%
	6-Agree	4	15,4%	5	21%	3	10%	12	15%
	7-Strongly agree	2	7,7%	3	12,5%	4	13,3%	9	11,25%
	<b>Total</b>	<b>26</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>80</b>	<b>100%</b>
The implementation of a CE will increase profitability	1-Strongly disagree	0	0	0	0	1	3,3%	1	1,25%
	2-Disagree	0	0	0	0	1	3,3%	1	1,25%
	3-Somewhat disagree	4	15,4%	1	4,1%	3	10%	8	10%
	4-Neither agree nor disagree	6	23%	7	29%	6	20%	19	23,75%
	5-Somewhat agree	4	15,4%	6	25%	1	3,3%	11	13,75%
	6-Agree	8	31%	4	17%	16	53,3%	28	35%
	7-Strongly agree	4	15,4%	6	25%	2	6,6%	12	15%
	<b>Total</b>	<b>26</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>80</b>	<b>100%</b>

Table 5: Cross-tabulation for 7 points Likert scale “agreement” questions (own creation)

Then we provided the descriptive statistics for the statements “The circular economy is only about recycling” and “The implementation of a CE will increase profitability” in order to identify the mode, mean average, and other statistical measures. The descriptive statistics was applied for the total amount of companies 80 in our case.

<i>The circular economy is only about recycling</i>	
Mean	3,481012658
Standard Error	0,243620826
Median	3
<b>Mode</b>	<b>1</b>
Standard Deviation	2,165349261
Sample Variance	4,688737423
Kurtosis	-1,366262694
Skewness	0,302458814
Range	6
Minimum	1
Maximum	7
Sum	275
<b>Count</b>	<b>80</b>

Table 5.1: descriptive statistics for 7 points Likert scale “agreement” questions (own creation)

<i>The implementation of a CE will increase profitability</i>	
Mean	5,17721519
Standard Error	0,147200969
Median	6
<b>Mode</b>	<b>6</b>
Standard Deviation	1,308350828
Sample Variance	1,711781889
Kurtosis	-0,928945043
Skewness	-0,337260886
Range	5
Minimum	2
Maximum	7
Sum	409
<b>Count</b>	<b>80</b>

Table 5.2: descriptive statistics for 7 points Likert scale “agreement” questions (own creation)

From Table 5.1 it can be seen that the most frequent answer (**mode**) to the question “How much do you agree with the statement that Circular economy is only about recycling?”: was “1-Strongly disagree” 22 companies from 80 chose this option.

The least frequent answer was “5- Somewhat agree”, only 7 companies from 80 chose this option. Analyzing all the answers to this question, it can be seen that most companies disagree with this statement (53,25%) to a greater extent than they agree (35%), and others (11,25%) chose a neutral position (see table 5). This suggests that most of the companies in Kazakhstan are more or less familiar with the concept of a Circular economy, and they understand that a Circular economy is more than just about “recycling”, it is a philosophy that includes a lot of mechanisms and tools.

Regarding the following question Table 5.2 “How much do you agree with the statement that the implementation of a Circular economy will increase the profitability of your

company?": the most frequent answer (**mode**) was "6 - Agree", 28 companies from 80 showed their agreement with this statement, however, the less frequent answer was "1 - Strongly disagree" and "2 - Disagree" only 1 company in total absolutely disagree with this statement.

Analyzing the results, the majority of respondent companies (63,75%) in total agree that the Circular economy is able to increase the company's profitability level, but we still have companies (12,5%), who demonstrated their disagreement with the statement, and (23,75%) of respondents companies preferred to choose a neutral position (see table 5).

In order to assess the level of involvement of the company in actions aimed at caring for and preserving the environment, the companies were asked the question "Is your company engaged in any of these activities?", with the possibility to choose several environmental activities. The data is provided in natural numbers (how much time companies chose the measure):

The results are illustrated in Figure 24.

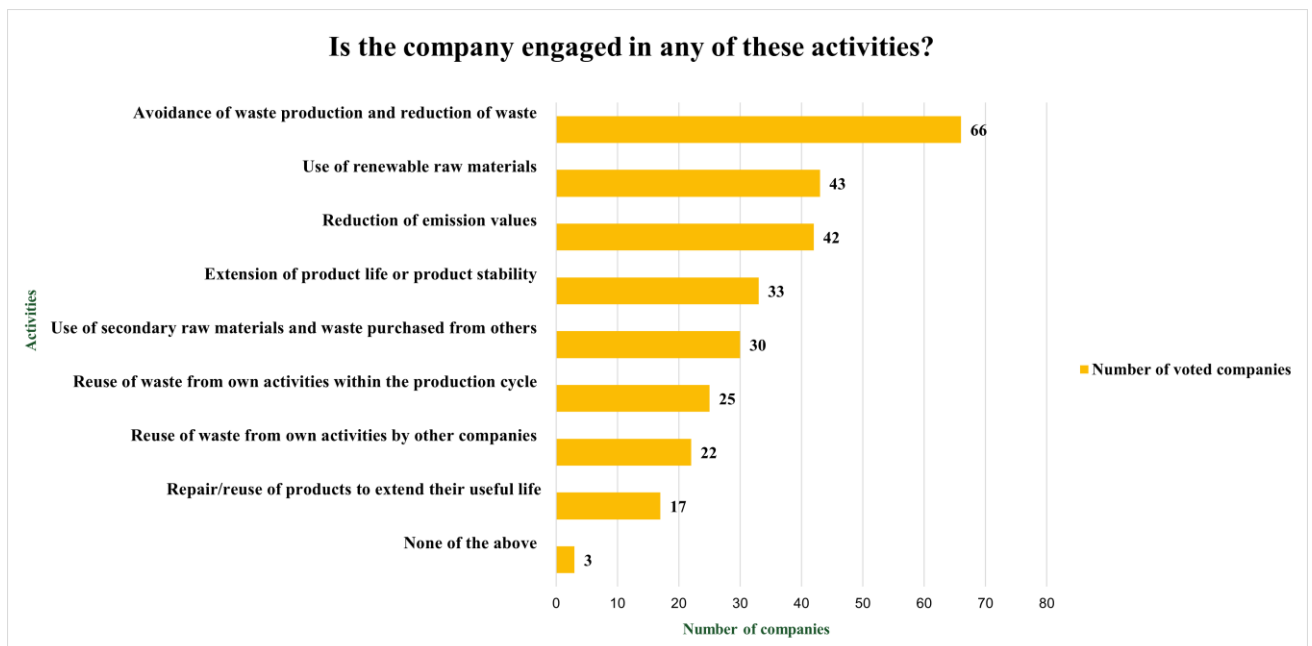


Figure 24: Company's Circular economy activities (own creation)

Based on the results we can assume that companies tend to apply activities that are focused on the reduction of waste (was chosen 66 times) and using renewable raw materials (was chosen 43 times) (see Figure 24). Moreover, respondent companies apply activities concerning activities that are aimed to reduce the emission values (chosen 42 times), and actions that extend the product's life and stability (chosen 33 times).



On the other hand, the activities like reuse of waste and repairing products in order to extend their life (was chosen 17 times), can not be considered as frequently used by companies in Kazakhstan. 3 companies out 80 didn't apply any of the activities.

The purpose of the next question was to find out the policy of the company towards waste and to identify how frequently companies send their waste for recycling. In this block of questions, a 7 point Likert scale was used.

A 7 point Likert scale was the frequency type with options from *1-Never* to *7-Every* time.

The data is provided in natural numbers (the number of voted companies) and their % equivalent. The results are illustrated in Table 6:

Statement	7 points Likert scale	Agriculture & Food		Construction		Light industry		Total	%
How frequently do companies send waste for recycling	1-Never	1	4%	1	4,1%	2	6,6%	4	5%
	2-Rarely	0	0	3	12,5%	3	10%	6	7,5%
	3-Occasionally	1	4%	3	12,5%	2	6,6%	6	7,5%
	4-Sometimes	2	8%	5	21%	2	6,6%	9	11,25%
	5-Frequently	4	15,3%	4	17%	7	23,3%	15	18,75%
	6-Usually	7	27%	3	12,5%	9	30%	19	23,75%
	7-Every time	11	42%	5	21%	5	17%	21	26,25%
	<b>Total</b>	<b>26</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>80</b>	<b>100%</b>

Table 6: Cross-tabulation for 7 points Likert scale “frequency” questions (own creation)

<i>How frequently do companies send waste for recycling</i>	
Mean	5,265822785
Standard Error	0,183468742
Median	6
<b>Mode</b>	<b>7</b>
Standard Deviation	1,630705847
Sample Variance	2,659201558
Kurtosis	-0,004659796
Skewness	-0,861131569
Range	6
Minimum	1
Maximum	7
Sum	416
Count	80

Table 6.1: Descriptive statistics for 7 points Likert scale “frequency” questions

From Table 6.1, we can see that the **mode** is the 7- *Every time* option (26,25%). Also, it can be seen that the majority part of respondent companies send their waste for recycling (80%), while others (20%) never send their waste for recycling or do it in very rare cases (see Table 6).

Another 7 point Likert scale question, was aimed to understand the respondent companies' viewpoint regarding the Importance of the Circular economy in today's realities.

A 7 point Likert scale was the Importance type with options such as *Not important at all*, *Low importance*, *Slightly important*, *Neutral*, *Moderately important*, *Very important*, and *Extremely important*. Then the descriptive statistics for total amount of companies 80 were applied for Table 7, in order to identify mode, mean and other statistical measures. The data is provided in natural numbers (the number of voted companies) and their % equivalent. The results are illustrated in Table 7:

Statement	7 points Likert scale	Agriculture & Food		Construction		Light industry		Total	%
How companies rate the importance of Circular Economy practices in today's economy	1-Not important at all	1	4%	0	0	2	7%	3	3,75%
	2-Low importance	0	0	0	0	1	3,3%	1	1,25%
	3-Slightly important	1	4%	1	4,2%	0	0	2	2,5%
	4-Neutral	5	19,2%	4	17%	5	17%	14	17,5%
	5-Moderately important	2	7,7%	6	25%	5	17%	13	16,25%
	6-Very important	10	38,4%	6	25%	10	33,3%	26	32,5%
	7-Extremely important	7	27%	7	29,1%	7	23,3%	21	26,25%
	<b>Total</b>	<b>26</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>80</b>	<b>100%</b>

Table 7: Cross-tabulation for 7 points Likert scale "importance" questions (own creation)

<b><i>How companies rate the importance of Circular Economy practices in today's economy</i></b>	
Mean	5,518987342
Standard Error	0,150581217
Median	6
<b>Mode</b>	<b>6</b>
Standard Deviation	1,338395131
Sample Variance	1,791301525
Kurtosis	0,631057259
Skewness	-0,897491828
Range	6
Minimum	1
Maximum	7
Sum	436
<b>Count</b>	<b>80</b>

Table 7.1 descriptive statistics for 7 points Likert scale "importance" questions (own creation)

Table 7 demonstrates a positive trend, 75% of respondent companies evaluated the Circular economy as an important one, with varying degrees of importance, from moderately to extremely important. Only 7,5 % of respondent companies in total perceive the Circular economy as something not so important, and 17,5 % were neutral towards CE. The most frequent answer (**mode**) from the total amount of companies (80) was *6-Very important* (see Table 7.1), 26 companies from different sectors chose this option.

The next task was to identify the number of companies that have already implemented Circular economy practices. There was a question that included only two option answers like Yes/No. The results are illustrated below:

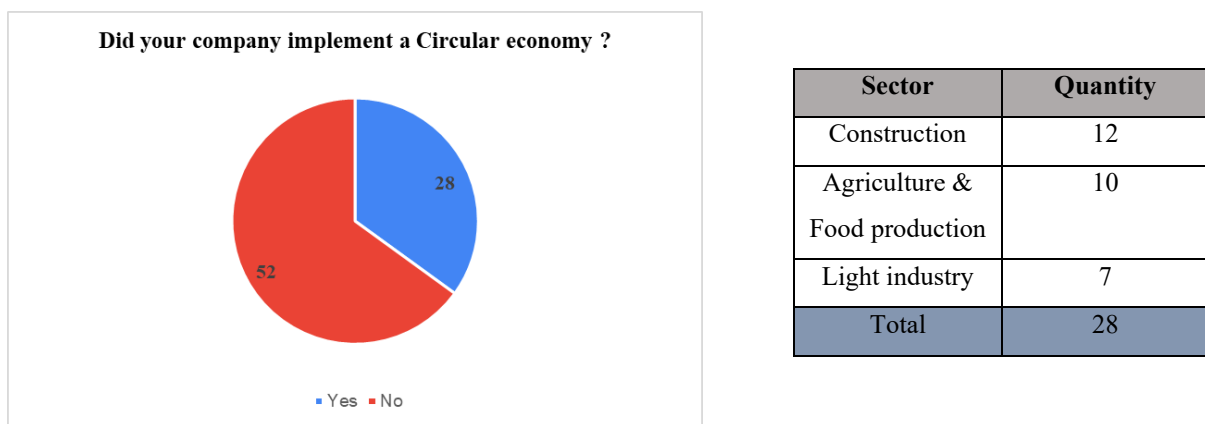


Figure 25: Respondent company's Circular economy implementation statistics (own creation)

Based on Figure 25, we can assume that 28 (35%) companies out of 80 have already implemented a Circular economy into their company, the prevailing sectors of the economy in which these companies operate are *construction* and *agriculture & food production*. The remaining 52 (65%) businesses have not adopted a Circular economy. Following that, we will look at the various types of circular models that the respondent organizations have implemented. The models are illustrated in Table 8:

CE model type	Number of companies	%
Recovery, recycling, and reuse of resources/energy	15	53,6 %
Use of recycled, recyclable, or bio-based materials produced by specialized suppliers	6	21,43 %
Extending the life cycle of products and components	4	14,29 %
Providing renewable energy, bio-based, or fully recyclable input material to other companies or institutions	3	10,71 %
Dematerialization of products, Pay-for-Use, or product as a service	0	0
<b>Total</b>	<b>28</b>	<b>100%</b>

Table 8: The Circular economy models (own creation)

Table 8 shows that more than half of the companies (53,6%) chose the CE economy model which is based on recovering and recycling resources/energy, the second most frequently used model (21,43%) was the usage of recycled materials that were produced by other suppliers. Unfortunately, such models as extending the lifecycle of products and providing renewable energy and materials to other companies weren't preferred by respondent companies only 25 % in total.

Another diagram illustrates the main reasons why respondent companies decided to implement CE. The companies had the right to choose several options. The data is provided in natural numbers (how much time companies chose the measure).

The results are shown in Figure 26:

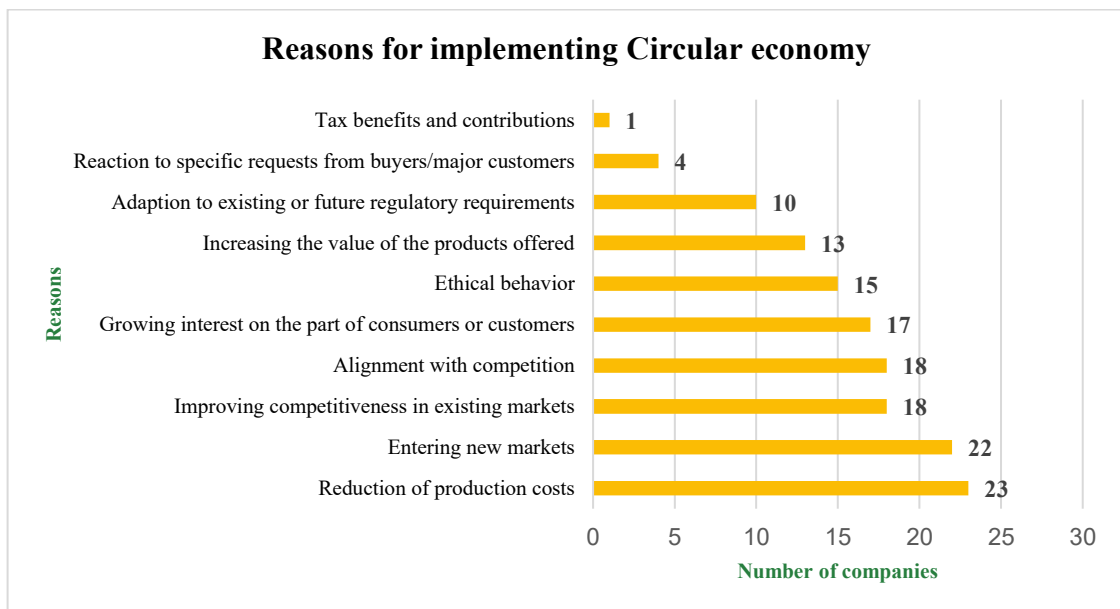


Figure 26: Main reasons for CE implementation (own creation)

From Figure 26 we can see 5 top reasons why companies from the survey were motivated to introduce CE:

- Reduction of production costs (23 times was chosen);
- New market opportunities (22 times was chosen);
- Improving the competitive advantage (18 times was chosen);
- Alignment with competition (18 times was chosen);
- Growing CE interests from customers (17 times was chosen).

There are 52 companies out of 80 that didn't implement CE. 32 out of 52 companies expressed their interest to introduce CE in the future, and other 20 companies are not ready now to implement CE (see Figure 27).

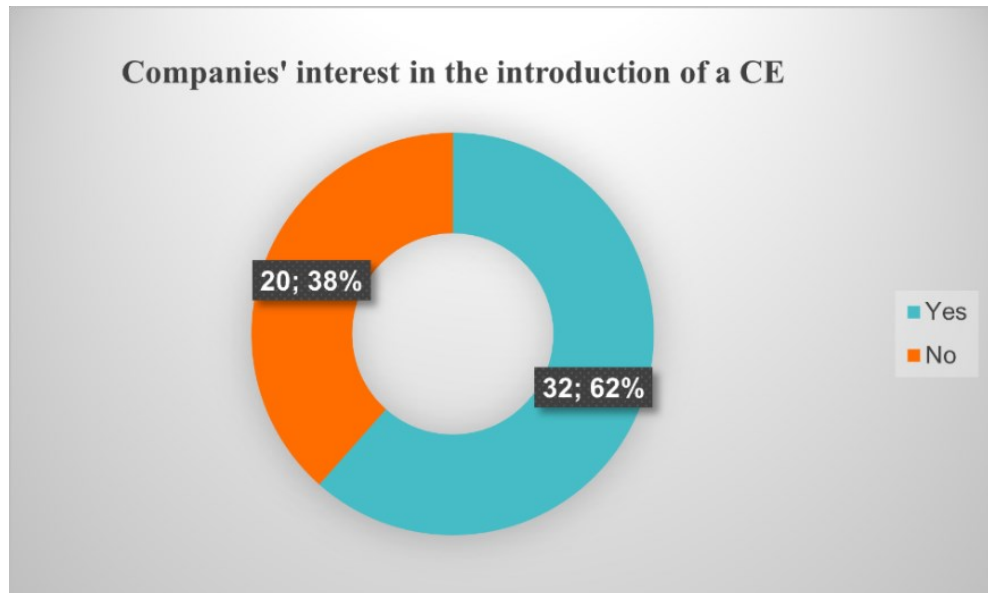


Figure 27: Companies' commitment toward CE implementation (own creation)

In order to develop correct and appropriate recommendations regarding the introduction of a Circular economy, it was necessary to identify possible problems and difficulties that companies are afraid to face in the future while implementing CE practices in their organizations. Companies had an opportunity to choose more than one option.

The data is illustrated in natural numbers, in other words, it shows how much time each option was chosen by companies. The results are illustrated in Figure 28.

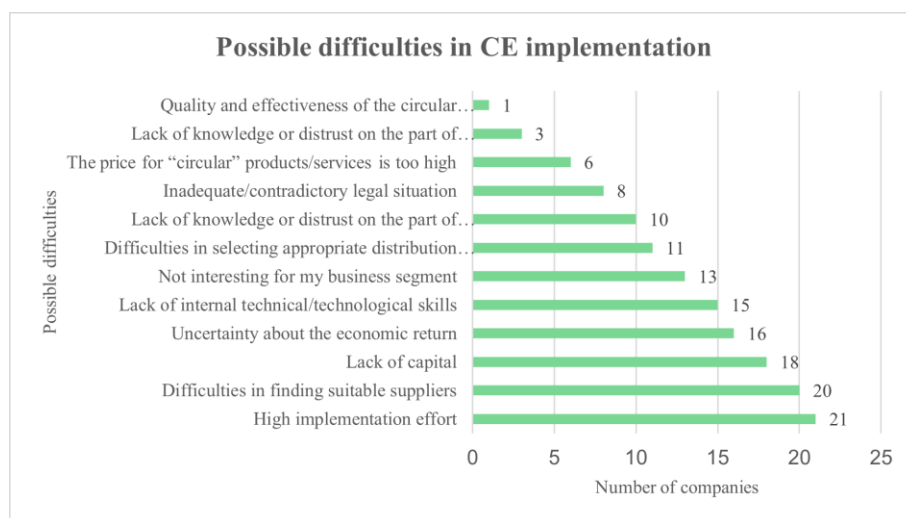


Figure 28: Possible difficulties in CE implementation (own creation)

Based on Figure 28 we can resume the top 5 difficulties which may occur according to the respondent companies:

- High implementation effort (chosen 21 times);
- Difficulties in finding suitable suppliers (20 times);
- Lack of capital (18 times);
- Uncertainty about economic returns (16 times);
- Lack of technical/technological skills (15 times).

#### 4.3 Survey data analysis and summary statistics. Sustainable supply chain

The first part of the survey questionnaire was about Circular economy practices, however, the second one covered the Sustainable supply chain part. The second block consisted of 12 questions in total, there were used different types of questions such as 7 point Likert scale questions, multiple choice questions with only one answer option, and Yes/No questions.

The first question aimed to identify the supply chain components that the company would like to improve as a priority in order to maintain sustainability, respondent companies had to choose only one option. The data is measured in the number of voted companies. The outcome is illustrated in Figure 29:

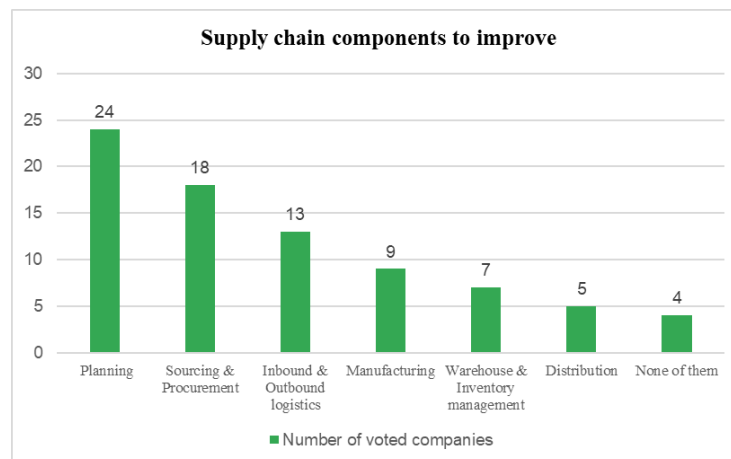


Figure 29: Supply chain components (own creation)

Figure 29 shows that companies mostly would like to Improve supply chain components that are related to planning 24 (30%), sourcing & procurement 18 (22,5%), and logistics 13 (16,25%). The other components like manufacturing 9 (11,25%), inventory management 7 (8,75%), and distribution 5 (6,25%) are not in priority for the minority of respondent companies. And only 4 companies don't want to improve anything.

The next set of questions was 7 point Likert one, this kind of question was aimed to identify the respondent companies' level of satisfaction with such aspects as digitalization of processes, supply chain transparency, and supply chain management.

There were provided possible options such *Completely dissatisfied*, *Mostly dissatisfied*, *Somewhat dissatisfied*, *Neither satisfied nor dissatisfied*, *Somewhat satisfied*, *Mostly satisfied*, and *Completely satisfied*. 80 companies participated in this block of questions. The data is provided in natural numbers in the form of voted companies, and in their percentage equivalent.

Table 9 summarizes the responses:

Statement	7 points Likert scale	Agriculture & Food		Construction		Light industry		Total	%
The level of satisfaction with the digitalization of processes	1- Completely dissatisfied	1	4%	0	0	6	20%	7	8,75%
	2-Mostly dissatisfied	4	15,3%	2	8,3%	4	13,3%	10	12,5%
	3-Somewhat dissatisfied	5	19,2%	2	8,3%	2	7%	9	11,25%
	4-Neither satisfied nor dissatisfied	4	15,3%	3	12,5%	13	43,3%	20	25%
	5-Somewhat satisfied	3	11,5%	3	12,5%	2	7%	8	10%
	6-Mostly satisfied	5	19,2%	6	25%	1	3,3%	12	15%
	7- Completely satisfied	4	15,3%	8	33,3%	2	7%	14	17,5%
	<b>Total</b>		<b>26</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>80</b>
Statement	7 points Likert scale	Agriculture & Food		Construction		Light industry		Total	%
	1- Completely dissatisfied	0	0	0	0	2	7%	2	2,5%

The level of satisfaction with Supply chain transparency	2-Mostly dissatisfied	3	11,5%	2	8,3%	4	13,3%	9	11,25%
	3-Somewhat dissatisfied	4	15,3%	0	0	6	20%	10	12,5%
	4-Neither satisfied nor dissatisfied	8	31%	4	17%	15	50%	27	33,75%
	5-Somewhat satisfied	5	19,2%	5	21%	1	3,33%	11	13,75%
	6-Mostly satisfied	5	19,2%	7	29,1%	1	7%	13	16,25%
	7- Completely satisfied	1	4%	6	25%	1	3,33%	8	10%
	<b>Total</b>	<b>26</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>80</b>	<b>100%</b>
<b>Statement</b>	<b>7 points Likert scale</b>	<b>Agriculture &amp; Food</b>		<b>Construction</b>		<b>Light industry</b>		<b>Total</b>	<b>%</b>
The level of satisfaction with supply chain management	1- Completely dissatisfied	0	0	0	0	2	7%	2	2,5%
	2-Mostly dissatisfied	3	11,5%	1	4,2%	2	7%	6	7,5%
	3-Somewhat dissatisfied	3	11,5%	2	8,3%	6	20%	11	13,75%
	4-Neither satisfied nor dissatisfied	8	31%	3	12,5%	15	50%	26	32,5%
	5-Somewhat satisfied	5	19,2%	5	21%	3	10%	13	16,25%
	6-Mostly satisfied	5	19,2%	5	21%	1	3,3%	11	13,75%
	7- Completely satisfied	2	8%	8	33,3%	1	3,3%	11	13,75%
		<b>Total</b>	<b>26</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>80</b>

Table 9: Cross-tabulation for 7 points Likert scale “satisfaction” questions (own creation)



<i>The level of satisfaction with the digitalization of processes</i>	
Mean	4,417721519
Standard Error	0,206678179
Median	4
<b>Mode</b>	<b>4</b>
Standard Deviation	1,83699584
Sample Variance	3,374553716
Kurtosis	-0,9842545
Skewness	-0,1583125
Range	6
Minimum	1
Maximum	7
Sum	349
<b>Count</b>	<b>80</b>

Table 9.1 descriptive statistics for 7 points Likert scale “satisfaction” questions (own creation)

<i>The level of satisfaction with Supply chain transparency</i>	
Mean	4,367088608
Standard Error	0,168211486
Median	4
<b>Mode</b>	<b>4</b>
Standard Deviation	1,495096388
Sample Variance	2,23531321
Kurtosis	-0,668795154
Skewness	0,027871669
Range	6
Minimum	1
Maximum	7
Sum	345
<b>Count</b>	<b>80</b>

Table 9.2 descriptive statistics for 7 points Likert scale “satisfaction” questions (own creation)

<i>The level of satisfaction with supply chain management</i>	
Mean	4,46835443
Standard Error	0,169803754
Median	4
<b>Mode</b>	<b>4</b>
Standard Deviation	1,509248778
Sample Variance	2,277831873
Kurtosis	-0,639037305
Skewness	0,073633767
Range	6

Minimum	1
Maximum	7
Sum	353
<b>Count</b>	<b>80</b>

Table 9.3 descriptive statistics for 7 points Likert scale “satisfaction” questions (own creation)

Table 9 shows that the most frequent answer (**mode**) for all three questions was “4-Neither satisfied nor dissatisfied”. Table 9 also illustrates that the companies were mostly satisfied with the three above-given components, and the minority of companies were less satisfied or not satisfied at all.

The next set of questions was Yes/No, the goal of these questions was to determine does the company obtain the components such as environmental requirements, environmental policy, digital technologies, environmental management and etc or not. The results are shown in natural numbers and their percentage equivalent. You can see the statistics of the response in Table 10:

Statement	Yes		No		Total	
	Number of companies	%	Number of companies	%	Number of companies	%
Customers set environmental requirements	52	65 %	28	35 %	<b>80</b>	<b>100 %</b>
Company has a formal environmental policy	66	83,5 %	13	16,5 %	<b>80</b>	<b>100 %</b>
Company sets environmental requirements for its suppliers	70	87,5 %	10	12,5 %	<b>80</b>	<b>100 %</b>
Company use digital technologies in its activities	32	40%	48	60%	<b>80</b>	<b>100 %</b>
Company uses recycled or recyclable materials when packages its product	31	38,75%	49	61,25%	<b>80</b>	<b>100 %</b>
Company meets or have environmental management standards	54	67, 5%	26	32, 5 %	<b>80</b>	<b>100 %</b>
Company’s products can be reused/environmentally safely disposed of	47	58,75%	33	41,25%	<b>80</b>	<b>100 %</b>
<b>Mean value</b>	<b>50</b>	<b>63%</b>	<b>30</b>	<b>37%</b>	<b>80</b>	<b>100%</b>

Table 10: SSC Yes/No questions descriptive statistics summary (own creation)

Table 10 summarizes and illustrates that the majority of respondent companies (63%) obtained the above-given components, and others (37 %) don’t obtain them, these statistics illustrate the positive trend in terms of sustainable supply chain practices.

The last 7 point Likert scale question was expressing agreement with the statement that a Sustainable supply chain can help to improve the company’s profitability and optimize the cost.

From Table 11 we can see that the most frequent answer (**mode**) was *6- Agree* 43,7%. And as a whole picture, we can see that the companies mostly agreed with the statement about 80 %, the other 6, 25% somehow disagree and 13,75% preferred to choose a middle option. The results of the survey are shown in Table 11:

Statement	7 points Likert scale	Agriculture & Food		Construction		Light industry		Total	%
How much do you agree with the statement that a sustainable supply chain improves productivity and optimizes costs	1-Strongly disagree	0	0	0	0	1	3,33%	1	1,25%
	2-Disagree	0	0	1	4,1%	1	3,33%	2	2,5%
	3-Somewhat disagree	0	0	1	4,1%	2	7%	3	3,75%
	4-Neither agree nor disagree	4	15,3%	3	12,5%	3	10%	10	12,5%
	5-Somewhat agree	3	11,5%	4	17%	7	23,3%	14	17,5%
	6-Agree	13	50%	11	49%	11	37%	35	43,75%
	7-Strongly agree	6	23%	4	17%	5	17%	15	18,75%
	<b>Total</b>	<b>26</b>	<b>100%</b>	<b>24</b>	<b>100%</b>	<b>30</b>	<b>100%</b>	<b>80</b>	<b>100%</b>

Table 11: Cross-tabulation for 7 points Likert scale “agreement” questions (own creation)

<i>How much do you agree with the statement that a sustainable supply chain improves productivity and optimizes costs</i>	
Mean	5,544303797
Standard Error	0,134574073
Median	6
<b>Mode</b>	<b>6</b>
Standard Deviation	1,196120528
Sample Variance	1,430704317
Kurtosis	0,725179242
Skewness	-0,983569622
Range	5
Minimum	2
Maximum	7
Sum	438
<b>Count</b>	<b>80</b>

#### 4.4 Discussion

In this section, we are going to discuss the results of the survey, aggregate the results based on common characteristics, and provide some interpretations. The research findings are going to be discussed in two parts, the first part is related to Circular economy practices, and the second part will cover Sustainable supply chains. As it was mentioned before we were using Google forms online survey questionnaire as the main tool for collecting the data. We used Excel as a main software for analyzing the data.

The survey's goal was to determine Kazakhstani companies' readiness and adaptability for CE and SSC practices implementation. To do so, it was necessary to determine their attitudes toward these two concepts, as well as their expectations for the implementation of CE and SSC. Also, it was important to identify potential difficulties, barriers, and limitations that businesses may face when implementing CE and SSC. Based on the survey results, recommendations for the implementation of CE and SSC practices in Kazakhstani enterprises will be developed.

The results of the survey related to CE can be aggregated into 4 main groups:

- Kazakhstani companies' perceptions, beliefs, and attitudes toward CE;
- Circular economy in action. In other words how Kazakhstani companies apply CE on practice;
- The reasons behind CE implementation;
- Possible barriers and difficulties on the way to CE according to respondent companies.

Firstly, in order to assess the level of readiness of Kazakhstani companies to implement the Circular economy, it was necessary to determine the level of their understanding of the CE concept, and how much they understand the seriousness and importance of the Circular economy in today's reality. In order to achieve this task, we asked companies several questions which were based on 7 points Likert scale technique. Based on survey results (Table 5), we can say that the majority amount of respondent companies (53,25%) do not think that CE is only about recycling, they understand that the Circular economy serves as an effective alternative to the linear model of the economy. Moreover, the majority of respondent companies (63,75%) tend to believe that CE is able to increase the company's profitability, this idea can be supported by a statement which was provided by McKinsey Research (2017), that the CE is able to significantly increase a company's profitability by reducing its dependence on natural resources.

As for the degree of importance with which Kazakhstani companies perceive the Circular economy, we can say that the results of the survey (Table 7) showed quite positive statistics: 75 % of respondent companies evaluated the Circular economy as an important concept, which gives us hope that perhaps the Kazakhstani market is ready to adopt a Circular economy in large scale and that Kazakhstani companies are sufficiently open to new changes and ready to move towards Circularity.

Next, it was necessary to analyze the approximate current situation related to the prerequisites of circularity in Kazakhstan, and determine the number of companies that have applied the Circular economy into practice. Based on survey results (Figure 24) we can divide the activities in which companies are most engaged, into 4 main groups:

- Reduction of waste and emissions;
- Usage of secondary and renewable raw materials;
- Reuse the waste;
- Extending the useful life of the product.

According to the study's findings, 77 out of the 80 respondent companies are already involved in some form of environmental activity. This shows that Kazakhstani companies are more than predisposed to the introduction of the Circularity concept. Moreover, the survey showed (Table 6), that the major amount of respondent companies (80%) tend to send their waste for recycling, which also can be considered a great sign on the way to the Circular economy transition.

The survey showed that 28 companies out of 80 (figure 25) have already implemented CE, especially companies from economic sectors like construction, and agriculture & food production sectors. Nowadays, Kazakhstan's government actively engages companies to switch to the green concept. Construction companies are actively learning the green principles of construction and certifying their buildings with international standards of sustainability. It is worth saying that 32 companies out of 52 respondents (Figure 27) companies who have not implemented the Circular economy yet, expressed their intention to adopt CE in the future.

If to aggregate the reasons behind CE implementation, we can see 5 top reasons behind CE implementation: Reduction of production costs (23 times was chosen); New market opportunities (22 times was chosen); Improving the competitive advantage (18 times was chosen); Alignment with competition (18 times was chosen); Growing CE interests from customers (17 times was chosen). By implementing CE Kazakhstani companies will be able to significantly decrease the costs related to the materials and resources, and companies are able to invest their financial resources to another areas like improving technology or digitalizing the

production process for an instance. These initiatives may cause a significant increase in production which will have a positive effect such as import substitution as a result.

In order to develop the recommendations within the framework of the master thesis, it is necessary to determine the main difficulties that Kazakhstani companies may face in the future when implementing CE. Based on survey results (Figure 28) we can say that respondent companies worry that the CE will require a lot of implementation effort, the problem is that “green education” is not developed in Kazakhstan, and companies don’t obtain the checklist/road map or special coach who can guide the company from the beginning to the end in Circular economy journey. Also, companies can be stressed about the financial aspects, they may assume that their capital may not be enough in order to adopt CE tools, and also uncertainty about the economic return can stop companies to switch from a linear economy to a circular one. The next difficulty is the lack of internal technical and technological skills, in order to overcome this difficulty companies should be educated in the field of circular and green economy. One of the main tasks of Strategy Kazakhstan 2050, is to provide clear and effective education to Kazakhstani entrepreneurs, which will help companies in Kazakhstan apply the transition to circularity (Concept for the transition of the Republic of Kazakhstan to Green Economy, 2013)

It is crucial to say, that in order to maintain sustainability it is necessary to keep all the supply chains’ components stable and functional. The first question from the SSC part was aimed to determine the supply chain components whose functionality and effectiveness do not satisfy the respondent companies. According to the companies surveyed, we can identify the top three supply chain components that require improvement (see Figure 29): planning, sourcing & procurement, and inbound & outbound logistics. These components are directly dependent on the quality of supply chain management. According to Ed Romaine (2022), the final goal of supply chain management is to satisfy both customers and stakeholders at the same time. Based on this, it is necessary to develop recommendations for effective supply chain management in order to achieve its sustainability.

Next, we should determine the respondent companies’ level of satisfaction with the categories such as *digitalization of processes*, *supply chain transparency*, and *supply chain management*. The responses summary showed (Table 9) that the majority of companies were satisfied with these above-given categories according to 7 points Likert scale, however, the most frequent answer was “*Neither satisfied nor dissatisfied*”, this type of answer is mostly positive rather than negative, but when companies chose this kind of middle option, it means

that they are not sure about their satisfaction, and it shows that there is a possibility that they may be not satisfied with above-given categories in a sense.

Another set of 7 questions, was asked in order to define respondent companies' position related to ecological management and their policies concerning environmental protection. Companies were surveyed and examined for the presence of categories such as environmental requirements, formal environmental policy, environmental requirements for suppliers, the usage of digital technologies, environmental management standards and etc. The responses statistics illustrated that on average 63 % of companies obtain all of the above-given elements (Table 10). We can assume that the possible reason for such positive statistics is due to the fact that the majority of respondent companies are quite large and well-known organizations in the Republic of Kazakhstan, and these companies may present themselves as companies with good ecological vision, and they may demonstrate the presence of all the above-mentioned elements in order to maintain an ecological image.

The last question was supposed to display respondent companies' opinions and beliefs about the sustainable supply chain concept, 80 % of companies were agree that a sustainable supply chain is able to optimize costs and improve productivity. This shows that Kazakhstani companies are familiar with the idea of SSC, they understand the importance and effectiveness of SSC, and they perceive SSC as an effective tool in order to make companies sustainable, and environmentally responsible.

## 5. Conclusion

The master thesis had an objective to demonstrate SSC and CE opportunities in Kazakhstan. Moreover, it shows the importance of CE and SSC in today's realities. In order to achieve these objectives, first of all, the thesis provided theoretical background by describing the main ideas of SSC and CE, the thesis showed the importance of sustainability and being sustainable starting from the company's level to the world's one.

The master thesis demonstrated the importance of sustainable and green supply chain management. In order to justify the effectiveness of the Sustainable supply chain and Circular economy, thesis provided the examples of world-leading companies such as Renault, Philips, Nike, and Walmart which successfully implemented these two practices.

The thesis applied an empirical setting by analyzing Kazakhstan as a great platform and Almaty as a starting point for SSC and CE implementation. The second part of the thesis analyzed the annual resource flow in Almaty by three main sectors; agriculture & food production, construction, and industry. The study presented the case approach by telling about companies in Kazakhstan like Amiran which successfully introduced sustainable supply chain practices in its agro-industrial complex. Moreover, the thesis provided examples of Kazakhstani companies like Raduga KDR, KazWaste, and recycling which effectively applied CE principles to their practices. The research also reported on Kazakhstan's government position towards CE, the main initiatives which the state applied in order to spread the idea of CE over the country, and the strategy Kazakhstan 2050 which is aimed to transfer Kazakhstan towards circularity and green economy.

The third part covered the primary quantitative research which was conducted within the framework of the master thesis. The survey included 80 companies that operate on the territory of Kazakhstan, from 3 economic sectors: agriculture & food production, construction, and light industry. The survey was conducted by spreading the questionnaire to the companies. The survey's goal was to identify Kazakhstani companies' perspectives toward CE and SSC practices.

The survey results demonstrated a positive outcome, it showed that Kazakhstani companies are familiar with CE and SSC concepts. For example, companies understand that the circular economy is not only about recycling, they understand the importance of CE and that CE is a philosophy that includes a lot of principles, tools, and mechanisms.

Although the survey showed that most of the respondent companies are engaged in environmental activities, these activities include the reduction of waste and the usage of renewable materials. Most companies send their waste for recycling which also demonstrates



the positive trend. 28 companies out of 80 have already implemented CE, and the companies who haven't adopted it yet expressed their desire to implement it in the future. However, there are difficulties and barriers which stop some companies to implement CC like lack of capital or lack of technical skills for an instance.

Regarding the SSC, based on the survey outcome we can see that companies have a strong opinion that SSC is able to increase profitability and optimize costs. Most companies obtain environmental elements such as the official company's policy towards the environment, standards, requirements and etc. Companies would like to improve some supply chains components such as planning, procurement, and logistics. The last part resumes the thesis and provides recommendations to Kazakhstan's government and companies on how effectively implement CE and SSC practices.

In conclusion, based on the empirical setting and results of the survey we can say that Kazakhstan can become a great platform for SSC and CE implementation, Kazakhstan is open to and ready to implement them. Kazakhstan is developing very fast and it has a lot of opportunities, abilities, and resources for effective and successful SSC and CE implementation.

## **5.1 Research limitations**

The first limitation is the sample size, there were 80 companies in total who took the participation in the survey. Initially, it was planned to collect 100 responses, but some companies refused to participate in the survey, and as a result, we collected 80 responses. Unfortunately, 80 responses, are not able to precisely show 100% accurate statistics, because there is a large number of companies that operate in Kazakhstan's market, and it is complicated to cover all of them within the scope of the thesis. However, thanks to these 80 companies, we can create an idea and simulate the approximate situation in Kazakhstan regarding the Circular economy and Sustainable supply chain.

The second limitation was the survey method, our survey included multiple choice closed questions, we applied these types of questions because it could be predicted that companies would not prefer answering open questions due to the fact that it takes more time.

## 5.2 Policy Implications

- ***Provide education towards Circular economy and Sustainable supply chain.***

The survey showed that most of the companies identified the lack of knowledge of CE, uncertainty about the economic return, lack and of internal technical/technological skills as difficulties and barriers on the way to CE and SSC introduction.

The government should support companies by providing free education towards CE and SSC basics. Make free courses that teach the fundamental principles and mechanisms of CE and SSC. Furthermore, in order to demonstrate the effectiveness of SSC and CE, the state should incorporate financial education into SSC and CE concepts in order to demonstrate their effectiveness in terms of economic and financial returns.

- ***Organize events and establish platforms for the exchange of knowledge and experience.***

The state needs to hold various events where companies can share their experience in the field of circular economy and sustainable supply chains. Such events can even be held in a virtual space. Moreover, the state may also attract foreign experts in the fields of CE and SSC, who will train and motivate companies to shift to the side of circularity and sustainable development through master classes and lessons.

- ***Offer concessional loans and provide subsidies to companies.***

The survey showed that the lack of capital also may consider a barrier on the way to CE and SSC. A lot of respondent companies expressed their desire to implement CE and SSC. The government should support companies by providing concessional loans and subsidizing them in order to incentivize companies to switch towards circularity and sustainability. After all, if companies really start to conduct waste-free production, this will significantly reduce the amount of waste and the carbon footprint throughout the country.

- ***The use of garbage and waste as raw materials for the production of consumer goods.***

The results of the survey showed that most companies hand over their garbage and waste for recycling. Cities' state and local governments can set up special recycling centers that accept business waste and produce small household goods, for example. This initiative can be tested in a vacant building or a temporary room constructed specifically for this purpose. If the concept is successful, it can be expanded and replicated in other parts of the city.

- ***Creation of special enterprises for repair and restoration.***

According to the survey, businesses are less involved in repair/restoration activities. The government needs to establish organizations that will recover items such as vehicles, equipment, and furniture for example. They can begin by restoring small equipment and then

progress to larger machines. Because Almaty is prone to circularity, the first such enterprise could be established there.

### 5.3 Managerial Implications

- ***To produce packaging of their own waste.***

The survey showed that 38,75% of companies use recycled materials when packaging their products. Based on this, it is possible to offer companies the option of producing their own waste packaging or donating their waste to other companies as raw materials for waste production. For example, Jelmer Hoozgard (2019) suggested that farmers may pack their products in packaging materials made from their own waste for agricultural enterprises. After use, such packaging can be converted into an organic mixture, which can then be converted into a soil improver, effectively returning chemicals to where they came from - the soil.

- ***Implementation of the service business model***

Companies can provide their products not as goods, but as services. How? For example, to try to produce durable high-quality goods, and in the future take this product for restoration or modernization.

- ***Optimize transportation (logistics)***

The survey showed that 16% of respondent companies are not satisfied with logistics as a component of the supply chain. Here we can recommend them optimize their transportation by applying several possible strategies:

- Set the nearby distribution points for delivering products to the final point in the fastest way. For example, companies from Almaty city may open distribution points in the Almaty region.
- Fill trucks completely and leave a minimum amount of free space (if possible).
- Use electric vehicles as an alternative to classic ones.

- ***Plan the amount of inventory in advance***

According to the survey, we can see that some companies expressed their desire to improve planning and inventory management. We can suggest them to estimate the amount of inventory in advance, by applying different software like big data for an instance or other digital tools, which can assume the possible demand in order to prevent a large number of stocks. This practice integration can significantly shift companies to the sustainability of their supply chains.

- ***Switch from linear to circular supply chain***

In order to increase the company's sustainability and optimize the costs companies should switch from linear SC to a circular one. It would help to significantly decrease the costs, and optimize the company's processes and enhance profitability increase.

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# Appendix

## Survey Questionnaire Sustainable supply chains and Circular economy practices

### Questions

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#### *Company characteristics:*

1. **Sector:**
2. **Activities:**
3. **Number of employees – full time equivalents (end of 2021):**
  - a) 1-9
  - b) 10-49
  - c) 50-249
  - d) 250+
4. **Turnover 2021:**
5. **How much do you agree with the statement “Circular economy is only about recycling”?**
  - a) 1 – Strongly disagree
  - b) 2 – Disagree
  - c) 3 – Somewhat disagree
  - d) 4 – Neither agree nor disagree
  - e) 5 – Somewhat agree
  - f) 6 – Agree
  - g) 7 – Strongly agree
6. **Which of the following measures would help your organization pursue circular economy goals?**
  - a) Increased recycling
  - b) Reducing the use of virgin materials
  - c) Supply chain collaboration
  - d) Developing new business models
  - e) Generating new revenue streams
  - f) Shifting to repair and recovery
  - g) Re-design/design for disassembly
  - h) Achieving takeback from customers
  - i) Developing shared ownership schemes
  - j) Reducing risks of price volatility in the materials

- k) None of the above
7. **How much do you agree with the statement “the implementation of a Circular economy business model will increase the profitability of your company”?**
- a) 1 – Strongly disagree
  - b) 2 – Disagree
  - c) 3 – Somewhat disagree
  - d) 4 – Neither agree nor disagree
  - e) 5 – Somewhat agree
  - f) 6 – Agree
  - g) 7 – Strongly agree
8. **Is the company engaged in any of these activities?**
- a) Reduction of resource consumption (water, energy, raw materials)
  - b) Avoidance of waste production and reduction of waste
  - c) Reduction of emission values
  - d) Reuse of waste from own activities within the production cycle
  - e) Reuse of waste from own activities by other companies
  - f) Use of secondary raw materials and waste purchased from others
  - g) Use of renewable raw materials
  - h) Extension of product life or product stability
  - i) Repair/reuse of products to extend their useful life
  - j) None of the above
9. **How often do you send your company's waste for recycling?**
- a) 1 – Never
  - b) 2 – Rarely, (in less than 10% of the chances when I could have)
  - c) 3 – Occasionally, (in about 30% of the chances when I could have)
  - d) 4 – Sometimes, (in about 50% of the chances when I could have)
  - e) 5 – Frequently, (in about 70% of the chances when I could have)
  - f) 6 – Usually, (in about 90% of the chances I could have)
  - g) 7 – Every time
10. **How do you rate the importance of Circular Economy practices in today's economy?**
- a) 1 – Not at all important
  - b) 2 – Low Importance
  - c) 3 – Slightly important
  - d) 4 – Neutral

- e) 5 – Moderately important
- f) 6 – Very important
- g) 7 – Extremely important

11. Did your company implement a circular economy business model? (yes/no)

**If no to response 11:**

12. **Is your company interested in implementing some circular economy practices?**

Yes/No

13. **What difficulties do you think your company could face when implementing a Circular economy?**

- a) Not interesting for my business segment
- b) Inadequate/contradictory legal situation
- c) Lack of capital
- d) High implementation effort
- e) Uncertainty about the economic return
- f) Lack of internal technical/technological skills
- g) Technological difficulties
- h) Difficulties in finding suitable suppliers
- i) Difficulties in selecting appropriate distribution channels
- j) Lack of knowledge or distrust on the part of intermediaries/operators (technical offices, dealers, operators, etc...)
- k) Price for "circular" products/services too high
- l) Quality and effectiveness (actual or perceived) of the "circular" products/services produced.

**If yes to response 11:**

14. **Since when your company has implemented the Circular economy?**

15. **Your circular business model is mainly based on?**

- a) Recovery, recycling, and reuse of resources/energy

- b) Providing renewable energy, bio-based, or fully recyclable input material to other companies or institutions.
  - c) Use of recycled, recyclable, or bio-based materials produced by specialized suppliers.
  - d) Extending the life cycle of products and components
  - e) Dematerialization of products, Pay-for-Use, or product as a service
- 16. For what reasons did you introduce a Circular Economy business model in your company?**
- a) Reduction of production costs
  - b) Increasing the value of the products offered
  - c) Improving competitiveness in existing markets
  - d) Entering new markets
  - e) Ethical behavior
  - f) Reaction to specific requests from buyers/major customers
  - g) Growing interest on the part of consumers or customers
  - h) Alignment with competition
  - i) Adaption to existing or future regulatory requirements
  - j) Tax benefits and contributions
- 17. Which components of the Supply chain would you like to improve in your company?**
- a) Planning
  - b) Sourcing & Procurement
  - c) Inbound & Outbound logistics
  - d) Manufacturing
  - e) Warehouse & Inventory management
  - f) Distribution
- 18. How satisfied are you with the digitalization level of processes in your company?**
- a) 1 – Completely dissatisfied
  - b) 2 – Mostly dissatisfied
  - c) 3 – Somewhat dissatisfied
  - d) 4 – neither satisfied or dissatisfied
  - e) 5 – Somewhat satisfied
  - f) 6 – Mostly satisfied
  - g) 7 – Completely satisfied
- 19. How satisfied are you with the transparency level of your supply chain?**
- a) 1 – Completely dissatisfied

- b) 2 – Mostly dissatisfied
- c) 3 – Somewhat dissatisfied
- d) 4 – Neither satisfied or dissatisfied
- e) 5 – Somewhat satisfied
- f) 6 – Mostly satisfied
- g) 7 – Completely satisfied

**20. How satisfied are you with the supply chain management in your company?**

- a) 1 – Completely dissatisfied
- b) 2 – Mostly dissatisfied
- c) 3 – Somewhat dissatisfied
- d) 4 – Neither satisfied or dissatisfied
- e) 5 – Somewhat satisfied
- f) 6 – Mostly satisfied
- g) 7 – Completely satisfied

**21. Do your customers set environmental requirements?**

- a) Yes
- b) No

**22. Does your company have a formal environmental policy that includes a commitment to legal compliance, continuous measurement and continuous improvement of environmental performance?**

- a) Yes
- b) No

**23. Do you have environmental requirements for your suppliers?**

- a) Yes
- b) No

**24. Does the company use any new digital technologies in its activities? (such as artificial intelligence, and ERP systems)**

- a) Yes
- b) No

**25. Do you use any recycled or recyclable materials when you are packaging your product?**

- a) Yes
- b) No

**26. Does your company meet or have environmental management standards (e.g., Green Office certification, ISO 14001, EMAS)?**

- a) Yes
- b) No

**27. Can your company's products be reused/environmentally safely disposed of?**

- a) Yes
- b) No

**28. How much do you agree with the statement that a sustainable supply chain allows you to improve productivity and optimize costs?**

- a) 1 – Strongly disagree
- b) 2 – Disagree
- c) 3 – Somewhat disagree
- d) 4 – Neither agree or disagree
- e) 5 – Somewhat agree
- f) 6 – Agree
- g) 7 – Strongly agree