UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER THESIS

CIRCULARITY IN PLASTIC PACKAGING INDUSTRY: PRO EMBA'S SUSTAINABLE BUSINESS MODEL

Ljubljana, October 2021 LIZA RAHNE

AUTHORSHIP STATEMENT

The undersigned Liza Rahne, a student at the University of Ljubljana, School of Economics and Business, (hereafter: SEB LU), author of this written final work of studies with the title CIRCULARITY IN PLASTIC PACKAGING INDUSTRY: PRO EMBA'S SUSTAINABLE BUSINESS MODEL, prepared under supervision of prof. dr. Adriana Rejc Buhovac,

D E C L A R E

1. this written final work of studies to be based on the results of my own research;
2. the printed form of this written final work of studies to be identical to its electronic form;
3. the text of this written final work of studies to be language-edited and technically in adherence with the SEB LU's Technical Guidelines for Written Works, which means that I cited and / or quoted works and opinions of other authors in this written final work of studies in accordance with the SEB LU's Technical Guidelines for Written Works;
4. to be aware of the fact that plagiarism (in written or graphical form) is a criminal offence and can be prosecuted in accordance with the Criminal Code of the Republic of Slovenia;
5. to be aware of the consequences a proven plagiarism charge based on the this written final work could have for my status at the SEB LU in accordance with the relevant SEB LU Rules;
6. to have obtained all the necessary permits to use the data and works of other authors which are (in written or graphical form) referred to in this written final work of studies and to have clearly marked them;
7. to have acted in accordance with ethical principles during the preparation of this written final work of studies and to have, where necessary, obtained permission of the Ethics Committee;
8. my consent to use the electronic form of this written final work of studies for the detection of content similarity with other written works, using similarity detection software that is connected with the SEB LU Study Information System;
9. to transfer to the University of Ljubljana free of charge, non-exclusively, geographically and time-wise unlimited the right of saving this written final work of studies in the electronic form, the right of its reproduction, as well as the right of making this written final work of studies available to the public on the World Wide Web via the Repository of the University of Ljubljana;
10. my consent to publication of my personal data that are included in this written final work of studies and in this declaration, when this written final work of studies is published.

Ljubljana, _____ Author's signature: _____

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

sl. - Slovene
EU - European Union
UN - United Nations
UNEA - The United Nations Environment Assembly
NGO - non-governmental organization
PE - polyethylene
HDPE - high density polyethylene
LDPE - low density polyethylene
PET - polyethylene terephthalate
PP - polypropylene
PS - polystyrene
EPS - expanded polystyrene
XPS - extruded polystyrene
PVC - polyvinyl chloride
PVA - polyvinyl alcohol
MARPOL - International Convention for the Prevention of Pollution from Ships
EIA - environmental impact assessment
SME - small-to-medium enterprise
EPR - extended producer responsibility
SUP – single-use plastics
ISO - International Organization for Standardization
B2B - business to business
B2C - business to customer
R&D - research and development
PR - public relations
BYO - bring your own
AORA - Australian Organic Recycling Association
ERP - enterprise resource planning

INTRODUCTION

Biodiversity loss, water, air and soil pollution, resource depletion and excessive land use are just a few environmental problems we face today. There is no denying it - our planet is in crisis and unless several stakeholders, e.g. policymakers, companies and consumers, transition to more sustainable models, our long-term well-being is under question (McDonough & Braungart, 2002). However, many industry players agree that in order make the transition scalable, we need further research on more specific practical solutions - one of which is circular economy (Pauli, 2018). Setting natural world as an example, circular economy is encouraging industries to make the best of our scarce resources by designing products for durability, prolonged service life and minimised waste accumulation (Ellen MacArthur Foundation, 2021). It tries to change economic logic from what manufacturers, media and even policymakers have been teaching us for years instead of resourcefulness and care for the planet: that used goods, even though still in a good shape, are a sign of poverty. By implying reuse, remanufacturing and recycling, circular economy tries to shift the belief from "new is superior" to "old is resourceful" (Stahel, 2010).

When discussing circular economy, a lot of focus is directed to closing the loop in the plastic packaging industry. Due to its enormous waste creation, its direct visibility and its huge recyclability potential, plastics have become a top priority in the last few years' transitioning towards circularity. According to Plastics Europe (2020), European plastics value-chain today is composed of over 55,000 companies, which employ more than 1.5 million Europeans and create a turnover of over 350 billion EUR. In 2019, worldwide production of plastics amounted to almost 370 million tonnes (in 2018, 359 tonnes) and European production to 57.9 million tonnes (Plastics Europe, 2020).

Since most of those products end up in landfills and oceans, the plastic industry, including packaging, plays a crucial part in European Commission's agenda for a climate-neutral, circular EU economy. As a part of New Industrial Strategy, Circular Economy Action Plan was adopted in 2015 and in December 2018, declaration of Circular Plastics Alliance (CPA) was launched to boost the EU market for recycled plastics to 10 million tonnes by 2025 (European Commission, 2020a). As a part of the Green Deal, bans and consumption reduction of selected plastic packaging items were confirmed in 2019 to ensure that by 2030, all plastics packaging placed on the EU market is reusable or easily recycled (European Commission, 2020a). In the Covid-19 lockdown it might be tempting to believe that the virus has taken all the attention away from problems in the packaging industry, but once the pandemic is over, governments will be left with piles of waste and enormous debts. Even if the deadlines of some EU and government actions are being postponed, the plan for plastic packaging is very unlikely to change. If not else, the money coming from Plastics Tax, Extended Producer Responsibility and Deposit return schemes, will be too tempting for the highly indebted governments (Gummer, 2020).

Partially thanks to those measures, the amount of plastics waste in Europe that is sent to be recycled has doubled since 2006, but more than a quarter is still dumped in landfills. According to Plastics Europe (2020), 39.6 % of European plastics converters demand is for packaging, which makes it by far the biggest end-user market. In 2018, 17.8 million tonnes of packaging waste were collected, but unfortunately only 42% were actually recycled. In 2018, 4 million tonnes of recycled plastics were transformed into new products, mostly used in building & construction (46%) and the packaging industry (24%). Despite the positive trend in recycled percentage, very few practical solutions are widely available and that is why most companies struggle with the transition towards circularity (Plastics Europe, 2020).

However, those challenges can offer several opportunities for the right industry players. The EU, for example, is not only banning and limiting single-use consumption but also investing heavily in green projects concerning the plastic packaging industry. Furthermore, the transition is also supported financially on national level; in Slovenia, this is mainly the government funding and investments from institutions such as Slovene Enterprise fund, SPIRIT Slovenia, SID bank and others (European Commission, 2019).

The future of plastic packaging producers therefore depends highly on their ability to work in sync with the newly proposed legislation and make the most of the incentives offered. This also applies to a small family business PRO EMBA d.o.o. (hereinafter PRO EMBA), based in Vodice, Slovenia. Founded in 1991, the company specialises in production of HDPE foil and bags. Additionally, other packaging materials, such as food delivery boxes, single-use cups, latex gloves and more, are imported from various suppliers around Europe and Asia and sold within Slovenia. The legislation proposed by the EU, from ban and consumption reduction of selected plastic packaging items to EU packaging levy and others all highly affect the business. To ensure its long-term competitiveness, PRO EMBA must move towards more sustainable options, ideally biodegradable materials and recycling. While plastic packaging, especially HDPE foil and bags produced in-house offer many opportunities, finding a solution for a small company with no R&D department can be rather difficult. There are very few successful industry examples to learn from and clients in Slovenia are quite reluctant to pay a premium that sustainable packaging solutions usually require. But with legislation, technology and consumer awareness slowly moving towards sustainability, having a solid plan for the transition towards circularity will be the only way for (companies like) PRO EMBA to stay competitive in the long run.

The **purpose** of this thesis is therefore to address the topic of circularity on a global, regional and, local level from a theoretical, legislative and, practical perspective. For PRO EMBA d.o.o., understanding the seriousness of the situation, finding appropriate solutions, and transitioning towards a circular business model, may be a pivotal step in developing long-term market presence. Research and critical analysis should help the company understand proposed legislation in the plastic packaging industry, some of the best practices around the globe and most importantly, what actions could be applied specifically to their business model. It clarifies the costs and challenges of specific solutions and their potential benefits.

If the proposed actions turn out successful, the company could gain incredible competitive advantage and set an example for others in the field, producers as well as the consumers.

The main **goal** of the thesis is to develop a sustainable business model for PRO EMBA to transition towards circularity in the plastic packaging industry. This is achieved by developing a solid theoretical background, researching the actions policymakers are proposing and most importantly, studying some of the best practical examples. The main goal is therefore divided into the following sub-goals:

- defining what part of the policymaking applies to the plastic packaging industry: including both the bans/limitations and financial incentives,
- finding the best industry examples of circular business models and sustainability strategies,
- selecting what solutions can be applied to PRO EMBA and developing a sustainable business model.

Even though a small amount of quantitative data was also analysed, the study is based predominantly on qualitative **research methods**. The theoretical-conceptual oriented data was collected and analysed through investigative research techniques.

As the first step of the thesis was to build a solid theoretical background, the first chapter reflects on the literature review of definition and components of circular economy. It explains the historical development of the concept and summarises the most important works that shaped the contemporary understanding of circularity. The second chapter is devoted to quantitative data on production and recycling in order to show the importance of the problems concerning the plastic packaging industry. Policymaking agendas and actions regarding the plastic packaging industry applied on a global, European and Slovenian level are presented in the third chapter. The first three chapters answer the **first research sub-question**: What is circular economy composed of and how does circularity apply to the plastic packaging industry?

In order to find the best practices of adjusting to the new legislation and making the best of the initiatives offered, possible alternatives of plastic packaging and best industry examples are presented in the fourth chapter, answering the **second research sub-question**: What are the best industry practices for closing the loop in the plastic packaging industry?

In the last chapter, PRO EMBA's current operations and business model are presented in order to find out which of the researched practices would best fit the company and answer the **third research sub-question**: Which of those practices are applicable and feasible for PRO EMBA? Based on all the knowledge gained from literature review, case studies and company analysis, sustainable business model was developed as the last step of the thesis.

1 CIRCULAR ECONOMY

1.1 Development of circular economy

While sustainability and circular economy started gaining more attention only a few decades ago, the idea of circularity is anything but new. In fact, the circular model is what enabled our planet to thrive for millions of years before humankind first appeared. In nature, there is no such thing as waste - everything is food for something else - and even humankind lived in circular society for thousands of years. In order to survive, the early man had to make the best possible use of natural resources and caring for nature was the only way to prosper (Stahel, 2010).

But the industrial revolution enabled societies to overcome the limits of natural resources and the circular economy of scarcity, which humankind lived in for thousands of years, ended in the 18th century (Benyus, 1997). In time, more and more goods were man made, taken from nature and changed to such an extent that the natural world could no longer process them. As long as humans were relying on physical labour, the rate of human destruction could not precede the rate of natural renewal. But the discovery of oil changed all that: combined with the development of synthetic materials that started to replace wood, metals and other natural sources, environmental degradation started to show its first signs. However, at the time, nature seemed limitless and worrying about resource depletion or the consequences of dumping the waste into landfills seemed entirely unnecessary (Stahel, 2016).

The individuals who seemed to understand that this kind of system would not work forever were very rare and quite unpopular: the first idea of sustainability was developed in 1713 by Hans Carl von Carlowitz who introduced concerns regarding the scarcity of timber and talked about 'sustainable forestry'. He believed that only the quantity of trees that could be regrown should be cut annually in order to maintain its capital. This approach was named '*Nachhaltigkeit*' or '*sustainability*' and introduced the care for nature, as the foresters realised that nature is their main source of wealth (von Carlowitz, 1713).

Another author to warn the public of finite resources was Thomas Malthus, who believed that growth of the human population brings terrible consequences. By the time he published his *Population: The First Essay* in 1798, other writers have also started to notice that the environment had begun to change.

Some of them have helped preserve the environment by forming conservation societies, but the real concern was raised only in 1962 with Rachel Carson's *Silent Spring* (McDonough & Braungart, 2002). After the 1960s, scientists were encouraged to research the issue further and several international discussions about the complexity of the situation were raised. Lots of work on the topic emerged in the following decades, from *Population Bomb* by Ehrlich

(1968), *The Limits to Growth* by Meadows and others (1972), *Small is Beautiful: Economics as if people mattered* by Schumacher (1973) (McDonough & Braungart, 2002).

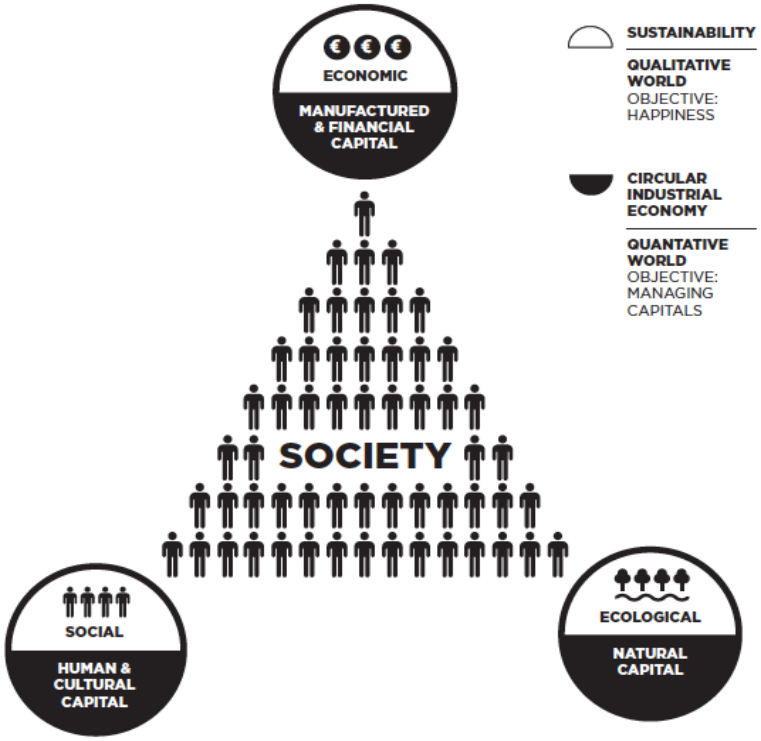
Probably the most important milestone happened in 1987, when *Our Common Future* was published by the United Nations. The document, known also as the 'Brundtland Report', outlined guiding principles for sustainable development and defined it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 37). Despite the current widespread use of the word 'sustainability', of which more than 300 definitions can be found online, both the definition and the principles outlined in Our Common Future still form the basis of sustainability that we know today.

Around the time of 'Brundtland Report', circularity started gaining attention as well. Boulding (1966) had already introduced the idea of a system where nature and economy worked in harmony in 1966 and this inspired Pearce and Turner (1990) to further study the linearity of the economy. Many believe them to be the first to introduce the concept of circularity (Geissdoerfer, Savaget, Bocken & Hultink, 2017), despite the fact that Stahel and Reday (1976) also played an important part by focusing on circularity of industrial economics. However, the concept of circular economy we know today has evolved through many theoretical influences, such as laws of ecology (Commoner, 1971), regenerative design (Lyle, 1994), industrial ecology (O'Rourke, Connelly & Koshland, 1996), biomimicry (Benyus, 1997), cradle-to-cradle (McDonough & Braungart, 2002), looped and performance economy (Stahel, 2010) and the blue economy (Pauli, 2010) (Geissdoerfer, Savaget, Bocken & Hultink, 2017).

1.2 Definition of circular economy

Despite the fact that sustainability was first mentioned much earlier than circularity, both concepts started gaining momentum around the same time. To make a clear distinction between the two, Stahel (2016) presented them as two sides of a coin - sustainability as the qualitative part striving for happiness, and circular economy as a quantitative part with the objective of managing capitals (see Figure 1).

Figure 1: Sustainability and the circular economy: two faces of the same coin



Source: Stahel (2010).

Today, the European Commission (2020a) defines circular economy as "an economy where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised". While this is most certainly a good basis for policies and actions that the EU, the UN and others are working on, many promoters of the concept find the definition too shallow (Kirchherr, Reike & Hekkert, 2017). Stahel (2016) believes that "circular economy should change economic logic because it replaces production with sufficiency: reuse what you can, recycle what cannot be reused, repair what is broken, remanufacture what cannot be repaired" (Stahel, 2016, p. 436). It introduces asset management that prolongs the value and utility of products for as long as possible and applies "an attitude of 'caring' and the 'factor time' into economics and society" (Stahel, 2016, p. 7). In a way, this is a criticism of linear economy's focus on finished goods consumption, resulting in a speedy creation of waste (Stahel, 2010).

Ellen MacArthur Foundation defines the circular economy as an economic activity that builds and rebuilds the overall health system and benefits all: businesses, society, and our planet (Ellen MacArthur Foundation, 2021). Webster (2017) goes even further by implying that economy should be designed for intentional restoration by relying on renewable resources, eliminating waste and eradicating use of toxic chemicals. Circularity therefore does not focus only on the end result, such as reuse or recycling, but mainly on prolonging the product life cycle with proper design and making the production less harmful for the environment (Cardoso, 2018).

In this thesis, we will use the definition of circular economy that takes aspects from several authors into account: “Circular economy is an economy that is restorative by design: that reduces the use of scarce resources while encouraging the responsible use of renewable ones, that prolongs the product life-cycle by maximising the long-term value of products, and with that, eradicates waste”.

1.3 Theoretical background of circularity

The circularity we know today is a result of ideas and influences coming from several different authors. Many theories have contributed to the development of components that define what a circular economy should look like. This subchapter outlines the most influential theories and their guiding principles at the core of circularity.

1.3.1 Laws of ecology (1971)

Commoner criticised the linearity of the industrial model as early as 1971: inspired by the book *The Social Costs of Private Enterprises*, he wanted to prove that nature and industry can coexist, despite the contemporary disbelief. According to Marx, continuous growth is the very essence of capitalism and the idea of stationary capitalism is therefore contradictive. That, combined with limitation of resources, creates a serious incompatibility between the industrial system and the environment (Commoner, 1971).

Still, Commoner (1971, p. 520) believed that “nature is not ‘the enemy’ but our essential ally” and that by following certain principles, we can turn the situation around. He remained optimistic, mostly thanks to the fact that environmental degradation is not a consequence of human biological actions, but social ones - which are much faster and easier to change. Despite the fact that solving environmental crisis is extremely complex and interconnected, he developed four Laws of Ecology (Everything is connected to everything else, Everything must go somewhere, Nature knows best, There is no such thing as free lunch) that should serve as a guideline to restore what we have taken from nature (Commoner, 1971). The four laws are explained in more detail in the Appendix 2.

1.3.2 Regenerative design (1994)

Lyle (1994) believed the biggest reason for environmental crisis lies in over-simplification of our system: while nature thrives in diversity and complex networks, industry is trying to apply simple, replicable models with degenerative linear flows that are destined to fail. But capitalism, combined with population growth, can only be sustained if the energy and material systems were designed as self-renewing and regenerative (Motloch, 1995).

That is why Lyle (1994) introduced regenerative design, that continuously replaces used energy and materials through its own processes. It should be based on the natural operational

system, minimised use of non-renewable resources (unless reuse and recycling are a part of the design), responsible use the renewable resources (only to the capacity of renewal) and reduced accumulation of waste. Ideally, the energy should be regenerated by solar radiation, and materials renewed by reusing and recycling.

With *Regenerative design for sustainable development*, Lyle (1994) built foundations of the circularity framework that McDonough, Braungart and Stahel have later further developed.

1.3.3 Industrial Ecology (1995)

Industrial ecology is based on the idea that waste reduction does not necessarily lead to improved overall sustainability and that creative waste, emission and resource management can be very profitable. O'Rourke, Connelly and Koshland's (1996) main objectives include closing the loop in material cycles and causing a shift in the way industry manages environmental issues.

Industrial ecology strives for transition from linear to closed, circular economy where waste of one industry is an input for another one, just like in the efficient and sustainable natural cycles. O'Rourke, Connelly and Koshland (1996) concluded that often the sustainability issues stem from market and regulatory failures and could therefore be improved if decision makers would have access and the willingness to research real information and real costs of circularity. Of course, companies and consumers should also cooperate and work hard on achieving these environmental goals (Witjes & Lozano, 2016). Just as Stahel (2010), Lave et al. (1998) also talk about the importance of design in lowering the costs of waste collection and recycling, especially as the spot market for recyclates is often uncertain and volatile (Hond, 2000).

1.3.4 Biomimicry (1997)

Benyus (1997) developed an approach where the industry learns from nature, imitating its designs and processes in order to improve sustainability of the economy. Biomimicry stems from the belief that economy is not that different from ecosystems after all; both use energy and materials in order to produce goods. What distinguishes those processes is the fact that natural production is cyclical while industry performs only linear transformations. But with innovation inspired by nature, humankind has a good chance to change that as well.

The top commandments we can learn from the well-functioning ecosystems are: using resources responsibly, diversifying to fully use the given resources, using waste as a resource, gathering and using energy efficiently, optimising rather than maximising, eliminating toxins wherever possible, remaining in balance with the biosphere, stop ignoring nature's warning signs and instead use them as an information-based feedback system, encouraging local production and consumption (Benyus, 1997).

1.3.5 Cradle-to cradle (2002)

McDonough and Braungart (2002) have criticised the way linear economy uses limited resources to manufacture cheap products with short life cycles. As most items today are produced with a 'built in obsolescence' that encourage customers to replace them with a newer version, it is often much cheaper to buy a new product than repair an existing one. This is why the cradle-to-cradle model focuses on design as the first signal of human intention and the key for transition toward circular economy (McDonough & Braungart, 2002).

Just like Stahel (2010), McDonough and Braungart (2002) divide all materials into two different types of nutrients: biological and technical. Biological nutrients are circular by nature and can easily re-enter the environment as they biodegrade over time, cycling back to the nutrients they are composed of. On the other hand, man-made, technical materials, such as plastics, cannot simply cycle back to nature on their own: systems where their value can be restored need to be created (McDonough & Braungart, 2002).

The first problem of current design is that we mix both types of nutrients which means neither can be reused, recycled or salvaged after their lifespan. In order to move from "cradle-to-grave" to "cradle-to-cradle", we need to eliminate the concept of waste, which McDonough and Braungart (2002, p. 104) believe "means that the valuable nutrients are contained in the material shape and determine the design: form follows evolution, not just function". As long as products are designed to stay either solely in the biological cycle or solely in the technical cycle, both circles can restore the valuable nutrients of materials with upcycling rather than downcycling.

Another important part of cradle-to-cradle design is the possibility of disassembly. The option to replace only the necessary parts reduces waste, saves producer's money and lowers the need for raw materials. Furthermore, McDonough and Braungart (2002) encourage the use of the local sources: not only local materials, but also physical processes and flows of energy. Taking advantage of wind and sun power would give smaller players a chance, create more stable system and therefore benefit both companies and customers.

Keeping all this in mind, cradle-to-cradle approach changes the traditional design from cost, aesthetic and performance driven to a "triple bottom line", built on a tripod of ecology, equity and economy (McDonough & Braungart, 2002). Currently, most businesses tend to build their products around economical part and only then add the others as a bonus. The design that McDonough and Braungart (2002) talk about, starts by taking others into account in order to create value in all three sectors.

1.3.6 Performance economy (2010)

Performance Economy is based on two different sustainable models that encourage responsible use of finite resources and take into account all three pillars of sustainability: economical, environmental and social. The differences between the two are presented in the Table 1.

Table 1: Differences between the Lake Economy and the Loop Economy

Product-life phase	**The Lake Economy**	**The Loop Economy**	**Ruling principle of product-life phases**
Production	Upgradable system design	Primary recycling of production waste	100% yield
Utilisation	Reuse of goods and components	Remanufacturing and technological upgrading of goods	Efficiency of the smallest loop
End-of-life	Remarketing of components	Secondary recycling of mixed waste	Zero waste
Limits	Outdated technology	Second law of thermodynamics	
Nature	Forest, fish stock	Waste is food	Cycles (water cycle, leaves)

Source: Stahel (2010).

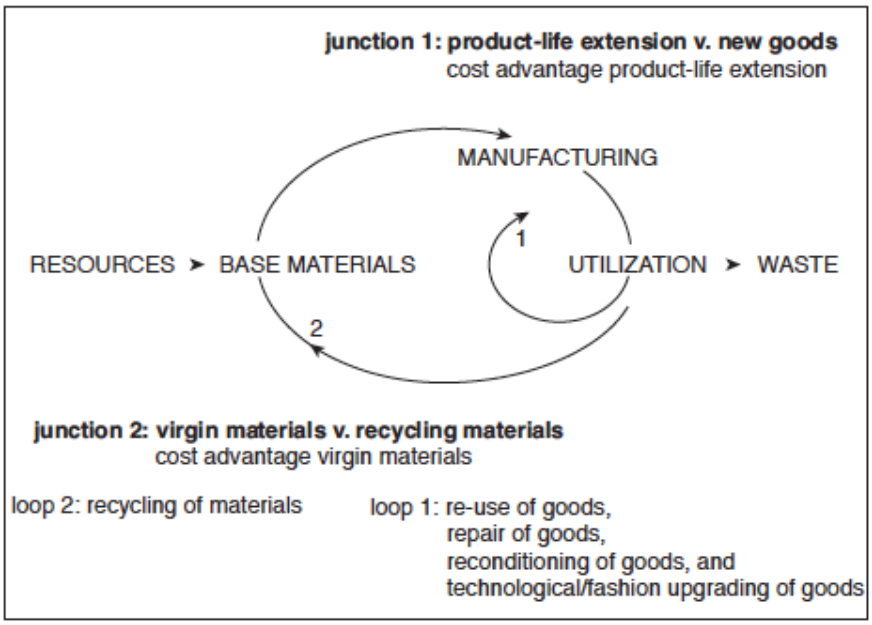
The first, *Lake Economy* is a precedent of contemporary shared economy: it is based on the understanding that only biological items are in fact consumable. Technical materials, on the other hand, can only be used - they provide us with a service, which is why ownership is often unnecessary (Ellen MacArthur Foundation, 2021). The main players in the Lake economy are producers or fleet managers that manufacture the items, not for selling them to the end user, but rather offer its services to consumers - selling the performance. This way, the same item can have many users in its life cycle, but only a single owner - the producer that keeps it in charge over most of its service-life. As this model replaces exchange value of goods with utilisation value, it mostly applies to the products under warranty, those of greater value that last for a longer period (like washing machines or automotive parts). Taking back the used goods pays off, as the producer can reuse components while manufacturing new goods or can repair them and lease them again. However, it is important that the products are designed in a durable way, with modular design and standardised components so that they can easily be reused, repaired or remanufactured (Stahel, 2010).

The second, *Loop Economy* (see Figure 2), starts at the end of products' utilisation and consists of several players. As the name suggests, the product cycles around the producer, customers and remanufacturer - it crosses several points of sale and has many users. It prolongs product service-life through reuse, repair, remanufacturing and technological upgrading. The reuse is an important component, but a distinction between reusing goods or

components (Loop 1) and reusing molecules (Loop 2) must be made. As its goal is slowing down the flow of materials, the first kind of reuse is preferable with long service-life goods, but it is also feasible with other items, like fashion for example. It used to be limited to the local communities in the past, but the spread of internet has enabled worldwide second-hand shops, available to the majority of the population via Ebay, etc. It is preferable to the second one as it preserves more value, saves about 75% product embodied energy and prevents waste (Stahel, 2010).

The second, molecule reusing, is what we know as recycling - closing the cycle between waste and material production. Generally, less energy is saved in this kind of reuse, but the percentage varies a lot among different materials. The goal of circular economy is to maintain the value of the product for as long as possible and to keep the molecules as pure and valuable as possible, which is why Stahel (2016, p. 436) encourages companies: “Do not repair what is not broken, do not remanufacture something that can be repaired, do not recycle a product that can be remanufactured”. Despite that remanufacturing has lower labour productivity, it is still preferred over recycling due to job creation, resource and financial savings. However, the scarcity of certain virgin materials and design for single use often make recycling the best possible option. Stahel’s (2010) Loop 2 activities can be further grouped in three categories: the first, primary recycling of production waste, which is the easiest to perform as collection usually happens inside the company and the waste is clean mono material. Second group is secondary recycling of end-of-use products, which includes mixed material waste from several owners and is therefore much more expensive. As this recycling allows products and molecules to regain value and brings them back into new use, it is often called the “grave-to-cradle” approach. The last group is natural cycles, which includes processes that turn natural materials, such as biomass, into hydrogen.

Figure 2: Closing the loops: A self-replenishing, more sustainable Loop Economy and the junctions between these loops and a linear economy.



Source: Stahel (2010).

Stahel (2010) stresses three important aspects to keep in mind with both loops:

- Speed of circular flow: the faster the flow, the more rapid the resource loss.
- The cycles have no beginning and no end which means products can enter at any time.
- Due to reverse compound interest law and second law of thermodynamics, the smaller the cycle is, the more efficient and consequently profitable it is.

1.3.7 Blue Economy (2010)

Pauli (2010) built a sustainable model that companies could use in order to tackle environmental issues while also improving their competitiveness. Just like Stahel's Performance Economy (2010), Blue economy strives for abundance achieved by local solutions based on innovative, clean technologies working in sync with nature. While Green Economy has offered some amazing solutions, those were usually very expensive, available to chosen few and therefore not scalable. Pauli (2010) believes Blue Economy will change this - to show that by 'using what we already have', generating value and responding to basic needs of conusmers, sustainability is attainable for almost everyone (Pauli, 2018).

Approach is based on 21 principles, with background in physics, simplicity of minimalistic design and the idea of "waste equals resource". Similarly to Benyus (1997) and Stahel (2010), the model uses nature - its circularity, efficiency of local systems, constant change and diversity - as an inspiration. Most importantly, Blue Economy is based on belief that every challenge, including environmental issues, is an opportunity that entrepreneurs can

use in their advantage. Gunter Pauli's book The Blue Economy (2010) and its successors describe hundreds of business solutions based on this model.

2 PLASTICS INDUSTRY

When discussing circular economy, a lot of focus is directed to closing the loop in the plastic packaging industry. Due to its enormous waste creation, its direct visibility of environmental degradation and its huge recyclability potential, plastic packaging has become a top priority in transitioning towards circularity.

2.1 Plastic packaging industry and its importance

In the fight against their pollution, many forget that plastics were actually invented with a goal of improving the quality of everyday life. Which indeed they have - thanks to their durability and versatile usage options, plastics experienced almost exponential growth in the last century: from 2 million tonnes produced in 1950 to 370 million tonnes in 2019 (Geyer, Jambeck & Law, 2017). According to Plastics Europe (2020), European plastics value-chain today is composed of over 55,000 companies, which employ more than 1.5 million Europeans and create a turnover of EUR 350 billion. Just European plastic raw material producers and plastics converters produced 57.9 million tonnes of plastics and created a positive trade balance of EUR 13 billion in 2019 (Plastics Europe, 2020).

Plastic packaging accounts for almost 39.6% of European plastics production and is therefore the largest sector of the European plastics industry. In 2018, it was valued at EUR 72.2 billion and thanks to increasing technology advancements and consumer packaging applications, it is expected to grow at CAGR of 4.4% in the years 2021 to 2025 (Plastics Europe, 2020). According to Plastics Europe (2020), the European production of plastic packaging amounted to almost 23 million tonnes in 2019.

Those numbers show that plastics and plastic packaging define the way we live today and that the world without them is almost unimaginable. There are several features, from energy efficiency, lightness, flexibility and ease of sterilisation, that make plastics an ideal material for different sorts of packaging. While household care, industrial packaging and pharmaceuticals also use enormous amounts of plastics, the biggest part is intended for food and beverage industry. The ability to hygienically protect groceries and prolong shelf-life without adding preservatives are the main reasons for that. Furthermore, there are several different polymer types with their own benefits that can be applied to protect, deliver or present specific goods (Andrady & Neal, 2009). In general, plastics can be divided in two groups:

– Thermoplastics (such as HDPE, LDPE, PP, PET, …) include materials that melt when heated and harden when cooled. This allows the converters to reheat and reshape the products in order to create the product of choice (Plastics Europe, 2020).
– Thermosets (such as polyurethane, silicone, viny esters, …) are materials that undergo a permanent chemical change when heated and therefore cannot be reshaped or reformed (Plastics Europe, 2020).

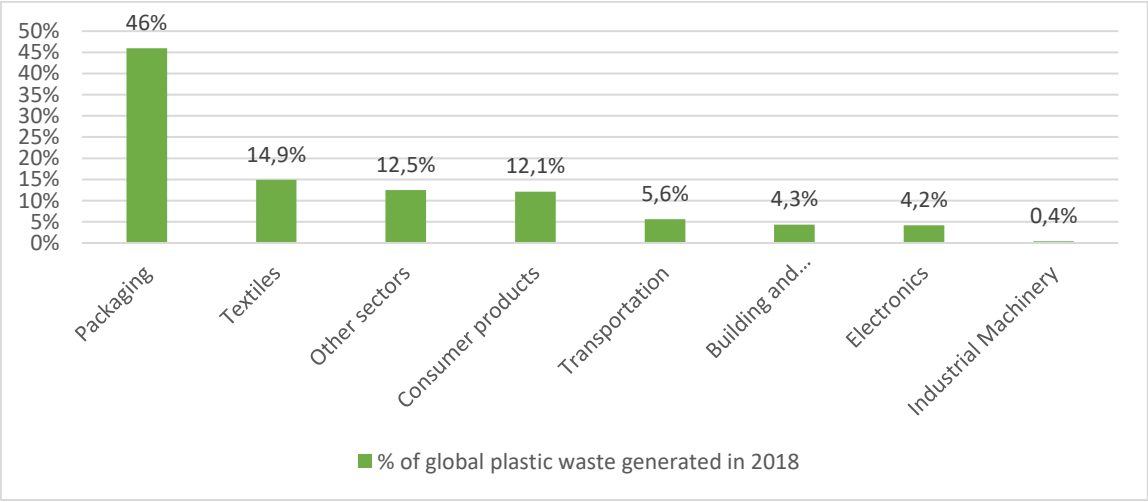
As the focus of this thesis is on the thermoplastics, the most common polymers in the European plastic packaging are presented in the Appendix 3 (Table_Apx 1).

2.2 Plastic packaging industry and the environment

While durability combined with temperature and chemical resistance make plastics an ideal packaging material, they, on the other hand, make it one of our biggest environmental problems.

The vast majority of polymers used for packaging materials (presented in Appendix 3) is derived from fossil fuel, which means they cannot decompose naturally at the end of their service life and are destined to accumulate in the landfills or even worse, the natural environment (UN Environment Programme, 2019). In 2018, more than 342.6 million tonnes of plastic waste were generated globally and around 157.6 million tonnes or 46% of that were contributed by the plastic packaging (Statista, 2021). The main reason why packaging is still responsible for almost half of the generated plastic waste (see Figure 3) is its extremely short service-life. Most items are produced for single use only and that is why compared to, for example, plastic building and construction goods, packaging has much worse effect on the environment.

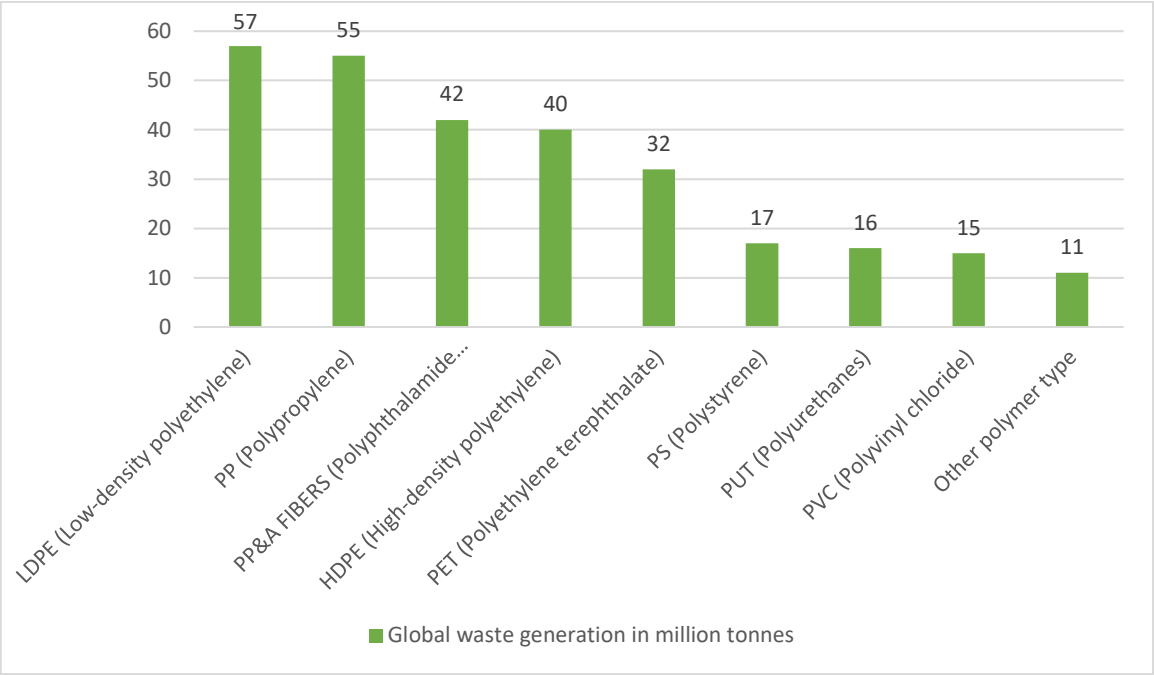
Figure 3: Global plastic waste generation by industrial sector in 2018



Source: Statista (2021).

In the Figure 4, primary plastic waste generation by polymer is presented. In 2015, the biggest polluters were LDPE and PP products, which generated 57 million tonnes and 55 million tonnes of waste (Geyer, Jambeck & Law, 2017).

Figure 4: Global primary plastic waste generation by polymer type in 2015



Source: Geyer, Jambeck & Law (2017).

There are three different ways to manage plastic waste (Geyer, Jambeck & Law, 2017):

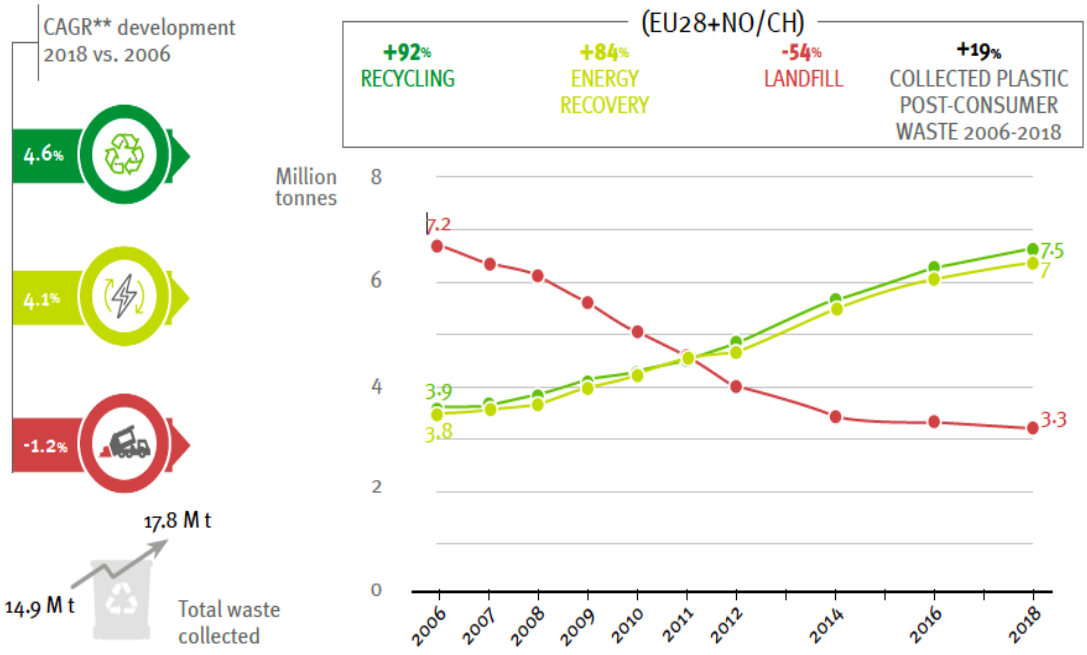
- In 2015, around 55% of global plastic waste was discarded in either managed facilities (sanitary landfills), open dumps or the natural environment. While most plastic packaging is still managed this way in the less developed part of the world, the Western countries, especially EU, have shifted strongly towards recycling. In 2018, only 3.3 million tonnes or 18.5% of the European (EU28+NO/CH) plastic post-consumer packaging waste ended up in landfill. In the industrialized developing countries, on the other hand, a major part still ends up in the ocean and other unregulated sites, mostly thanks to inadequate waste management infrastructure (d'Ambrières, 2019).
- Energy recovery is the conversion of plastic waste into heat, electricity or fuel through different processes, such as combustion, gasification, pyrolization, anaerobic digestion, and landfill gas recovery (European Bioplastics, 2015). Despite the innovative technologies emerging in the last decades, the vast majority of plastics is still treated with incineration (in 2015, 25% of global waste was incinerated) (Geyer, Jambeck & Law, 2017). The latter is a process of reducing the amount of waste to be landfilled while exploiting the energy of plastics by producing electricity or heating. It is also named thermal recovery or "energy from waste" and can be divided into two processes: mass burn or refuse-derived fuel systems (European Bioplastics, 2015). Health and

environmental effects of such technique depend highly on design and control of emission technology (Geyer, Jambeck & Law, 2017). According to Plastics Europe (2020), 7 million tons or 39.5% of the European (EU28+NO/CH) plastic post-consumer packaging waste was treated with energy recovery in 2019. While recycling of plastic packaging waste is definitely preferred over energy recovery, unfortunately not all types of packaging can actually be recycled. However, with innovative technologies like deriving fuel from plastic waste, a combination of recycling and energy conversion could be the strategy towards 100% recovery rate of plastic packaging (European Bioplastics, 2015).

- Despite that recycling is only postponing and not permanently avoiding the packaging disposal, it is by far most favourable way of managing plastic packaging waste. First of all, it reduces the need for raw materials, helps preserve the energy and consequently, decreases future waste generation. In 2015, only 20% of global plastic waste was recycled: as mentioned, the recycling rates are still quite low in the developing countries, but the developed ones are working very hard to improve them (Geyer, Jambeck & Law, 2017). Western Europe and Japan both have mature economies, above average waste management infrastructure and relatively expensive labour, which makes them a perfect example of what kind of countries usually encourage higher recycling rates (d'Ambrières, 2019). In the EU, the amount of plastic waste that was sent to be recycled in 2018 has doubled since 2006 (Plastics Europe, 2020). In 2018, 17.8 million tonnes of plastic post-consumer packaging waste were collected, and 7.5 million tonnes or 42% of that, were actually recycled. 4 million tonnes of the recycled plastics were transformed to new products, mostly used in building & construction (46%) and the packaging industry (24%) (Plastics Europe, 2020).

Figure 5 indicates the twelve-year evolution of plastic packaging (household, industrial and commercial) waste treatment in the EU28+NO/CH.

Figure 5: 2006-2018 evolution of European (EU28+NO/CH) plastic (household, industrial and commercial) packaging waste treatment



***CAGR: Compound Annual Growth Rate is the mean annual growth rate over a specific period of time*

Source: Plastics Europe (2020).

2.3 Plastic packaging industry in Slovenia

When it comes to the global, or even the European production of plastics, Slovenia, thanks to its small size, cannot play a very important role. According to Plastics Europe (2020), the country ranks 23rd out of 30 European countries (EU28+NO/CH) when it comes to absolute demand for the plastic resin. While European demand in 2019 was around 50.9 million tonnes, with the top three countries Germany, Italy and France accounting for 47.5% or 24.2 million tonnes, Slovenian was below half million tonnes (Plastics Europe, 2020).

However, on the country level, the plastics industry is far from negligible: with 858 companies registered and 12,209 people employed in production of the plastic goods, it is one of the most important Slovenian business activities (SURS, 2021). In 2018, producers of plastics amounted up to 5% of all converters in the country based on the number of people employed (GZS, 2018). The following Table 6 presents the Plastics production industry in Slovenia in 2019 according to the SKD classification from 2008. The numbers presented include only the companies with plastics production registered as their main activity. The actual data is therefore expected be somewhat higher but is practically impossible to measure.

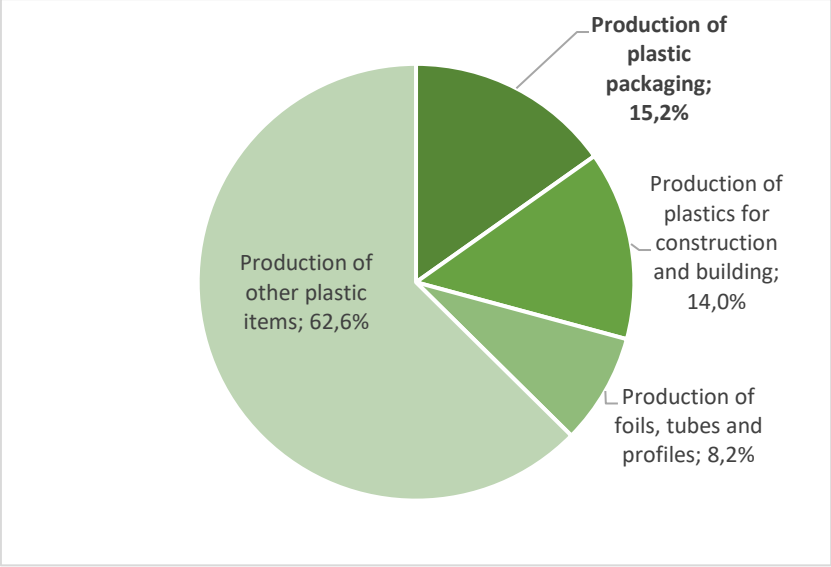
Table 2: Slovenian plastics production in 2019 according to the SKD 2008 classification

SKD Classification	**2019**
11110 Number of enterprises	858
12110 Turnover in 1000 EUR	1,637.069
12120 Production value in 1000 EUR	1,518,054
12130 Gross margin on goods for resale in 1000 EUR	22,172
12150 Value added at factor cost in 1000 EUR	507,858
12170 Gross operating surplus in 1000 EUR	195,236
16110 Number of persons employed	12,572
16130 Number of employees	12,209

Source: SURS (2021).

As seen in the chart below, most companies registered as plastics producers were focused on the production of plastic packaging in 2019 (SURS, 2021). From the 859 companies, 130 are specialised in the plastic packaging industry, 120 in the construction and building, 70 in the production of foil, tubes and profiles, and 539 in "other plastics items". However, the 2019 sales revenue was the highest in construction and building (EUR 293.4 million), followed by the production of foils, tubes and profiles (EUR 270.2 million), while plastic packaging amounted only up to EUR 238.7 million.

Figure 6: Share of registered plastics producers by sector in 2019



Source: SURS (2021).

While the number of companies registered as producer of plastic packaging has fallen slightly in the last decade (see Figure 7 below), both the sales revenue and the number of

employees have risen. Only around 10% of the Slovenian plastic packaging producers are small and medium sized, while the majority are micro companies (GZS, 2018). According to SURS (2021), the sales revenue of production of plastic packaging was EUR 238.7 million with 1,530 people officially employed in the industry. Table 3 presents the Plastic packaging production industry in Slovenia in 2019 according to the SKD classification from 2008. Again, the numbers presented include only the companies with plastics packaging production officially registered as their main activity, therefore the actual data is expected to be somewhat higher.

Table 3: Slovenian plastic packaging production in 2019 according to the SKD 2008 classification

SKD Classification	**2019**
11110 Number of enterprises	130
12110 Turnover in 1000 EUR	238,682
12120 Production value in 1000 EUR	215,358
12130 Gross margin on goods for resale in 1000 EUR	3,354
12150 Value added at factor cost in 1000 EUR	71,167
12170 Gross operating surplus in 1000 EUR	30,216
16110 Number of persons employed	1,576
16130 Number of employees	1,530

Source: SURS (2021).

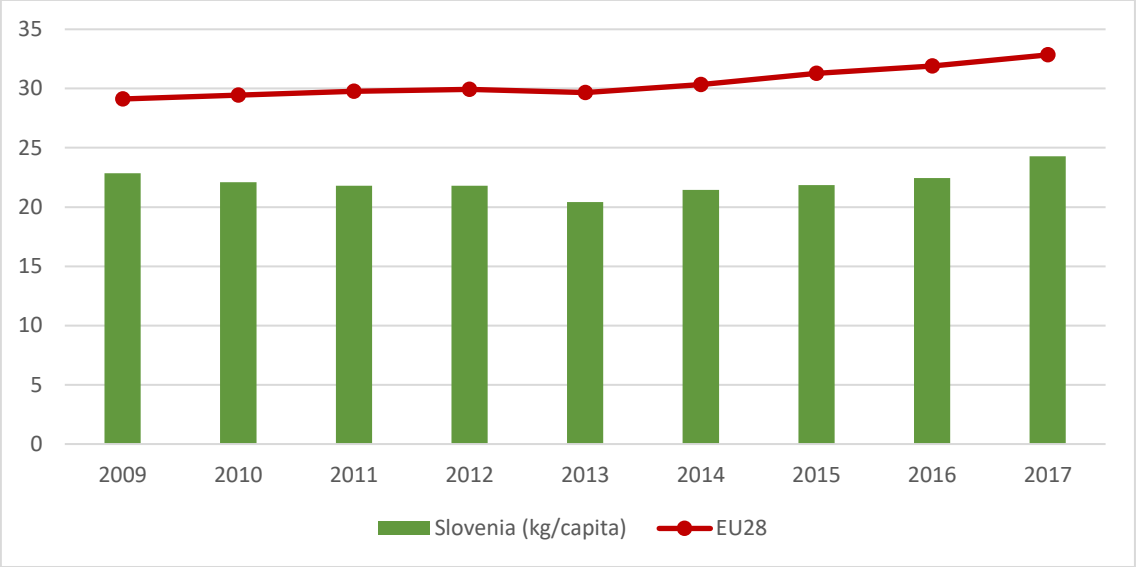
Figure 7: 2009-2019 evolution of Slovenian plastic packaging production industry: Number of registered companies, Number of employees and Sales Revenue

Source: SURS (2021).

When it comes to the plastic waste treatment, the EU member states are setting an example for the rest of the world and Slovenia is no exception. While the amount of plastic waste generated is still growing, its treatment has improved in the last years (Pograjc, 2018). According to Plastics Europe (2020), 31% of Slovenian plastic post-consumer waste were recycled in 2018, 40% energy recovered and 29% landfilled (Plastics Europe, 2020). However, an increasing amount of plastic waste is exported from the country: in 2020, this amounted up to 123,000 tonnes, which is almost 30% higher than in 2019. The biggest part is going to Malesia (31,700 tonnes in 2020), Bosnia (28,700 tonnes in 2020), Turkey (24,900 tonnes in 2020) and Indonesia (22,120 tonnes) (STA, 2021).

The amount of plastic packaging waste generated has been increasing in the last decade as well, but it is still quite far below the European (EU28) average. The latest data available is for 2017, when Slovenians have generated 24.28 kg of plastic packaging waste per capita, compared to the EU average of 32.84 kg per capita (Eurostat, 2019). The movement of plastic packaging waste generated in the last decade is presented in the Figure 8.

Figure 8: 2009-2019 evolution of plastic packaging waste generation in kg per capita; Slovenia vs. EU28



Source: Eurostat (2021).

When it comes to treatment of the plastic packaging waste, Slovenia is doing even better. Share of recycled plastic packaging waste has increased drastically in the last decade and is well above the EU28 average. In 2017, Slovenian plastic packaging recycling rate was 60.4%, while EU28 average was only 41.9% (Eurostat, 2021). According to Eurostat (2021), Slovenia ranked third in the EU in 2017, with Lithuania leading with 74.2% and Bulgaria second with 64.8% recycling rate.

3 POLITICAL AGENDA ON CIRCULARITY IN PLASTIC PACKGAGING INDUSTRY

3.1 Global level

127 countries worldwide have already proposed bans or taxes on single-use packaging, but the legislation still varies largely among different regions. Kenya, for example, has the strictest plastic bag ban around the globe - fines for carrying, manufacturing or selling them amount up to EUR 32,000 and even prison time (EIA, 2021). Some countries, on the other hand, have none - partially thanks to the underdeveloped infrastructure and waste management, but also due to several other reasons.

The most important global mechanism tackling the issue of climate change is the Paris Agreement, which entered into force in November 2016 and is currently signed by 189 countries. It provides the framework and actions intended for reduction of the global greenhouse gas emissions and limitation of the increase of temperatures, but does not directly affect the plastics industry (United Nations, 2021). When it comes to the latter, there is very little coordination on the global level: over 40 different conventions and other mechanisms offer legal basis for tackling the environmental issues concerning plastics. Most important ones include the Basel Convention, covering international trade of plastic waste and the Stockholm Convention, providing the framework for toxicity of specific chemicals used in plastics (Langrand, 2021). UN 2030 Sustainable Development Agenda briefly mentions plastic industry, predominantly in the 12th (Sustainable consumption and production) and 13th goal (Stop climate change). While both strive for reduction of plastics with main focus on single-use items, they offer very little practical solutions for producers and consumers (Plastic Soup Foundation, 2018).

In order to measure the progress of plastics reduction on a global level, New Plastics Economy Global Commitment was launched in 2018, led by Ellen MacArthur Foundation in collaboration with the UN Environment Programme. It unites businesses and governments that together represent 20% of all plastic packaging produced globally, committed to a set of 2025 targets. While the studies show they made great progress in some areas, such as bags and straws for example, the altogether single-use plastics reduction is barely noticeable (Ellen MacArthur Foundation, 2015).

Many experts agree that tackling plastic pollution has been so inefficient due to lack of international authority to coordinate the above-mentioned actions. The instruments are not well coordinated among each other even inside the same regions, whereas on the global level (Hassey, 2020). As the plastic production and pollution do not follow any national borders, neither should the legislation preventing their consequences (Langrand, 2021).

This is why a UN Global Treaty on Plastics, named also "*Paris Agreement for plastics*" was proposed and should be discussed on the UNEA 5th session in February 2021. At the 4th

UNEA meeting in 2019, 68 countries have already publicly expressed interest for new agreement concerning plastic pollution (EIA, 2021). The initiative mostly came from EU and Norway, but also bigger players like India and Russia expressed their support. US, at the time under Trump's administration, was strictly against it, but that is very likely to change with Biden's presidency. The 5th meeting was supposed to play a crucial role, as the negotiations for a new Convention regarding plastics should have begun. However, due to Covid-19, those were postponed to February 2022 when the UNEA is supposed to meet in person. Still, more than half of the nations present in February 2021 have expressed support, which now amounts up to 120 countries in favour of the global treaty (Langrand, 2021). In the end of 2020, the Nordic Council of Ministers published a 148-page report that should serve as a template for the potential treaty, suggesting that there already is some agreement on the key points like standardisation of terms, harmonised reporting and having national action plans with some extent of sovereignty (similar to Paris greenhouse gas emissions) (Raubenheimer & Urho, 2020).

However, as many issues are very challenging to address, it is clear that such agreement is still far away. Environmentalists warn that the current downstream focus on the plastics end-of-life treatment will not be enough. To reduce the amount of plastics leaking in the environment, legislation regarding waste and recycling will have to be combined with the upstream and midstream activities, mainly reduced production of plastics (Ford, 2020). That is difficult enough due to several benefits of plastics (explained in Ch. 2.1), but also the fact that so many powerful regions and corporations depend highly on its production, does not make it any easier. As there are great economic interests at stake, heavy lobbying efforts like framing the narrative and blaming the consumer are expected to slow down the negotiations (Hassey, 2020).

When the decision-makers will align their goals and finalise the agreement is therefore very difficult to say. If we look at some previous Conventions, the Paris Agreement for example, the discussion started already in 1991, while the final paper was signed only in 2016, 25 years after the development of its first framework. However, when it comes to plastics, the negotiations seem to accelerate; the Basel Convention was adopted only eight months after its first proposal, which is the fastest in the history of international agreements. According to Ford (2020), delaying a global agreement regarding plastics for only five years (keeping the current legal framework), means additional 80 million metric tons of plastic will land in the ocean by 2040. This is why experts are stressing the importance of speedy action and why it is quite likely that a "Paris agreement on plastics" is less than a few years away.

3.2 EU Level

Plastic packaging industry plays a crucial part in the European Commission's agenda for a climate-neutral, circular EU economy. While the Green Deal is a basis for the EU

environmental action, there are several other documents that focus specifically on the circular economy, the plastic industry and the plastic packaging industry.

3.2.1 Green Deal

The most important EU document tackling the sustainability issue is the European Green Deal. It sets the guidelines on how to make Europe the first climate-neutral continent by 2050 and provides a growth strategy to turn it into a global leader in achieving sustainability across several sectors. It includes actions on eight main policy areas (Clean Energy, Sustainable Industry, Building and renovating, Sustainable mobility, Biodiversity, From Farm to Fork, Eliminating Pollution and Climate Action) and covers also sustainable industry - policy mobilising industry for clean and circular economy. The focus of the latter is on the decarbonisation and modernisation of energy-intensive sectors by adopting minimum requirements to stop the environmentally harmful goods from being produced, while extending producer responsibility to encourage new business models. The measures will be taken mostly in the resource-intensive sectors, including plastics, in order to reduce micro plastics pollution, enhance reusable or recyclable packaging and reduce waste (European Commission, 2019). To achieve higher rates of recycling, market for secondary raw materials and by-products will be introduced. To ensure better waste materials for the businesses (that will lead to higher recycling rates) and simplified waste collection for citizens, the Commission will propose separate waste collection. Beside trying to improve waste materials for recycling, access to sustainable raw materials is also part of the Commission's plan (European Commission, 2019).

3.2.2 Circular Economy Action Plan

When it comes to circularity, the most important document on the EU level is the Circular Economy Action Plan, which was adopted in December 2018 as a part of new Industrial Strategy. It outlines a future oriented framework for transition towards an economic model that uses resources responsibly by reducing consumption and encouraging the circular use of materials. It was updated in the 2020 as the New Circular Economy Action Plan for a cleaner and more competitive Europe in order to accelerate transition set by European Green Deal and actions adopted in 2015 (European Commission, 2020a). The policy framework focuses on three goals:

- Designing Sustainable Products that should widen the Ecodesign Directive to as many products as possible and by that encourage producers to consider sustainability and circularity in the design process.
- Empowering consumers and public buyers by providing clear and trustworthy information on all aspects of sustainability, including lifespan and repair options.
- Circularity of production processes that should be achieved through improved reporting and certification system, supporting the bio-based industry and encouraging tracing

resources via new technology. This is supported by several other documents, including the Industrial Emission Directive, the Bioeconomy Action Plan and the SME Strategy (European Commission, 2020b).

3.2.3 EU Strategy for Plastics in The Circular Economy

The Circular Economy Action Plan already set plastics as key priority in 2015 and two years later the Commission set the 2030 goal to make all plastic packaging recyclable. This is why the EU Strategy for Plastics in The Circular Economy was adopted in 2018, introducing the vision for Europe's new plastics industry. It is based on innovative and environmentally friendly design and production that encourage reuse, repair, remanufacturing and recycling of goods (European Commission, 2018). It further develops 2030 goals that encompass durable designs, higher waste recycling rates, extended and modernised recycling capacities, more integrated plastics value chain, well-functioning market for recycled materials, use of innovative materials, and others. Those should be achieved by several actions (European Commission, 2018):

- Improving the economics and quality of plastic packaging recycling by designing for recyclability: in 2015, the Commission set the goal of 55% minimum recycled plastic packaging by 2025 and in 2018 the goal of all plastic packaging reusable or easily recycled by 2030.
- Boosting demand for recycled plastics, currently limited to low-value and niche products, by developing quality standards for sorted plastics waste and recycled materials combined with better coordinated separate collection and sorting. Extended Producer Responsibility (hereafter EPR) can financially boost such actions as well.
- Curbing plastic waste and littering by preventing the plastic waste in the environment, with focus on the single-use plastics and over packaging.
- Building a clear regulatory framework for plastics with biodegradable properties, restricting the use of oxo-plastics and banning the microplastics used as additives.
- Encouraging innovations and investments in circularity - mostly recycling, materials that fully biodegrade in water and alternative feedstock.
- Harnessing global action by supporting international policy or free trade agreements, promoting best practices and using external funding instruments to help improve waste management around the globe.

3.2.4 Packaging and Packaging Waste Directive

Both the Green Deal and the Action Plan for circular economy set plastics as one of the top priorities, but when it comes to the packaging specifically, the most important part of the EU legislation is the Packaging and Packaging Waste Directive. Its main purpose is to prevent and reduce the production of packaging waste through reuse and recycling and to harmonise those measures among the Member States (European Parliament & Council of the European

Union, 1994). The main document was signed in 1994 and defined several aspects of the packaging production and waste treatment. In 2015 amendment, the main focus was directed towards the plastic carrier bags (with or without handles) which are supplied to consumers at the point of sale. Member States were required to adopt measures like national reduction targets, marketing restrictions, economic instruments and others in order to significantly lower the consumption to maximum 90 lightweight plastic carrier bags per person by 31 December 2019 and 40 by 31 December 2025 (European Parliament & Council of the European Union, 2015). Additionally, lightweight plastic carrier bags were prohibited to be offered free of charge from 31 December 2018 on. However, those measures only apply to bags with thickness below 50my, and exclude very lightweight plastic carrier bags, defined as bags below 15my. In order for the EU to be able to evaluate progress of the Member States, mandatory reporting on the consumption of mentioned plastic bags was introduced from 27 May 2018 (European Parliament & Council of the European Union, 2015).

Packaging and Packaging Waste Directive was last amended in 2018, setting some more ambitious and clearer recycling targets: by 2025 65% of all packaging by weight (50% of plastic packaging) should be recycled and by 2030 this should rise to 70% (55% for plastics packaging) (Cole, 2018). Furthermore, the amendment also introduced the idea of EPR for the packaging and the member states are expected to establish appropriate schemes by the end of 2024. As many agree that the decision on what type and quantities of packaging are produced is usually in the hands of producers and not consumers, the EPR is supposed to serve as a financial incentive to fully consider the sustainability of the products (European Parliament & Council of the European Union, 2018a). Such schemes already exist in several states, but are very uncoordinated between each other and therefore major gaps exist in their efficiencies.

3.2.5 Single-use Plastics Directive

As the biggest plastic polluters, especially when it comes to the marine litter, are the items designed to be discarded after a single use, the EU Parliament and the Council of the EU have adopted the Single-use plastics directive in 2018. Similar to the Packaging and Packaging Waste Directive, it aims to reduce the quantity of plastic waste generated, but sets much clearer measures that the Member States must adopt in order to achieve the proposed targets. In order to focus the actions where they are most needed, the Directive is applicable for the plastic goods found most on the EU beaches, including certain types of packaging, fishing gear and oxo-degradable plastic. Despite that bio-based and biodegradable plastics are derived from biomass and supposed to biodegrade over time, they still fall under this Directive, as they are a modified and not naturally occurring material. However, plastic items that are designed for multiple uses (for the same purpose) during their service-life, may it be refill or reuse, are excluded from the actions proposed (European Parliament & Council of the European Union, 2018b).

The items that the EU Parliament and the Council of the EU's measures affect are divided into several groups (see Appendix 4 - Table_Apx 2), depending on different factors like availability of more environmentally friendly alternatives, feasibility of changing consumption patterns and whether they are already included in any other EU legislation. Member States are required to apply one or more following actions to a predefined group of products (European Parliament & Council of the European Union, 2018b):

- Consumption reduction: For many plastic packaging items no financially viable and truly more sustainable (in all phases: from production, use, reuse and recyclability) alternatives exist, so their full prohibition is almost impossible. This is why the Member States can decide themselves on the measures they will apply in order to achieve the reduction of the items listed in Table_Apx 2 under the category A. Such measures include national reduction targets, incentives for reusable alternatives, instruments prohibiting offering these items free of charge at the point of sale and others.
- Restrictions on placing on the market: If affordable more sustainable alternatives already exist, the Member States are required to prohibit placing the plastic single-use options on the market. The items that fall into this category are presented in the Table_Apx 2 under the Category B and cover also all items containing oxo-degradable plastics. Beside causing troubles in the conventional plastics recycling process, the latter cannot fully biodegrade and are one of the biggest sources of microplastics.
- Product requirements: Certain products, like plastic caps and lids will only be allowed to be placed on the market if they will confirm to specific product design requirements regarding the composition and the reusable or recyclable nature of products.
- Marking requirements: In order to raise awareness and provide clear information to consumers, products listed in the Table_Apx 2, category D, should only be placed on the market with a harmonised marking, offering the information on product's waste management options and negative littering impact.
- Extended producer responsibility: As mentioned, for certain packaging items no affordable sustainable alternatives are yet available, which is why EPR schemes will have to be created by Member States. Based on the polluter-pays principle, the scheme money will cover the costs of waste management, litter clean-up, data gathering, reporting and awareness resing measures. The Packaging and Packaging Waste Directive already set the minimum requirements for the EPR, but this directive widens its scope and clearly defines the costs that should be covered by it.
- Separate collection: Focusing on the beverage bottles, separate collection shall be improved in order to achieve 77% recycling rate by 2025 and 90% by 2029 (by weight) of the items listed in the Table_Apx 2, category C.
- Awareness resing measures: Changing consumption habits is probably the most difficult part of achieving 2025 and 2030 goals. However, promoting responsible consumer behaviour through economic and other incentives is a crucial step. It is very important for the end-users to receive clear and truthful information on the availability of more sustainable alternatives and the Member States are therefore obligated to provide it.

Single-use plastics directive requires the Member States to enforce most of the above proposed measures by 3 July 2021. As presented in the Appendix 4 under Table_Apx 2, only marking requirements are applicable from the 3 July 2024 onwards.

3.2.6 EU Packaging Levy

In July 2020, the European Union implemented another measure as a part of its recovery package and new 2021-2027 funding strategy: EU Packaging Levy. It introduces a new "packaging tax" on all non-recyclable plastics packaging waste in the amount of 0.80 EUR for each kg of waste created, which should encourage circular economy and recycling in the plastic packaging industry. The weight of the non-recycled plastic packaging will be calculated as a difference of the weight of packaging waste created and the weight of packaging waste recycled in the same year. The Member States are obliged to handle the charge from 1 January 2021, proceeds of which will go into EU Covid-19 recovery fund (Packaging Europe, 2021).

However, some of the countries will be eligible for a yearly flat rate reduction, expressed in the current prices. National governments will decide themselves how they will collect the revenue, as no methods or regulatory stipulations were proposed by the EU Council. In general, they have three options: subsume into general contributions, increase taxes on non-recycling disposal routes (landfill or energy recovery) or pass on the tax to producers. Most countries will probably decide for a combination, but as of August 2021, majority of the Member States are paying it out of their general budgets (Packaging Europe, 2021).

3.2.7 Funding opportunities

Despite that most described legislation and proposed measures focus on prohibition and limitation of certain products, the EU is not only banning the single-use consumption, but also investing heavily in the green projects concerning plastic packaging industry. European Commission has allocated over EUR 10 billion in the public funding to the transition towards circularity in years 2016-2020 only. Most of these funds came from the Cohesion Policy (EUR 7.1 billion), Horizon 2020 (EUR 1.4 billion, with EUR 350 million specifically for plastics industry) and some through financing facilities such as the European Fund for Strategic Investments and Innofin (EUR 2.1 billion) (SWITCH to Green, 2020).

However, when it comes to funding the environmental goals specifically, the LIFE Programme is the only EU funding instrument dedicated entirely to climate objectives. Since its launch in 1992, the programme has co-financed over 5000 projects, mostly through grants for enterprises (predominantly SMEs), public bodies and private non-profit organisations, supporting smaller scale projects to share best examples, test innovations and accelerate implementation of the EU legislation. In the 2014-2020 period, LIFE had a budget of EUR 3.5 billion, which was increased to EUR 5.43 billion in the current prices for the 2021-2027

timeframe. The new programme focuses on four main areas: Nature and Biodiversity, Circular Economy and Quality of life, Climate Change Mitigation and Adaptation and Clean Energy Transition. Under the Circular Economy, the focus is on recovery of resources from waste, water, air, soil and chemical management, as well as environmental governance. More specific information and 2021 calls for proposals shall be published later in 2021, when the LIFE multiannual work programme 2021-2024 will be adopted (European Commission, 2021a).

Despite that LIFE is the only programme focusing entirely on climate goals, almost every financial support coming from the EU is somehow related to sustainability. While most funding is available for several different sectors, no resources will be allocated to the projects that might harm the environment. For example, under the Horizon Europe, over 35% of 2021-2027 spending or almost EUR 34 billion will be available for the climate related projects. Horizon Europe is the largest EU research and innovation programme for 2021-2027, with over EUR 95.5 billion intended for tackling climate change, help achieve UN's Sustainable Development Goals and boost EU's competitiveness and growth. There are five mission areas that the current programme focuses on: adaptation to climate change (including societal transformation), cancer, climate-neutral and smart cities, healthy oceans, seas, coastal and inland waters and soil health and food (European Commission, 2021b).

In June 2021, the Commission adopted the main work programme for 2021-2022 period, in which EUR 14.7 billion funding will be available for green and digital transitions, plus sustainable recovery from Covid-19. More than 40% or around EUR 5.8 billion in total will be given to support the European Green Deal, but also Circular Economy Action Plan and EU Strategy for Plastics in The Circular Economy will not be left behind. While there is no exact amount set for the circularity goals, they have been identified as major contributors to climate change mitigation (European Commission, 2021b).

Plenty of investment opportunities will come from the InvestEU Programme as well. With an EU budget guarantee of EUR 26.2 billion, the Programme is set to mobilise over EUR 372 billion public and private investments in four policy windows: Sustainable Infrastructure window (EUR 9.9 billion), Research, Innovation and Digitisation window (EUR 6.6 billion), SME window (EUR 6.9 billion) and Social Investment and Skills window (EUR 2.8 billion). While no specific goals for circularity were set, at least 30% of the total InvestEU Programme and 60% of the Sustainable Infrastructure window should support financing investments contributing to EU's climate objectives (European Union, n.d.).

Additionally to those programmes, there are several others that will further support the sustainable goals and climate action, like Innovation fund, Interreg Europe, EIC Accelerator, Eurostars and others. Without a doubt, there are plenty of opportunities for the companies with innovative green ideas. In fact, the EU has faced the opposite issue in the past, as there were not enough projects that could be supported and the resources could not be fully exhausted.

3.3 Slovenian level

When it comes to the national legislation regarding plastics and plastic packaging in almost any Member State, the framework is more or less the same as the one proposed by the EU. Of course, countries vary among each other in how strict they are about achieving the goals, but the main approach remains the same across the national borders.

In Slovenia, the packaging legislation is arranged under the Decree on packaging and packaging waste handling (sl. Uredba o ravnanju z embalažo in odpadno embalažo), which was first adopted in 2006 and includes all the key parts of the EU Packaging and Packaging Waste Directive (Vlada RS, 2006). As proposed by the 2015 EU amendment of the latter, Slovenia has been working hard to reduce the consumption of the lightweight carrier plastic bags and has prohibited offering them free of charge from 1 January 2019 (Vlada RS, 2015).

Due to the Covid-19 delays only a part of the Single-use Plastics Directive measures planned for 3 July 2021 had been implemented. Slovenia is one of the few countries that proposed the Commission to postpone the deadline, but the EU has denied such request despite that many issues regarding the implementation remain unresolved and the producers, as well as consumers, are still confused whether and how the legislation will affect them.

As mentioned, the Member States were given some more freedom with the Consumption reduction of the products listed in Table_Apx 2 under the category A (see Appendix 4): Slovenia has set the national goal of 20% reduction by 2026. However, no clear plan or implementation act was yet established (as of August 2021), which can present a big problem when the progress will have to be reported to the Commission. The Restrictions on placing on market for the products listed in Table_Apx 2 under the category B and Marking requirements for the products listed in Table_Apx 2 under the category D have been transposed to Slovenian legislation on 20 August 2021 with the Uredba o prepovedi dajanja nekaterih plastičnih proizvodov za enkratno uporabo na trg v Republiki Sloveniji in o označevanju nekaterih plastičnih proizvodov in Uradni List RS. The measures are all exactly the same as proposed by the EU, with the Marking requirements allowed as a sticker for a transitional period of one year. Other measures such as product requirements, separate collection and awareness raising are yet to be discussed and enforced (Vlada RS, 2021b).

With 1 January 2021, Slovenian EPR schemes were extended to plastic packaging items and now affect also companies responsible for less than 15 tonnes of packaging waste annually (Vlada RS, 2021a). This is included in the amendment of Decree on packaging and packaging waste handling from the 9 April 2021 and arranged also under the Environmental Protection Act (sl. Zakon o varstvu okolja), which is the key part of Slovenian legislation when it comes to the environment. In the past, only those companies responsible for more than 15 tonnes of packaging waste per year had to report and pay for the quantities. The new amendment removed the limit and now all the businesses will have to sign contracts with the packaging waste management companies (sl. DROE) and report the quantities to them

(Miklavčič, 2021). Those responsible for below 1 tonne of waste yearly might be able to pay the flat rate only, everyone between 1 tonne and 15 tonnes will have to pay packaging waste management companies and those above 15 tonnes will have to pay additional amounts to Slovenian financial administration (sl. FURS) as well. This, combined with rising raw material prices, is very likely to create a huge financial burden for the plastics producers (Interseroh, 2021).

As a Member State, Slovenia is also required to comply with the EU Packaging Levy, meaning that the national government has to handle a charge of 0.80 EUR for each kg of non-recyclable plastic packaging waste created, starting from the 1 January 2021. Slovenia, however, is one of the mentioned countries eligible to a yearly flat rate reduction. The current regulation proposes the contribution to be paid from the budget of Republic of Slovenia, based on the statistics on the weight of non-recycled packaging waste that will be reported to the Commission by the Member States. In this case, it will not be a contribution that will depend on collected duties but is an own source on a statistical basis. Under the current regime, Slovenian companies therefore will not be burdened with additional duties due to the introduction of the EU Packaging Levy (Ministry of Finance Republic of Slovenia, 2020).

3.3.1 Funding opportunities in Slovenia

Just like any other Member State, Slovenia is also eligible to plenty of funding in order to help encourage businesses and public entities for a green transition. Until 2030, the country should receive EUR 1,838.47 million grants and EUR 666.20 million loans just from the EU Recovery and Resilience Facility, of which by far the most, EUR 587.65 million grants and EUR 473 million loans will be available for green projects. The focus will be on the renewable energy sources and circular economy, predominantly efficient use of resources. Another EUR 333 million should come from the React EU, with EUR 89.50 million allocated to tackling climate issues. Last but not least, under the Multiannual Financial Framework 2021-2027, EUR 3,315.95 million will be available, of which EUR 1,387.92 for the green transition. Together that means EUR 2,538.07 million for the Slovenian transition towards a more sustainable economy. These funds will be divided into five components: renewable energy and effective energy consumption (EUR 146 million), sustainable building renovation (EUR 86.05 million), clean and safe environment (EUR 472.80 million), sustainable mobility (EUR 307.80 million), and circular economy – efficient use of resources (EUR 48 million) (Kirbiš Rojs, 2021).

4 PLASTIC PACKAGING INDUSTRY TRANSITION TOWARDS CIRCULARITY

Transitioning towards the circular business model requires a lot more than just changing the packaging itself. Finding the appropriate strategy to tackle the plastic packaging problem

can therefore present a great challenge for both small local players as well as big multinationals. Ellen McArthur Foundation (2020b) plays a major part in encouraging companies for such transitions, providing the theoretical background, case studies, and support to different players. Their experts stress the importance of changing the whole business mindset, not just packaging itself. If companies want to reach the global, the EU and the national goals, they have to go beyond rethinking the packaging form and rather come up with innovative ideas to change the packaging needs, adjust the infrastructure and most importantly, adapt their business models (Saleem, 2016).

The first chapter about circularity presents different theoretical models for transitioning towards more circular plastic packaging industry. One of the most comprehensive ones is Stahel's (2010) Performance economy, encouraging companies to reuse, repair, remanufacture and recycle goods in this exact sequence in order to save as much material and energy as possible. As we are discussing a single-use plastic packaging with short service-life and little value, repair and remanufacturing are not financially viable with current business models. This thesis therefore focuses mostly on reuse and material circulation. The latter includes both recycling and composting, as compostable plastics have been gaining momentum in the recent years. Furthermore, elimination strategy will be added to the two, since plenty of products are still overpacked and a lot of packaging could simply be removed with proper design.

4.1 Possibilities of plastic packaging industry

4.1.1 Elimination

The elimination strategy can be divided into two ways of eliminating packaging: direct and innovative (Ellen MacArthur Foundation, 2020a).

Direct elimination includes rethinking what packaging is truly needed at all and removing the unnecessary parts. As it is the first, the easiest and the most effective step to eliminate waste, it is one of the EU priorities, mentioned both in the Strategy for Plastics in The Circular Economy and the Packaging and Packaging waste directive. While this kind of approach seems very logic and straightforward, until recently, most produce unfortunately was, or still is, overpacked. However, in the last years this is starting to change and we can see a trend in removing unnecessary multi-layer packaging (secondary plastic wrapping of products like canned foods), tear offs (items like water bottles) and plastic film (various products from fresh produce, clothing, cosmetics and others). Multinationals and big retailers are usually the ones implementing such practices: Nestle, Tesco or Walmart are some of the good examples. The strategy does not only allow companies to save on packaging costs, but also improves brand loyalty as the corporations are perceived as more environmentally friendly (Ellen MacArthur Foundation, 2020b).

The second, *innovative elimination*, tackles the packaging with an essential function that cannot be entirely eliminated. It focuses on finding new ways of achieving the same function with more sustainable options. As McDonough and Braungart (2002) warn, this has to happen in the first steps of planning and designing the packaging. Ellen MacArthur Foundation (2020a) encourages the companies to start with rethinking the items representing great challenges for circular economy, such as non-recyclable materials or fresh produce, beverage and cosmetics industries.

Different approaches to eliminate the packaging vary from enhancing its functionality, using innovative materials like edible or dissolvable films, redesigning the products and shifting to local production to require less packaging. The current trends are presented in the Table 4, where also company examples of successful implementations are described.

Table 4: Trends in plastic packaging elimination

Trend	**Solution**	**Company example**
Edible packaging	Using materials that can be eaten with the product.	Apeel: edible coating extending the shelf-life of fresh produce, distributed as a powder and mixed with water at the packaging centre (see Appendix 5 - Figure_Apx 1 and Figure_Apx 2). The company provides both the coating and service of applying it.
Dissolvable packaging	Using materials that dissolve in water.	Monosol: home, personal care and food industry films made from material that dissolves in water (see Appendix 5 - Figure_Apx 3). Solubag: foil, bags and other items made from PVA material that dissolves in hot water (see Figure 9). Originated in Chile as a by-product in the production of soluble capsules with cleaning. It is sourced from renewable resources and should also decompose in nature in less than 180 days.
Solid products	Products are redesigned in such way that they no longer require packaging.	Lush Cosmetics: manufacturing and distribution of cosmetics and beauty care products in solid form with zero packaging (see Appendix 5 - Figure_Apx 4). To ensure that anyone can still access the ingredients list, they introduced Lush Lens App that enables scanning the product with your phone and lists all the according ingredients (see Appendix 5 - Figure_Apx 5).

(table continues)

Table 5: Trends in plastic packaging elimination (continued)

Trend	Solution	Company example
Enhanced packaging functionality	Packaging is designed in such a way that a single unit serves several purposes.	Aqua Life from Danone: simple way of reducing the amount of packaging components with label-free bottles (see Appendix 5 - Figure_Apx 5). Snap Pack from Carlsberg: introducing tiny glue dots that stick aluminium cans together in packs without additional foil needed (see Appendix 5 - Figure_Apx 6).
Localised production and digitalisation	Using local production to reduce transport and protection requirements.	E-branjevka: delivery of fresh fruit and vegetables from local farmers. Fresh produce is delivered in returnable boxes with no additional packaging (see Appendix 5 - Figure_Apx 7).

Source: Ellen MacArthur Foundation (2020a); E-Branjevka (n.d.).

4.1.2 Reuse

As defined by the European Commission (2016), reusable packaging is the one designed for multiple rotations in its service life. The ISO standard 18603 (International Organization for Standardization, 2013a) emphasises that in order for packaging to be considered reusable, it needs to be refilled for the same purpose for which it was primarily designed. Furthermore, there should be a system for its reuse in place to make sure that the packaging actually gets reused in practice.

For the past few years, reuse has been gaining momentum, partially as it is often the most sustainable option, because it offers several economic benefits, and most recently, as the legislation is very inclined towards it. At Ellen MacArthur Foundation (2020a), they see a big opportunity in the reuse models, as they offer great financial opportunities while lowering the need for single-use packaging. Reuse was getting more attractive already before the Covid-19 and has only accelerated since then. Thanks to more people working from home, combined with stores, restaurants and bars closed, home delivery services have exploded since March 2020. At the beginning of the pandemic there were big concerns about the safety of reusable packaging options for the virus transmission, but the officials have confirmed that with proper hygiene, they are just as safe as the single-use ones (Ellen McArthur Foundation, 2020a). With digitalisation and e-commerce growth, the reuse systems have become much more practical and both user and business friendly. According to Reports and Data (2019), returnable packaging market across industries is supposed to grow from EUR 31.5 billion in 2018 to EUR 50.2 billion in 2026, with plastics leading the market in both value and volume. In fact, some EU Member States, like Italy and Germany have already included a mandatory reusable packaging for take-away and food delivery from 2023 onwards into their legislation. However, for successful reuse in practice, a well-

established collection system and infrastructure are necessary. While many of reuse businesses have experienced exponential growth in 2020 Covid-19 pandemic, experts warn that with the current infrastructure, reuse models cannot become scalable even in the most developed world (Ellen McArthur Foundation, 2020b).

Consumer oriented reuse systems can be divided into four different models, based on whether the packaging is refilled or returned and where such action occurs. Refill at home, refill on the go, return from home and return on the go model, including their suggested fields of applications and successful company models are explained in the Table 5 (Ellen MacArthur Foundation, 2020a).

Table 6: Four reuse models and their applications

Model	**Description**	**Suggested application**	**Company example**
Refill at home	User owns the packaging and refills the reusable container at home - for example, with refill subscription delivery to the door.	Customized products and packaging Auto-refill services: subscription models that encourage brand loyalty	L'Oreal: refill inserts for Yves Saint Laurent skincare products that customers can place into a durable glass packaging (see Appendix 6 – Figure_Apx 9).
Refill on the go	User owns the packaging and refills the reusable container away from home - for example, in a store.	Customised dispensing systems: personalised refill quantity (saving on larger quantities) and content (mixing the preferred flavours) Distributed sales points outside the stores: in office buildings for example	MIWA/Nestlé partnership: dispensing stations with instant coffee and pet food (see Appendix 6 – Figure_Apx 10). Unilever and Walmart Mexico: shampoo refill stations. Customers buy aluminium bottle together with the directions on how to clean it at home (see Appendix 6 – Figure_Apx 11).

(table continues)

Table 7: Four reuse models and their applications (continued)

Model	**Description**	**Suggested application**	**Company example**
Return from home	User does not own the packaging, as packaging is picked up at his home - for example, by a logistics company.	Auto-replenishment services: subscription services where packaging is collected with next delivery Improved packaging (profitable as it remains an asset to the business) Shared infrastructure: shared logistics and cleaning facilities	Vytal: started as a provider of reusables to restaurants and supermarket as 'return-on-the-go' and then launched a platform for food delivery in reusable packaging (see Appendix 6 – Figure_Apx 12). Customers can drop off used packaging at certain points or have it picked up with the next delivery. Loop: global reuse platform that offers more than 500 products in reusable packaging (see Appendix 6 – Figure_Apx 13). Company works with 400 multinationals like Nestlé, P&G, Unilever, Mars, Coca Cola and retailers like Carrefour, Tesco and Walgreens. Products are offered online and in store, their reusable packaging is dropped off at the partner store or picked at home. Afterwards it is professionally cleaned, refilled and reused.
Return on the go	User does not own the packaging and has to return it at a drop-off point - for example, in a deposit return machine.	'Reuse as a service': offering reusable packaging and infrastructure combined Shared infrastructure: shared logistics and cleaning facilities	CupClub: offering standardised, white-label packaging with build in digital traceability to food or beverage companies (see Appendix 6 – Figure_Apx 14). The company handles a network of drop-off stations, combined with washing and redistribution. ReCup: offering reusable plastic cups and bowls to restaurants, company canteens, municipalities etc. (see Figure 10). Customers have to pay a small deposit when ordering take away and get their money back when they drop it off at any ReCup partner. The packaging is then washed in a restaurant and used again.

Source: Ellen MacArthur Foundation (2020a); Social Chain (2021); CupClub (n.d.); ReCup (n.d.).

4.1.3 Material circulation

Both the single-use and the reusable products reach the end-of-service-life at some point and can no longer serve their purpose. This is when material circulation is the only remaining option and recycling or composting close the circular economy loop. It is important to distinct material circulation from reuse: the first focuses only on the material packaging is made from, while reuse refers to the packaging as a whole.

Just like Stahel (2010), McDonough and Braungart (2002) divide all materials into two different types of nutrients (biological and technical), plastic material circulation can be divided into recycling and composting. Plastic recycling mechanically or chemically breaks down the conventional plastic packaging in order to get the materials used for production of new products. Plastic composting, on the other hand, is only possible with specific bioplastic types that can be decomposed into a biomass, water and CO2 either in a home or industrial facility (International Organization for Standardization, 2013c).

4.1.3.1 Plastic recycling

Material recycling, as defined by ISO standard 18604 (International Organization for Standardization, 2013b), is reprocessing of a used packaging material into a secondary (recycled) material, a component of a product or a new product. It can be divided into mechanical recycling that maintains the polymer structure and the chemical recycling that breaks down the polymer structure into building blocks. The ISO definition excludes energy recovery and reprocessing materials back into fuels (International Organization for Standardization, 2013b).

While Stahel (2010) has given firm priority to reuse from recycling, even the most durable objects reach a point when they can no longer serve their function and recycling therefore becomes the most environmentally friendly option. Material Economics (2018) research has shown that packaging recycling can actually save up to 90% of the CO2 compared to new production. It also predicts that improved recycling processes could supply 60-70% of the European raw material demand (Material Economics, 2019). Furthermore, many studies show that if plastic packaging actually gets recycled, its overall environmental effect is much better than any currently available and scalable alternative. This is why the global, the EU and the national legislation is encouraging the use of recyclable plastics and why the recently introduced EU Plastic Levy only affects the non-recycled plastics. However, Ellen MacArthur Foundation (2020b) stresses that not every packaging made of recyclable material can be considered truly recyclable. For the latter, a well organised post-consumer collection and sorting are needed, combined with scalable recycling that is proven to work in practice. Still, most often the success of all three is determined already in the packaging design phase, which is why McDonough and Braungart (2002) introduced cradle-to-cradle design as a key to achieving circular economy at scale.

As mentioned, McDonough and Braungart (2002) have criticised the way companies mix biological and technical nutrients in the same products so that none of them can be successfully restored. This holds for the packaging as well - design that would allow for resource efficiency and easier recycling starts with simplicity. According to Ellen McArthur Foundation (2020a), currently 60-65% of the virgin material value of plastics collected is lost for the next rotation. Recycling yield, quality and economics must therefore be drastically improved if we want to see recycling at a larger scale. Huge time and cost savings are hidden in eliminating the unnecessary complexity of packaging design. By avoiding certain plastic types, colours and most importantly, material combinations, recyclability of packaging is highly improved (Rahimi & García, 2017). A great example is pasta packaging that is made almost entirely of paper but includes a tiny plastic window. While such detail brings almost no function (the inside of the box can as well be printed on it), it makes recycling practically impossible.

Another way to improve recycling quality and profitability is shifting collection to an earlier point in supply chain. For example, gathering the packaging before the product arrives to consumer (B2B instead of B2C), as this usually results in higher collection rates and cleaner material stream (Ellen MacArthur Foundation, 2020a). Changing to a reuse-return model also offers several benefits when it comes to recycling. Return packaging can be designed in a recycling efficient way and it can be easily collected with much cleaner stream, as it does not get mixed with other household trash.

Last but not least, once the packaging is designed for cost and time efficient recycling, the producers need to go a step further and include the recycled content into the mentioned designs. Only once the market for recyclates will be successfully established and the availability and cost of the material stabilised, the recycling will become scalable (Ellen MacArthur Foundation, 2020).

Current trends in recycling, their application and successful company examples are presented in the Table 6.

Table 8: Recycling trends and their applications

Trend	**Application**	**Company example**
Reducing packaging complexity	- Replacing problematic materials like PVC, PS, EPS with materials with already established recycling stream - Eliminating multi-material packaging - Using additives and features like closures or ZIP seals that are in line with the target recycling stream - Wherever possible, limiting the use of dyes, pigments, and inks	Coca-Cola Sprite bottle: switching from green Sprite PET bottles to clear bottles (see Appendix 7 – Figure_Apx 15).
Using Recycled Content	Helping establish a scalable recycled material market by using the recycled content	Waitrose and Partners: using recycled PET bottles for the new take-away trays. Instead of colouring them black, the plates are of different colours, depending on what recycled material they are made from (see Figure 11). Magnum: first ice cream tubs made from recycled polypropylene (see Appendix 7 – Figure_Apx 16).
Switching from B2C to B2B collection	Shifting collection to and earlier point in supply chain - for example before the product arrives to consumer	Surfdome/Patagonia's Plastic Cutback initiative: removing the clear plastic bags from purchased items before they are shipped to the customer, to make sure the plastic foil gets recycled. Furthermore, the plastic bags used for transport from suppliers are made from recycled material.
Changing to a reuse-return model	Ensuring efficient and clean collection by using reuse-return system	Swedish return system: managing take back, quality control, washing and redistribution of the reusable crates and pallets. Wholesalers and retailers pay a user fee and a deposit for half pallets and a user fee for the full ones.

Source: Ellen MacArthur Foundation (2020a).

4.1.3.2 Plastic composting

In the last few years, several 'bioplastics', 'biodegradable' and 'biobased' packaging options have been gaining momentum. There is still a lot of confusion when it comes to defining specific types, but due to different degradability characteristics, the distinction between the terms is of high importance:

- *'Bioplastics'* is the general term that includes both bio-based and biodegradable materials. However, as the bio-based materials are not always biodegradable and the biodegradable not always bio-based, the term can often be confusing (Ellen MacArthur Foundation, 2020a).
- *'Biobased'* refers to how the material is sourced: in order for the packaging to be defined as bio-based, it needs to be produced from material that is either partially or wholly sourced from biomass. It does not imply, however, if the packaging is biodegradable or not.
- *'Biodegradable'* implicates that the material packaging is made from, should broke down into carbon dioxide, water and biomass with the natural action of microorganisms. However, it does not define the specific conditions or the time-frame in which that may occur (International Organization for Standardization, 2013c).
- *'Compostable'*, on the other hand, defines precise conditions and time frame within which the plastics should broke down into carbon dioxide, water and biomass. Biodegradability is only one of the properties needed to make a packaging compostable and the terms should therefore not get confused among each other. Furthermore, as compostability is determined not only by the material but many other factors like size, format and additives, it is a characteristic of the packaging as a product and not of material or component. According to ISO 18606 (International Organization for Standardization, 2013c), the packaging can be either 'industrially compostable' or 'home compostable'. The first must be composted in a strictly controlled environment, with temperature and time frame defined by international standards and should result in a certificated compost. Home composting is a subject of much less strict conditions, usually depending on the householder's experience. It results in a compost that is not standardised (International Organization for Standardization, 2013c).

While well sourced and thoroughly managed bioplastics can bring many benefits and fit well into the circular economy, they are far from the perfect solution. Stahel (2010) and many others defined the key objective of circular economy as maximization of preserved material, embedded energy, and labour inside the loop. The fact that compostable packaging breaks down into water, CO2 and biomass, does not make it the preferable option is such view, as the whole material needs to be remade entirely.

Even bigger problem is the sourcing of bio-based materials: many companies use produce like corn, which some consider highly unethical, as people are still dying of hunger in 2021.

Making sure that such material is food contact compliant, especially on a larger scale, is also extremely difficult. Furthermore, the sources are currently quite limited and the price per kg is generally up to three or even five times the price of conventional plastics.

However, the most concerning problem is the consumer perception: if packaging claims to be biodegradable or compostable, that does not mean that it can be littered anywhere in the natural environment, as degradability is limited to the specific conditions. Composting can only be successful in certain environment, usually in the industrial composters with temperatures above 57°C and the exposure to ultraviolet light, while the degradability in natural surroundings is questionable (Royte, 2019). Even the packaging intended for home-composting can take extremely long time to break down. As long as people are not truly aware of this, a disturbing amount of biodegradable packaging will end up in the landfill, where it is very likely to produce greenhouse gases. As bioplastic is heavier than conventional one, it sinks in the ocean and in most cases, it cannot degrade in water, which makes it very problematic in the marine environment. If not properly collected, bio-plastics can cause great problems in the natural world and maybe even more importantly, in the recycling processes of conventional plastics (Royte, 2019).

This means that simply introducing biodegradable packaging will not save the littering or excessive waste problem on its own. Just like with the recyclable packaging, a well-established collection system and infrastructure are the key for successful implementation of compostable products. As most currently available compostable packaging is 'industrially compostable', such packaging waste needs to be collected and composted in an industrial composting facility. Same holds also for the 'home compostable' materials if the consumers do not have access to home composting, for example, in the big cities. As of 2021, still very few countries have appropriate infrastructure established, especially at scale (Ellen MacArthur Foundation, 2020a).

However, all those problems do not mean that bioplastic should not be used at all. Ellen MacArthur Foundation (2020a) lists two areas that make the use of such packaging most efficient: where collection and composting can help cycle the nutrients back to the soil (like tea bags or organic waste bags) and in contact with other biodegradable products (for example, stickers on fruit).

4.2 Examples of successful circular business models

4.2.1 Solubag

Under the elimination strategy, Solubag material was identified as one of the most appropriate alternatives for a company like PRO EMBA. Solubag is a group of global companies formed by eco-conscious Chilean scientists dedicated to the development and innovation of environmentally friendly packaging products like films, bags and others. Their

mission is “to deliver high-quality water-soluble, environmentally friendly technologies to their customers and responding to their requirements and needs by looking for permanent innovation” (Solubag, 2021).

The result of their innovative approach is a PVA material that originates from a by-product in the production of soluble capsules with cleaning agents. It is formed from calcium carbide from which non-petroleum polyvinyl alcohol (PVA) and natural gases are produced. A similar substance is used, for example, to coat vitamin tablets. The material dissolves in hot water (above 85°C) in less than 5 minutes and biodegrades in the natural environment in 180 days without harming the ecosystem. It is supposed to be so harmless that the water in which the film dissolves in, can be used to water the plants or even drink from. The resin can be used to produce foil and bags for several purposes with no special equipment. Producers can therefore use the PVA granulate in the same extrusion and production machinery as the usual flexible films. The bags can also be printed using the pastel non-toxic colours in order to keep the sustainability of the product at the highest level (Solubag, 2021).

Solubag currently offers the raw material, film and two types of bags: those that look and feel most similar to the PE bags (see top left bag in Figure 9) and the non-woven ones (see top right and bottom bags in Figure 9). Due to the Covid-19 pandemic, they also started producing masks and other protective materials with the same dissolvable technology. They can produce bags of different sizes, with different material thicknesses or different solubility temperatures. As of 2021, only transparent/white bags are available, but the company is trying hard to find a sustainable solution for the other colours as well.

Figure 9: Main Solubag products in 2021

Source: Solubag (2021).

In 2020, Solubag started their operations in the USA, creating the Solubag USA company in Key Biscayne, Florida. They have partnered with KBHS LLC (Kevin Harrington), Lancaster Advisory and Founder Capital in order to provide their above-mentioned products with the best possible service. In 2021, they also partnered with one of the main US retailers, Pharmapacks in order to supply their products to Amazon and Walmart. One of their most recent projects is the collaboration with Frutisa brand that uses the Solubag technology for their peanut packaging (Solubag, 2021).

However, while the company collaborates with some major global companies like Google, Pharmapacks, Sysco, Subway and others, it is still new to the European market. Here the legislation is much stricter and in order to fully grasp the opportunities that the EU offers, they will definitely need further certification. Food conformity, as well as the biodegradability certificates are extremely important and unfortunately Solubag has a great disadvantage here.

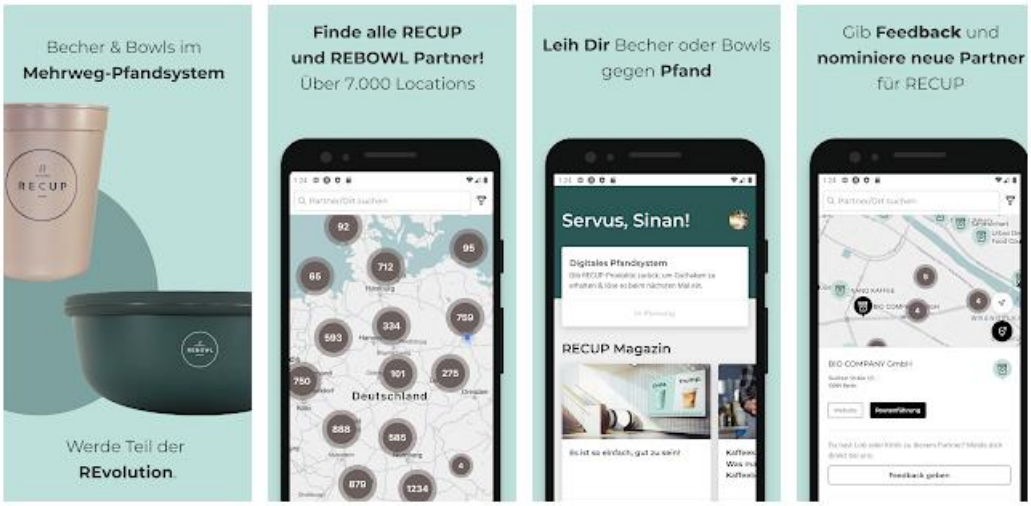
Solubag SWOT analysis is presented in the Appendix 8 under Table_Apx 3.

4.2.2 ReCup

Under the reuse strategy, the company that caught most attention in the European market is ReCup. This is a rather young company, based in Munich, Germany, managing reusable coffee cup and take-away bowl system with user platform. Their mission is to offer an innovative and sustainable reuse system for coffee-to-go and take-away-food in order to provide the responsible coffee and food lovers, as well as the take-away restaurants, with a simple and attractive packaging alternative. With its vision, ReCup wants to revolutionize the coffee-to-go market and make disposable cups disappear forever in order to contribute to a world with less waste and less resource consumption.

ReCup started its operations in 2016 with only 26 partners and in August 2021 they already have over 8500 of them. They mostly work with cafes, coffee chains and restaurants, but are expanding further to canteens and even whole cities. Their system is designed in a way that makes the experience as simple as possible for both the partner restaurant and the end consumer. Customers pay a deposit when they purchase their coffee in a reusable cup. After they finish drinking, they can simply return it to any ReCup partner and get their deposit back. All of their partners can be found on their webpage and also their own app (see Figure 10) that shows all the drop-off points where the customers can return the cups. Those partners can order whatever amount of the cups online with only a few clicks and have to pay a 1 EUR deposit for each cup. They then pay a monthly membership service fee to finance the operation of the system and handling of the mobile app. They are also responsible for cleaning and reusing the cups returned to them (ReCup, 2021).

Figure 10: ReCup App where the customers can find all the partners



Source: Google Play Store (2021).

The company started with uniform size cups only, but now offers cups in three different sizes and two different food containers. They used to outsource the production of packaging to other European producers, but have later built their own internal production. The packaging they offer is made from 100% recyclable PP material, which makes it very practical to clean and easy to recycle. With proper cleaning, it should be able to take on up to 1000 reuses, but the number of course depends highly on how they are handled. Both the cups and bowls are also super light which is good for the transport (ReCup, 2021).

ReCup SWOT analysis is presented in the Appendix 8 under Table_Apx 4.

4.2.3 "Recycle the rainbow" by Waitrose & Partners

Waitrose & Partners (hereafter Waitrose) is a successful brand of British supermarkets, founded in 1904. The company has strong business values and is dedicated to placing the highest value on animal welfare, environmental responsibility and food quality. Committed to reducing their impact on the environment, Waitrose has prioritised removing unnecessary plastics from their products and designing the packaging in a responsible way (Waitrose, 2021).

The company has pledged that by 2023, all their own-brand packaging will be reusable or made from widely recyclable or home-compostable material. In 2021, they claim that 86% of their own-brand packaging already meets that goal. Unlike many other competitors, Waitrose has a clear plan on how they will achieve their ambitious targets. They are using all of the four strategies described in Chapter 4.1, as they are eliminating the unnecessary packaging, allowing the customers to fill up their own containers with products ranging from pasta to washing up liquid and switching to recyclable or biodegradable materials (Waitrose, 2021). Furthermore, the company invested several million pounds into projects targeting

plastic pollution and had allocated even more funds to improve other aspects of their social responsibility.

However, their "Recycle the rainbow" project has probably caught the most attention and is a great example of how the material recycling strategy should look in practice. The main goal of the initiative is removing black plastic trays, as the sensors at recycling facilities cannot identify the dark pigment and such plastic is often impossible to sort. The black packaging therefore usually ends up in the landfill (over 1.3 billion trays each year) or in the natural environment, causing even more problems (Arvanitoyannis & Bosnea, 2001). In 2018, the company stopped using black plastic for Waitrose meat, fish, poultry, fruit and veg, as well as for confectionery range and many of the Christmas puddings, mince pies and biscuits (Chadwick, 2018).

In 2019, Waitrose launched coloured trays made from recycled plastic for its ready meals (see Figure 11). They are produced predominantly from mixed coloured PET bottles and trays which means they always vary in colour. Depending from what recycled material they are produced from, the trays differ from pink and red tones to shades of green and blue. This means that trays are unlikely to be the same twice and that consumers get their ready meal in a different colour every time they shop (Waitrose, 2021).

Figure 11: Waitrose & Partners coloured trays from recycled PET material

Source: Waitrose & Partners (2021).

With the new trays, Waitrose ensures that its packaging is more widely recyclable while continuing to replace single use plastics. "Recycle the rainbow" should get the company closer to its 2023 goal by saving a further 500 tonnes of black plastic going to landfill (Waitrose, 2021).

"Recycle the rainbow" SWOT analysis is presented in the Appendix 8 under Table_Apx 5.

4.2.4 BioPak

When it comes to compostable packaging, BioPak is showing the world that the biodegradable material can be implemented in a truly circular way. Based in Sydney, Australia, company focuses on reducing tree-based paper and fossil fuel-based plastic used in foodservice ware by offering sustainable, biobased and compostable packaging for Australia and New Zealand. Their mission is to produce the most sustainable, environmentally friendly packaging on the market (BioPak, 2021).

As the first packaging company in Australia and New Zealand to become carbon neutral, BioPak is working hard towards minimising any negative impacts their business has on the environment. This starts with responsibly-sourced materials and sustainable manufacturing which result in eco-friendly alternatives of wide range of products – cups, plates, bowls and trays, bags, and more (see Figure 12) (Ellen MacArthur Foundation, 2020d).

Figure 12: BioPak product range

Source: BioPak (2021).

However, what truly makes BioPak stand out from the competition is the awareness that simply switching to a compostable alternative is not circular on its own. As organic waste collection services are still not universally offered, the company established a circular system providing collection and composting service that ensures their packaging actually gets composed in practice. BioPak collects compostable packaging, food scraps and organic waste in a single bin, with no separation required. Such compost service is designed to close

the loop by making sure that single-use packaging, including the biodegradable items, does not end up in landfill (Ellen MacArthur Foundation, 2020d).

The collection service is offered across Australia and New Zealand in over 2,000 postcodes, where BioPak collaborates with over 200 local industrial composting services and waste management companies. By 2020, they have saved 660 tonnes of compostable packaging and food scraps from landfill and have created 66,000 bags of nutrient rich compost. Furthermore, the company has partnered with the Australian Organic Recycling Association (AORA) and is working collaboratively with the waste management industries and local governments to improve composting infrastructure and scale the operations (BioPak, 2021).

In addition to that, they also engage and actively cooperate in various environmental initiatives. They believe each business has an obligation to protect the nature and give back to the communities, which is why they donate their time, energy and 7.5% of all profits to environmental restoration initiatives (BioPak, 2021).

BioPak SWOT analysis is presented in the Appendix 8 under Table_Apx 5.

5 PRO EMBA

5.1 Company introduction

PRO EMBA is a small family company based in Vodice, Slovenia. It was founded in 1991 when the owners started with sales of various packaging materials, focusing mostly on the HDPE bags in roll. In almost thirty years, the range of products has expanded and the company had changed quite a lot, but the PE foils and bags have remained its main focus. Currently the company employs 7 people, most of whom have been a part of the team for over twenty years.

The main numbers from income statement, balance sheet and KPIs presented in the Table 7 all look very promising. For a company with only 7 employees, PRO EMBA's sales revenue and net profit are relatively high and consequently the value added per employee is one of the highest in the industry. Both the revenue and profit have been growing slowly but steadily in the past four years and as the Covid-19 did not negatively impact the food packaging industry, 2020 has been the most successful year for the company. As presented in the Table 7, the revenue has amounted to EUR 2,042,755 and the profit to EUR 268,438, both the highest since the company was founded 30 years ago. What might be even more important, there are no long-term liabilities, no short-term or long-term accruals and deferred income, while the short-term liabilities also account for less than 5%.

Table 9: PRO EMBA financial indicators from 2017 to 2020

INCOME STATEMENT	**2017**	**2018**	**2019**	**2020**
Sales revenue (EUR)	1,858,693	1,938,229	1,870,171	2,042,755
Net profit (EUR)	153,038	162,024	183,411	268,438
Number of employees	8	8	7	7
BALANCE SHEET	**2017**	**2018**	**2019**	**2020**
Assets (EUR)	**1,937,891**	**2,119,420**	**2,279,811**	**2,563,204**
Long-term assets (EUR)	1,068,549	944,454	890,455	798,047
Current assets (EUR)	820,829	1,125,755	1,340,843	1,765,157
Short-term accruals (EUR)	48,513	49,211	48,513	0
Liabilities (EUR)	**1,937,891**	**2,119,420**	**2,279,811**	**2,563,204**
Own funds (EUR)	1,872,175	2,034,198	2,217,610	2,486,048
Long-term liabilities (EUR)	0	0	0	0
Short-term liabilities (EUR)	65,716	85,222	62,201	77,156
Short-term and long-term accruals/ deferred income	0	0	0	0
KPIs	**2017**	**2018**	**2019**	**2020**
EBITDA	296,271	330,633	356,115	463,561
Current ratio	12.49	13.21	21.56	22.88
Solvency ratio	175.21	215.38	249.04	311.52
ROE	8.52	8.3	8.63	11.41
ROA	8.13	7.99	8.34	11.09
Value added (EUR)	473,822	521,346	517,811	629,769
Value added per employee (EUR)	63,176.27	69,885.52	79,663.23	96,887.54

Source: E-Bonitete (2021).

The majority (approximately 60%) of the yearly turnover comes from the internally produced HDPE and LDPE foil and bags. Some of the foil is sold to clients as a final or intermediate product, while most is transformed into bags serving various purposes: carrying bags, industrial bags, waste bags and pallet coverage bags.

Additionally, other packaging materials, such as food delivery boxes and single-use cups from various materials (mainly PP, PET and EPS, but also paper and sugarcane), PE bags with zipper, paper bags, PE gloves, latex gloves, baking paper, aluminium foils, stretch foils, and others are imported from various suppliers around Europe and Asia.

Products from both parts of the company are sold mainly B2B in Slovenia - from small businesses such as restaurants or smaller shops to larger corporations, such as Petrol, Spar, Mercator etc. As of 2021, there is basically no export, except some small amounts in the neighbour countries like Austria and Croatia.

Current PRO EMBA business model is presented in the Appendix 9 under Table_Apx 7.

5.2 Strategic actions for sustainable transformation of PRO EMBA

5.2.1 Responding to key environmental challenges

The last few years have brought many different challenges for PRO EMBA. While COVID-19 did not directly affect the packaging sales in a negative way, its side effects like supply chain disruptions, longer delivery times, raw material price increases, employment difficulties and even just the negative economic atmosphere have impacted almost any company no matter the industry.

However, the focus of this thesis is on the sustainability challenges and the consequences of the new EU legislation. The biggest issues that PRO EMBA is facing are mostly connected to two documents: the Packaging and Packaging Waste Directive and the Directive on single use plastics. Both are directly related to the items produced in-house, especially HDPE carrier bags.

The 2015 amendment of Packaging and Packaging Waste Directive includes important measures to significantly lower the consumption of the lightweight plastic carrier bags, which were prohibited to be offered free of charge from 31 December 2018 on (European Parliament & Council of the European Union, 2018a). Despite that those measures only apply to bags with thickness below 50my and exclude very lightweight plastic carrier bags (defined as bags below 15my), the company noticed a decline in sales of all kind of HDPE carrier bags. Due to simplification of such measures in the press, a lot of clients do not know the specifics of the legislation and prefer to stay away from all kinds of plastic bags.

Packaging and Packaging waste directive also introduced the ERP concept, but the Slovenian scheme changes adopted in 2021 do not make a big difference for PRO EMBA. The company was surpassing the 15 tonnes limit anyway so the only change are slightly higher fees and confused customers that do not know how to proceed with the new requirements.

Directive on single use plastics, on the other hand, directly affects several products that company imports. As PRO EMBA used to sell relatively high quantity of EPS boxes, plastic plates and plastic cutlery, they had to switch to more sustainable paper or biodegradable alternatives in July 2021. There is still a lot of confusion whether the XPS products can be used, but in any case, the clients will have to consider stepping away from almost any kind of polystyrene products in the near future. The other plastic boxes (PP, PET, OPS etc.) also represent quite a big share of PRO EMBA's product range. As not many alternatives are available for such products yet, the legislation only requires a consumption reduction, but again, many clients are confused and consequently more and more reluctant to plastic food takeaway boxes of all kinds. Marking and product requirements only affect a small part of the product range, all supplied from abroad. Still, the measure has made products slightly more expensive and such price increases negatively affect sales as well.

Another threat stems from the EU Packaging Levy that introduces a new packaging "tax" on all non-recyclable plastics packaging waste in amount of 0.80 EUR for each kg of waste created. Slovenia is eligible to a yearly flat rate reduction and the current national regulation proposes the contribution to be paid from the budget of Republic of Slovenia, meaning that (as of August 2021) companies will not be burdened with additional duties (Ministry of Finance Republic of Slovenia, 2020). However, due to the pressure from the EU and financial motives of the government, this is very likely to change in the near future. In case the duty of 0.80 EUR for each kg of waste created will be transferred to the producers like PRO EMBA, the current business will soon turn unprofitable. The prices of HDPE resin, for example, have moved from approximately 0.80 to 1.60 EUR per kg in the last five years, which means that the additional charge of 0.80 EUR per kg creates a huge difference and will be very difficult to compensate. In such scenario, the price of biodegradable alternatives will become comparable to the conventional plastic packaging prices and the companies with already established sustainable product range will have an important competitive advantage.

However, as PRO EMBA could overcome the majority of those issues by simply switching to the more sustainable materials, the biggest challenge is currently the extremely high price of biodegradable or recycled materials and finished goods, combined with Slovenian unwillingness to pay price premium for such alternatives. Despite that the customers are getting more environmentally aware in Slovenia, they are not prepared to pay more for the products that are less harmful to our planet. The company tried implementing several more sustainable alternatives to their conventional plastic products range, but the sales of the recyclable and biodegradable products remain very low compared to the plastic items. Unless the prices of the environmentally friendly items decrease or the willingness to pay price premium increases, the more sustainable product range is highly unlikely to surpass the profitability of the conventional plastic one.

5.2.2 Responding to key environmental opportunities

Unlike the challenges, opportunities are mostly linked to the Circular Economy Action Plan and the EU Strategy for Plastics in the Circular Economy. Both promise empowerment of consumers and public buyers by providing clear and trustworthy information on all aspects of sustainability, including lifespan and repair options. This is very much needed in Slovenia and could help boost the sales of sustainable products by making the customers aware that their benefits are worth paying price premium for.

For the product range that PRO EMBA imports from abroad, the best solution is definitely finding biodegradable, paper or other alternatives (similar to Australian BioPak presented in Ch. 4.2.4), that both the Circular Economy Action Plan and the EU Strategy for Plastics in The Circular Economy are highly inclined towards. It is much easier to switch the outsourced products than change the whole internal production process. Gradually transitioning towards such items could also give an invaluable insight on how ready the market is for the more

sustainable alternatives. The important aspect with new items is that additional channels should be established in order to adjust the brand image and reach as many clients as possible. Currently, PRO EMBA relies highly on the website interactions combined with phone/email contact. New customers are most often gained through word-of-mouth marketing and as the majority of clients see the company as a producer of conventional plastic packaging, a lot of work should be done on changing the customer perception. This shall start with changing the focus of the current website to the more sustainable product range and expanding the variety of channels through which the value proposition is delivered. A lot of room for improvement lies in the client visits and at least some kind of social media. As the focus is on the B2B operations, LinkedIn is probably the most appropriate to start with.

A great alternative for the plastic single-use food delivery boxes and cups is a reusable packaging deposit system that is currently gaining momentum in Germany. PRO EMBA already works with lots of different restaurants and cafes all across the country and therefore has a great advantage in creating a partner network. As the apps are not a common thing with older generations in Slovenia, a simple deposit system that ReCup uses (presented in Ch. 4.2.2) would probably be the best option. The packaging could be imported from already known suppliers abroad and then 'borrowed' by restaurants who would pay a monthly fee to PRO EMBA for arranging the partner network, logistics and the 'ownership' of the reusable packaging. Since the idea seems very promising, a lot of research was done inside the company to find out if the Slovenian market is actually ready for this. As mentioned, the customers are still reluctant to pay more for the sustainable options and unfortunately it seems that reusable deposit system is no different in this aspect. Such system takes a lot more than just price premium, as the consumer habits have to change entirely in order for it to work. German legislation is much more supportive of reusable packaging (which will become a mandatory alternative for all the take-away restaurants from 2023 onwards), which makes the idea easier to sell. Moreover, the Slovenian market is much smaller and as such systems run on economies of scale, making it profitable could be extremely difficult for PRO EMBA. Despite all that, the reusable packaging deposit system might offer a great opportunity in the following years thanks to its growing popularity.

For the own production, on the other hand, biodegradable or reusable alternatives have not been identified as the best option due to low demand for such items in Slovenia. There are also already quite big competitors focused exclusively on production of biodegradable foils and bags that export bigger quantities and therefore have economy of scale advantages over PRO EMBA, whose main market remains Slovenia. The company already sells a small range of biodegradable bags with handles and biodegradable trash bags, but even after several years, the sales of such items remain low: as of August 2021, way too low compared to conventional plastics, that producing them in-house could be profitable.

Dissolvable materials (like Solubag presented in Ch.4.2.1) might be a better option, as they are currently still unknown in Slovenia. Their biggest issue remains the high price and the

unpredictability of how compatible they actually are with the conventional machinery. However, with some funding combined with increased customer awareness, there might be a great opportunity here in the future. If nothing else, implementing them as one of the first companies in the country could be great marketing for PRO EMBA.

However, the most promising solution for internally produced product range is probably in the recycling. Both the Circular Economy Action Plan and the EU Strategy for Plastics in the Circular Economy promise to establish a better functioning market for recycled materials. Especially the latter document sets some promising goals regarding higher waste recycling rates, extended and modernised recycling capacities and more integrated plastics value. Despite that demand for recycled plastics is still limited to the low-value and niche products, developing quality standards for sorted plastics waste and recycled materials combined with better coordinated separate collection and sorting are likely to change that in the upcoming years (European Commission, 2018). PRO EMBA already recycles all the default, waste and by-products that accumulate during the production process and uses the material mostly for production of waste bags. The use of recycled materials is currently limited to the items that do not come in contact with food, but changing this would be a great opportunity to expand the range of packaging made from recycled materials. Even just under the EU Strategy for Plastics in The Circular Economy, lots of funding will be available for such innovations and the company should try their best to make the most of the recycling incentives offered.

Last but not least, opportunities are opening also in other aspects of sustainability, like using the renewable energy for example. Lots of funds are available in Slovenia for building the light-powered electricity sources in-house. The current PRO EMBA's production and warehouse building are perfectly structured and positioned to make the best of the rooftop solar cells. As the energy generated would be used for the production of goods, this could save the company electricity costs, improve another sustainability aspect of their packaging and serve as a great marketing tool.

5.3 Sustainable Business Model

PRO EMBA's current business model (see Appendix 9 – Table_Apx 7) relies on a single revenue stream: sales of internally produced PE items and imported finished plastic packaging. Its value preposition is based on the price/quality ratio of conventional plastic packaging, reliable products and quick delivery. Customer relationship is limited to website, email and phone interactions. The channels PRO EMBA currently uses are predominantly website, direct email list and partner recommendations. The company focuses on two customer segments: customers looking for simple, cheap and durable standard plastic packaging and customers looking for customized plastic packaging.

In contrast to the current one, sustainable business model presented in Table 8 includes several environmentally friendly actions that could help the company improve their

competitiveness in the upcoming years. All the adjustments proposed (coloured green in Table 8) are based on the theoretical and practical knowledge gained in this thesis.

First of all, the product range is extended to a versatile offer of sustainable packaging options (from conventional, recycled and reusable plastic packaging to biodegradable items) that can be customized for each customers' needs. In order to improve energy efficiency and sustainability of the production process, solar cells are built and used as a renewable source of electricity. Accordingly, new customer segments are introduced: starting with environmentally aware customers looking for a reliable and affordable sustainable packaging (either recycled or biodegradable) and restaurants/caffes in search for innovative reusable packaging solutions. In order to attract more customers in the two segments and help change the brand perception to a more sustainable packaging producer, the customer relationship is extended with personal 1 to 1 interaction, while PR and social media are added as new channels.

Introducing all those changes of course requires several new partners (new machinery and solar cell technicians, suppliers of various new materials, reusable partner network) and costs (new machinery and its maintenance, costs of new materials, "ownership" of reusable packaging, and marketing costs associated with changing the brand perception). However, the transformation also results in new revenue streams: monthly fees for reusable packaging and revenue from renewable energy supply in case energy surplus can be created with the solar cell infrastructure.

Table 10: PRO EMBA's sustainable business model

<table>
<tr>
<td rowspan="2"><u>KEY PARTNERS</u>
- PE resin suppliers
- Production machinery suppliers and technicians
- Finished plastic packaging suppliers
- Logistics companies
- Software providers
- Webpage designers
- Finished biodegradable packaging suppliers
- Recycled material suppliers
- Recycling machinery suppliers and technicians
- Solar cells suppliers and technicians
- Reusable packaging suppliers
- Reusable packaging partner network
- Dissolvable resin suppliers</td>
<td><u>KEY ACTIVITIES</u>
- Production of PE films and bags
- Sales of both internally produced goods and imported product range (expanded to recycled, biodegradable and reusable alternatives)
- Logistics
- PE materials recycling
- Reusable packaging network organisation</td>
<td rowspan="2"><u>VALUE PROPOSITION</u>
- Excellent price/quality ratio of conventional plastic packaging
- Reliable products
- Quick delivery
- Short production times
- Accessible central location (Slovenian and also EU market)
- Customization possibilities
- Versatile offer of sustainable packaging options (from conventional, recycled and reusable plastic packaging or paper / biodegradable items) that can be customized for each customer’s needs</td>
<td><u>CUSTOMER RELATIONSHIP</u>
- Phone/email contact
- Customer website interactions
- (Rare) personal interactions
- Personal 1 to 1 interaction
- Social media interactions</td>
<td rowspan="2"><u>CUSTOMER SEGMENTS</u>
Mass market B2B:
1. Customers looking for simple, cheap and durable standard plastic packaging
2. Customers looking for customized plastic packaging
3. Environmentally aware customers looking for a reliable and affordable sustainable packaging (either recycled or biodegradable)
4. Restaurants/Caffes looking for innovative and sustainable reusable packaging network</td>
</tr>
<tr>
<td><u>KEY RESOURCES</u>
- Production machinery
- Employees
- 30 years expertise and know-how in the plastic packaging industry
- Customer data base
- Warehouse
- Truck
- Recycling machinery
- Solar cells</td>
<td><u>CHANNELS</u>
- Webpage
- Direct email list
- Partner recommendations
- Internet text/image search
- Social media
- PR (Zelena Slovenija etc.)</td>
</tr>
</table>

(table continues)

Table 8: PRO EMBA's sustainable business model (continued)

COST STRUCTURE	**REVENUE STREAM(S)**
- Production machinery and infrastructure (5%) - Costs of raw material (27%) - Cost of imported finished goods (40%) - Employees (5%) - Logistics (1%) - Production machinery maintenance (1%) - Energy sources (1%) - Cost of recycled materials (11%) - Recycling machinery (2%) - Recycling machinery maintenance (0,5%) - Solar cell infrastructure and repair (1,5%) - "Ownership" of reusable packaging (1%) - Marketing costs associated with changing the brand perception (1%) - Other (3%)	- Product sales (98%, of which approximately 35% from the 1st customer segment, 40% from the 2nd customer segment and 25% from the 3rd customer segment) - Customers can pay up-front or through financing (once partnership is at least somewhat established) - Monthly fees for reusable packaging (4th customer segment: 1,5%) - In case energy surplus can be created with the solar cell infrastructure, energy supply can present additional stream (below 0,5 %)

Source: Own work.

CONCLUSION

While durability, lightness and ease of sterilisation make plastics an ideal packaging material for the end consumer, our planet is the one paying the price. The amount of plastic waste created each year is truly disturbing and despite the recent efforts to improve the packaging waste management in the developed world, the numbers keep growing on the global level.

Due to its high price and impracticality, sustainable packaging is still lagging far behind the conventional one in Slovenia, but the newly proposed legislation and the growing number of environmentally aware customers show that a drastic change in plastic packaging industry is inevitable. Measures included in different EU documents, from the Green Deal, the Circular Economy Action Plan, the EU Strategy for Plastics in the Circular Economy, the Packaging and Packaging Waste Directive, the Single-use Plastic Directive and, EU Packaging Levy all strive for a shift from current linear economy towards circular business models.

As it is clear that the plastics problem is way too complex to be solved with a simple set of measures, such transitions require a lot more than just changing the packaging itself. If companies want to reach the global, EU and national goals, they have to go beyond rethinking the packaging form and rather embrace the whole circularity mindset. They are encouraged to reuse, repair, remanufacture and recycle goods in this exact sequence in order to save as much material and energy as possible. Their long-term success depends highly on the ability to come up with innovative ideas in changing the packaging needs, adjusting the infrastructure and most importantly, adapting their business model.

This thesis focuses on three main strategies for transition towards circularity in the plastic packaging industry and presents several successful examples for each of them. The first, elimination, includes direct elimination of packaging that is not truly needed and innovative elimination that introduces new materials like dissolvable resin. The second, reusable packaging, focuses on production of durable plastic items and creation of return systems so that products can be used multiple times. The last, material circulation, is divided into plastic recycling and plastic composting, which includes bio-based, biodegradable and compostable materials. As it helps close the loop in the plastics industry where no other alternatives are feasible, plenty of funds are available for material circulation under LIFE programme, Horizon Europe, InvestEU and, others. Furthermore, both recycling and biodegradable materials are highly supported by the legislation, especially the Circular Economy Action Plan and the EU Strategy for Plastics in The Circular Economy.

The case study analysis of the most successful industry examples (Solubag, ReCup, Recycle the rainbow and BioPak) leads to four solutions that PRO EMBA can use in order to excel in the turbulent plastic packaging market. The biggest opportunity definitely lies in plastic recycling: in addition to already established primary recycling of production waste, both

recycling itself and use of recyclates could be extended to a wider range of internally produced packaging. The second part of material circulation, plastic composting, offers a great opportunity for the products that PRO EMBA imports. Expanding the biodegradable packaging product range will give the company an invaluable insight on how ready Slovenian market is for such items. With the knowledge gained, the products identified as the most successful could also be produced in-house in the future. Additional to those two main shifts, testing the dissolvable resin in own production could offer a great marketing tool as the materials are still rather unknown in the Slovenian market. Last but not least, great opportunity for the food delivery boxes and cups lies in creating reusable packaging deposit system with their already established partner network.

While there is no denial that PRO EMBA will face several challenges in the upcoming years, this thesis clearly shows that the situation is far from hopeless. The newly proposed legislation and transition towards more sustainable economy are not limited to restrictions and bans, but offer several opportunities and incentives for innovative companies. If PRO EMBA will remain open for change, there will be plenty of chances to improve their competitive advantage and prosper financially, while also taking our planet into account.

REFERENCE LIST

1. Andrady, A. & Neal, M. (2009). Applications and societal benefits of plastics. *Philosophical transactions of the royal society. Biological Sciences*, 364(1526), 1977-1984.
2. Arvanitoyannis, I. & Bosnea, L. (2001). Recycling of polymeric materials used for food packaging: Current status and perspectives. *Food Reviews International*, 17(3), 291-346.
3. Benyus, J. M. (1997). *Biomimicry: Innovation inspired by nature*. New York: Morrow.
4. BioPak. (2021). *Commited to positive change.* Retrieved 20 June 2021 from https://www.biopak.com.au/about/give-back-program
5. Boulding, K. E. (1966). "The economics of the coming Spaceship Earth". *Environmental Quality in a Growing Economy, ed. H. Jarrett. Baltimore: Johns Hopkins University Press*, 3-14.
6. Brundtland, G.H. (1987). *Our common future: Report of the 1987 World Commission on Environment and Development*. United Nations, Oslo.
7. Cardoso, J. L. (2018). The circular economy: Historical grounds. *In A. Delicado, N. Domingos & L. de Sousa (Eds.), Changing societies: Legacies and challenges* (pp. 115-127). Lisbon: Imprensa de Ciências Sociais.
8. Carson, R. (1962). *Silent spring*. Boston :Houghton Mifflin
9. Chadwick, P. (2018, 19 January). Waitrose pledges to scrap black plastic trays from 2019. Retrieved 8 June 2021 from https://www.packagingnews.co.uk/news/waitrose-pledges-scrap-black-plastic-trays-2019-19-01-2018

10. Cole, R. (2018). *EU circular economy package becomes law*. Retrieved 15 January 2021 from https://resource.co/article/eu-circular-economy-package-becomes-law-12697
11. Commoner, B. (1971*). Closing circle*. New York: Knopf.
12. CupClub. (n.d.). *About us*. Retrieved 20 April 2021 from https://cupclub.com/page/about
13. d'Ambrières, W. (2019, 1 March). Plastics recycling worldwide: Current overview and desirable changes. *Field Actions Science Reports Special issue 19 | 2019*. Retrieved 10 March 2021 from http://journals.openedition.org/factsreports/5102
14. E-Bonitete. (2021). *Rezultati poslovanja: PRO EMBA d.o.o.* Retrieved 10 September 2021 from https://www.ebonitete.si/
15. E-Branjevka. (n.d.). *Kdo smo*. Retrieved 10 April 2021 from https://www.e-branjevka.si/staticne-strani/menu-spodaj/o-nas#cid-8
16. Ehrlich, P. R. (1968). *Population bomb*. New York, Ballantine Books
17. EIA. (2021). *A legally binding agreement on plastics pollution*. Retrieved 22 March 2021 from https://eia-international.org/ocean/plastic-pollution/legally-binding-agreement-on-plastic-pollution-faqs/
18. Ellen MacArthur Foundation. (2015). *The new plastics economy: Rethinking the future of plastics*. Retrieved 17 January 2021 from https://www.ellenmacarthurfoundation.org/publications/the-new-plastics-economy-rethinking-the-future-of-plastics
19. Ellen MacArthur Foundation. (2020a). *Upstream innovation: A guide to packaging solutions*. Retrieved 30 January 2021 from https://emf.thirdlight.com/link/agyt3es34kjy-k2qe8a/@/preview/1?o
20. Ellen MacArthur Foundation. (2020b). *The new plastics economy: Catalysing action.* Retrieved 30 January 2021 from https://www.newplasticseconomy.org/assets/doc/New-Plastics-Economy_Catalysing-Action_13-1-17.pdf
21. Ellen McArthur Foundation. (2020c). *The circular economy: a transformative Covid-19 recovery strategy: How policymakers can pave the way to a low carbon, prosperous future*. Retrieved 14 April 2021 from https://ellenmacarthurfoundation.org/a-transformative-covid-19-recovery-strategy
22. Ellen McArthur Foundation. (2020d). *BioPak: Closing the loop on single-use food packaging.* Retrieved 20 June 2021 from https://www.ellenmacarthurfoundation.org/case-studies/closing-the-loop-on-single-use-food-packaging
23. Ellen MacArthur Foundation. (2021). *Global commitment - new plastics economy.* Retrieved 5 April 2021 from https://www.newplasticseconomy.org/projects/global-commitment.
24. European Bioplastics. (2015, April). *Fact sheet: Energy recovery.* Retrieved 11 March 2021 from https://docs.european-bioplastics.org/publications/bp/EUBP_BP_Energy_recovery.pdf
25. European Commission. (2015). *Closing the loop - EU Action Plan for the Circular Economy.* Retrieved 15 January 2021 from

https://ec.europa.eu/transparency/regdoc/rep/1/2015/EN/1-2015-614-EN-F1-1.PDF.com
26. European Commission. (2016). *Directive 2008/98/EC on Waste (Waste Framework Directive)*. Retrieved 15 January 2021 from http://ec.europa.eu/environment/waste/framework/
27. European Commission. (2018). *European Strategy for Plastics in a Circular Economy.* Retrieved 21 January 2021 from https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN
28. European Commission. (2019). *Food contact materials.* Retrieved 15 January 2021 from https://ec.europa.eu/food/safety/chemical safety/food contact materials
29. European Commission. (2020a). *New Circular Economy Strategy for a cleaner and more competitive Europe*. Retrieved 29 January 2021 from https://ec.europa.eu/environment/circular-economy/index_en.htm
30. European Commission. (2020b). *Commission communication on the Sustainable Europe Investment Plan.* Retrieved 2 April 2020 from https://ec.europa.eu/commission/presscorner/detail/en/fs_20_48?fbclid=IwAR12jUmq0LuD4UMx5iGfmnWIWQ_67maifYhI5N6KpWEr7egl42WnvxPDrIw
31. European Commission. (2021a). *LIFE programme*. Retrieved 2 July 2021 from https://cinea.ec.europa.eu/life_en
32. European Commission. (2021b). *Horizon Europe*. Retrieved 1 July 2021 from https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en
33. European Parliament and Council of the European Union. (1994). *Directive 94/62/EC on Packaging and Packaging Waste.*
34. European Parliament and Council of the European Union. (2018a). *Directive 2008/98/EC on Waste (Waste Framework Directive amendment of 30 May 2018).*
35. European Parliament and Council of the European Union. (2018b). *Amending Directive 94/62/EC on Packaging and Packaging Waste.*
36. European Union. (n.d.). *InvestEU.* Retrieved 1 July 2021 from https://europa.eu/investeu/home_en
37. Eurostat. (2019). *Packaging and packaging waste*. Retrieved 15 January 2021 from https://ec.europa.eu/Eurostat/web/waste/key-waste-streams/packaging.
38. Eurostat. (2021, 8 February*). Recycling rates of packaging waste for monitoring compliance with policy targets, by type of packaging (ENV_WASPACR*). Retrieved 11 March 2021 from https://appsso.Eurostat.ec.europa.eu/nui/submitViewTableAction.do
39. Ford, D. (2020). *We need a Paris Agreement for plastics*. Retrieved 5 April 2021 from https://www.scientificamerican.com/article/we-need-a-paris-agreement-for-plastics/.
40. Geissdoerfer, M., Savaget, P., Bocken, N. M. P. & Hultink, E. J. (2017). The circular economy - a new sustainability paradigm. *Journal of Cleaner Production*, 143, 757-768.
41. Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use and fate of all plastics ever made. *Science Advances*, 3(7)

42. Google Play Store. (2021). ReCup app. Retrieved 7 June 2021 from https://play.google.com/store/apps/details?id=de.recup&hl=sl&gl=US
43. Gummer, F. (2020). The need to address plastics is as strong as ever. *Sustainable Plastics*, Sept-Oct 2020, 14-15
44. GZS. (2018). Proizvajalci izdelkov iz plastičnih mas v Sloveniji. Retrieved 15 April 2021 from: http://www.navodnik.si/images/stories/pdf_datoteke/GZS-brosura.pdf
45. Hahladakis, J. & Iacovidou, E. (2018). Closing the loop on plastic packaging materials: What is quality and how does it affect their circularity. *Science of the Total Environment*, 630, 1394-1400.
46. Hassey, M. (2020). *Seeking global action on plastic*. Retrieved 12 April 2021 from https://www.newsecuritybeat.org/2020/07/seeking-global-action-plastic-2/.
47. Hond, F. (2000). Industrial ecology: A review. *Regional Environmental Change*, 1 (2), 60-69.
48. International Organization for Standardization. (2013a). *Packaging and the environment – Reuse* (ISO Standard No. 18603:2013). Retrieved 15 May 2021 from https://www.iso.org/standard/55871.html
49. International Organization for Standardization. (2013b). *Packaging and the environment – Material Recycling* (ISO Standard No. 18604:2013). Retrieved 17 May 2021 from https://www.iso.org/standard/55872.html
50. International Organization for Standardization. (2013c). *Packaging and the environment – Organic Recycling* (ISO Standard No. 18606:2013). Retrieved 17 May 2021 from https://www.iso.org/standard/55874.html
51. Interseroh. (12 March 2021). *Kakšne so vaše obveznosti po novi uredbi o embalaži*. Lecture, Webinar.
52. Kirbiš Rojs, M. (2021, 16 June). *Komu bodo namenjene miljarde EU sredstev*. Presentation, TikoPro Webinar.
53. Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *SSRN Electronic Journal*, 221-232.
54. Langrand, M. (2021). *A new global treaty to tackle plastic pollution*. Retrieved 20 April 2021 from https://genevasolutions.news/sustainable-business-finance/a-new-global-treaty-to-tackle-plastic-pollution.
55. Lave L., Conway-Schempf N., Harvey J., Hart D., Bee T. & MacCracken C. (1998). Recycling postconsumer nylon carpet. *J Ind Ecol 2* (1), 117-142.
56. Lyle, J. (1994). *Regenerative design for sustainable development*. New York: John Wiley.
57. Malthus, T. R. (1798). *First essay on population*. London: Macmillan & Co. Ltd.
58. Material Economics. (2018). *The circular economy: A powerful force for climate mitigation.* Retrieved 15 April from https://materialeconomics.com/publications/the-circular-economy-a-powerful-force-for-climate-mitigation-1
59. Material Economics. (2019). *Industrial transformation 2050: Pathways to net-zero emissions from EU heavy industry*. Retrieved 15 April from https://materialeconomics.com/publications/industrial-transformation-2050

60. McDonough, W. and Braungart, M. (2002) *Cradle to cradle: Remaking the way we* make things. North Point Press, New York.
61. Meadows, D. H., Meadows, D. L., Randers, J., Behrens, W., & Club of Rome. (1972). *The Limits to growth: A report for the Club of Rome's project on the predicament of mankind.* New York: Universe Books.
62. Miklavčič, J. (2021, 1 April). *Direktiva o zmanjšanju vpliva nekaterih plastičnih proizvodov na okolje in izzivi njene implementacije*. Webinar.
63. Ministry of Finance Republic of Slovenia. (2020, 11 December). 146. točka sklepov Evropskega sveta o uvedbi novega vira lastnih sredstev iz naslova nereciklirane plastične embalaže.
64. Motloch, J. (1995). Regenerative design for sustainable development. *Landscape and Urban Planning*, 32(3), 198-201.
65. O'Rourke D., Connelly L. & Koshland C. P. (1996). Industrial ecology: A critical review. *International Journal of Environment and Pollution 6*(2-3), 89-112.
66. Packaging Europe. (2021, 22 March). *Unpacking the EU Plastic Packaging Levy*. Retrieved 12 April 2021 from https://packagingeurope.com/unpacking-the-eu-plastic-packaging-levy/
67. Pauli, G. (2010). The Blue Economy. *Our Planet*, 24-27.
68. Pauli, G. (2018). *What is the Blue Economy.* European Ecovillage Conference 2018. [You Tube]. Retrieved 10 February 2021 from https://www.youtube.com/watch?v=kANI9LrUxUw
69. Pearce, D. W., and R. K. Turner. *Economics of natural resources and the environment*. Baltimore MD: Johns Hopkins University Press, 1990
70. Plastic Soup Foundation. (2018). *Global sustainability goals and plastic soup.* Retrieved 5 April 2021 from https://www.plasticsoupfoundation.org/en/2018/08/global-sustainability-goals-and-plastic-soup/.
71. Plastics Europe. (2020). *Plastics - the facts 2020: An analysis of European plastics production, demand and waste data.* Retrieved 15 January 2021 from https://www.plasticseurope.org/en/resources/publications/619-plastics-facts-2018.
72. Plastics Europe. (2021). *What are plastics?* Retrieved 30 January 2021 from https://www.plasticseurope.org/en/about-plastics/what-are-plastics
73. Pograjc, M. (2018, 18 April). *Glavni poudarek ob letošnjem dnevu Zemlje: prenehajmo si onesnaževati okolje s plastiko.* Retrieved 13 March 2021 from https://www.stat.si/StatWeb/News/Index/7354
74. Rahimi, A. & García, J. (2017). Chemical recycling of waste plastics for new materials production. *Nature Reviews Chemistry,* 1(6).
75. Raubenheimer, K., & Urho, N. (2020). *Possible elements of a new global agreement to prevent plastic pollution*. Retrieved 3 June 2021 from http://dx.doi.org/10.6027/temanord2020-535.
76. ReCup. (n.d.). *Mission*. Retrieved 15 April 2021 from https://recup.de/mission/
77. ReCup. (2021). ReCup und ReBowl. Retrieved 7 June 2021 from https://recup.de/

78. Reports and Data. (2019). *Returnable packaging market size & share | Industry report, 2019*. Retrieved 18 April 2021 from https://www.reportsanddata.com/report-detail/returnable-packaging-market
79. Royte, E. (2019). *Eat your food and the package too.* Retrieved 20 April 2021 from https://www.nationalgeographic.com/environment/article/food-packaging-plastics-recycle-solutions
80. Saleem, H A. (2016). The challenging shift to a circular economy: The relevance of social ecology in executive transition. *Preprints* 2016, 1–9.
81. Schumacher, E. F. (1973) *Small is beautiful: A study of economics as if people mattered*. London: Vintage.
82. Social Chain. (2021, 11 February). *Digital multiple-use system VYTAL on track for growth: Food Chain GmbH increases its investment*. Retrieved 30 April 2021 from https://www.socialchain.com/en/articles/digitales-mehrwegsystem-vytal-auf-wachstumskurs-food-chain-gmbh-erhoeht-ihr-investment
83. Solubag. (2021). *What is Solubag*. Retrieved 15 May 2021 from https://www.solubag.eu/
84. STA (2021, 4 March). *Iz Slovenije lani izvozili 123,000 ton odpadne plastike.* Retrieved 13 March 2021 from https://www.sta.si/2874621/iz-slovenije-lani-izvozili-123-000-ton-odpadne-plastike
85. Stahel, W. (2010). *The performance economy* (2nd ed.). London: Palgrave Macmillan.
86. Stahel, W. R. & Reday-Mulvey, G. (1981). *Jobs for tomorrow: The potential for substituting manpower for energy.* New York: Vantage Press.
87. Stahel, W. R. (2016). The circular economy. *Nature*, 531(7595), 435-438.
88. Statista. (2021). *Distribution of plastic waste generation worldwide in 2018, by sector*. Retrieved 4 March from https://www.statista.com/statistics/1166582/global-plastic-waste-generation-by-sector/
89. SURS. (2021). *Poslovanje podjetij po dejavnosti (SKD 2008), Slovenija, letno* (ID tabele: 1450403S). Retrieved 8 March 2021 from https://pxweb.stat.si/SiStatData/pxweb/sl/Data/Data/1450403S.px/table/tableViewLayout2/
90. SWITCH to Green. (2020). *EU best practices: Circular Economy Action Plan.* Retrieved 30 January 2021 from http://www.switchtogreen.eu/wordpress/wp-content/uploads/wp-post-to-pdf-enhanced-cache/1/circular-economy-strategy.pdf
91. The Blue Economy. (2010). *The Blue Economy principles.* Retrieved 10 February 2021 from https://www.theblueeconomy.org/principles.html
92. UN Environment Programme. (2019). *The role of packaging regulations and standards in driving the circular economy.* Retrieved 29 January 2021 from https://www.unenvironment.org/resources/report/role-packaging-regulations-and-standards-driving-circular-economy
93. United Nations. (2021). *The Paris Agreement*. Retrieved 5 April 2021 from https://www.un.org/en/climatechange/paris-agreement.
94. Vlada RS. (2006, 8 August). Uredba o ravnanju z embalažo in odpadno embalažo. *Uradni list RS,* št. 84/06

95. Vlada RS. (2015, 24 December). Uredba o spremembah in dopolnitvi Uredbe o ravnanju z embalažo in odpadno embalažo. *Uradni list RS,* št. 103/15
96. Vlada RS. (2021a, 9 April). Uredba o spremembah in dopolnitvi Uredbe o ravnanju z embalažo in odpadno embalažo. *Uradni list RS*, št. 54/2021
97. Vlada RS. (2021b, 20 August). Uredba o prepovedi dajanja nekaterih plastičnih proizvodov za enkratno uporabo na trg v Republiki Sloveniji in o označevanju nekaterih plastičnih proizvodov. *Uradni list RS*, št. 131/2021
98. von Carlowitz, H. (1713). *Sylvicultura oeconomica, oder haupwirthliche Nachricht und Naturmdfiige Anweisung zur wilden Baum'Zucht*. Leipzig: Braun.
99. Waitrose. (2021). Plastics and packaging. Retrieved 8 June 2021 from https://www.waitrose.com/home/inspiration/about_waitrose/the_waitrose_way/packaging.html
100. Webster, K. (2017). *The circular economy: a wealth of flows*. Isle of Wight: Ellen MacArthur Foundation.
101. Witjes, S. & Lozano, R. (2016). Towards a more circular economy: proposing a framework linking sustainable public procurement and sustainable business models. *Resources, Conservation and Recycling*, 112, 37-44

APPENDICES

Appendix 1: Povzetek (Summary in Slovene language)

Kopičenje odpadkov ter z njimi povezana onesnaženost zraka, voda in tal, že vrsto let opozarjajo, da naše potrošniške navade potrebujejo korenito spremembo. Mediji in zakonodaja kot enega največjih vzrokov zanje navajajo plastično industrijo, predvsem embalažo za enkratno uporabo. Evropska Unija je v zadnjem desetletju sprejela celo vrsto ukrepov, ki omejujejo proizvodnjo in prodajo okolju manj prijazne embalaže in spodbujajo trajnostno naravnano krožno gospodarstvo v plastični industriji. Potrošniki, predvsem pa proizvajalci, se tako srečujejo z mnogimi izzivi, kako se najuspešneje odzvati na novo sprejeto zakonodajo in trajnostne spodbude izkoristiti za izboljšanje tržnega položaja. Med njimi je tudi družinsko podjetje PRO EMBA, ki se že tri desetletja ukvarja s proizvodnjo in prodajo polietilenske embalaže za enkratno uporabo. Glavni fokus predstavljajo HDPE folije in vreče iz lastne proizvodnje, prodajni program pa dopolnjuje distribucija raznovrstne embalaže, od lateks in PE rokavic, folij za živila, vreč z zadrgo do posod za dostavo hrane. Nova zakonodaja in vse večja osveščenost potrošnikov PRO EMBO silita v spremembo poslovnega modela, ki pa zaradi majhnosti podjetja in težko dostopnih primerov dobrih praks, ni najlažja naloga.

Namen magistrskega dela je poglobljena analiza teorije krožnega gospodarstva, z njim povezane novo sprejete zakonodaje in uspešnih primerov praks v industriji plastične embalaže. Razumevanje trenutne situacije in iskanje primernih poslovnih rešitev za prehod v krožno gospodarstvo je ključnega pomena za dolgoročni uspeh podjetja PRO EMBA. Glavni cilj magistrske naloge je razvoj trajnostnega poslovnega modela, temelji pa na treh raziskovalnih vprašanjih: kaj je krožno gospodarstvo in kako se navezuje na industrijo plastične embalaže, kako izgledajo najboljši primeri krožnih poslovnih modelov v industriji plastične embalaže in katere od omenjenih rešitev so primerne za podjetje PRO EMBA.

Čeprav je krožnost v ekonomiji precej nov koncept, naš planet po njenem principu deluje že milijone let. Krožno gospodarstvo namreč izhaja iz naravnih sistemov, ki spodbujajo odgovorno ravnanje z viri, oblikovanje vzdržljivih izdelkov in minimiziranje odpadkov. S ponovno uporabo, prenovo izdelkov in recikliranjem lahko zapremo krog trenutno izrazito linearne plastične industrije in sledimo naravi, kjer je vsak odpadek hrana za drug organizem.

Kljub temu, da je problem plastične industrije precej prezapleten, da bi ga lahko rešili s sprejetjem nekaj uredb, zakonodaja tako na globalnem kot evropskem nivoju poskuša narekovati prehod v trajnostno gospodarstvo. Evropska Unija z ambicijo postati prva klimatsko nevtralna celina celotnemu svetu postavlja smernice boja proti podnebnim spremembam. Večina sprejetih dokumentov, vse od Zelenega dogovora, Akcijskega načrta za krožno gospodarstvo, Evropske strategije za plastiko v krožnem gospodarstvu, Uredbe o embalaži in odpadni embalaži, Direktive o zmanjšanju vpliva nekaterih plastičnih proizvodov na okolje (SUP direktiva) do tako imenovanega 'Davka na plastiko', spodbuja proizvajalce embalaže za enkratno uporabo k uporabi reciklirane plastike in materialov iz obnovljivih virov. Stremijo tudi k bolj okolju prijazni infrastrukturi, učinkovitejšemu

zbiranju in ločevanju odpadkov ter razvoju sistemov embalaže za večkratno uporabo. V kolikor podjetja želijo slediti Evropskim ciljem, bodo torej morala pokazati mnogo več kot le spremenjeno sestavo in izgled že uveljavljene embalaže. Prehod v krožni poslovni model zahteva spremembo celotne strategije, le ta pa inovativen pristop in visoko stopnjo predanosti podjetja.

V magistrskem delu so predstavljene tri strategije za trajnostni prehod v industriji plastične embalaže: izločanje embalaže (neposredno izločanje embalaže, ki ni nujno potrebna in inovativno izločanje z npr. v vodi topnimi materiali), embalaža za večkratno uporabo in kroženje materialov (uporaba reciklirane plastike ter biorazgradljivih materialov). Za vsako od navedenih rešitev je predstavljenih nekaj primerov dobre prakse, štiri za PRO EMBO najbolj primerne pa so podrobneje opisane v študijah primera (Solubag, ReCup, Recycle the rainbow and BioPak).

Največjo priložnost za lastno proizvodnjo zagotovo predstavlja recikliranje konvencionalnih plastičnih materialov: poleg že uveljavljenega primarnega recikliranja proizvodnih odpadkov bi lahko samo recikliranje in uporabo reciklata razširili na širšo paleto izdelkov. Za prodajni program, ki ga PRO EMBA trenutno uvaža, rešitev predstavlja embalaža iz biorazgradljivih ali kompostabilnih materialov. Razširjena ponudba tako imenovane 'bio embalaže' bi podjetju iz prve roke zagotovila informacije o stopnji pripravljenosti slovenskega trga za omenjene artikle. S pridobljenim znanjem bi lahko produkte, identificirane kot najbolje prodajane, v prihodnosti proizvajali tudi v okviru lastne proizvodnje. Poleg navedenih dveh glavnih rešitev, odlično priložnost, predvsem za prepoznavnost podjetja, ponuja uporaba inovativnih materialov, kot je npr. v vodi topen granulat podjetja Solubag. Zadnja predstavljena rešitev pa je primerna za embalažo namenjeno dostavi hrane in pijače, ki v tujini v zadnjih letih postaja vse bolj razširjena. Gre za vzpostavitev depozitnega sistema embalaže za večkratno uporabo, ki bi ga PRO EMBA lahko prenesla na že vzpostavljeno partnersko mrežo restavracij.

Čeprav je pred proizvajalci plastične embalaže za enkratno uporabo precej težko obdobje, polno izzivov, magistrska naloga dokazuje, da situacija še zdaleč ni brezupna. Novo sprejeta zakonodaja in prehod v okolju prijaznejše gospodarstvo ne prinašata le omejitev, temveč tudi mnogo priložnosti in spodbud za inovativna podjetja. Med njimi je tudi PRO EMBA – v kolikor bo podjetje odprto za spremembe, je pred njim odlična priložnost, da v okviru sprejetih ukrepov izboljša svojo konkurenčno prednost in finančno uspešnost, hkrati pa poskrbi tudi za naš planet.

Appendix 2: Commoner's four laws of ecology

The first law of ecology: Everything is connected to everything else.

This may be difficult to understand today because companies and customers love to believe that each singular event has its independent singular cause. However, in nature, everything is interconnected and self-stabilizing: removing one component may cause a collapse is several other areas. The more complex an ecosystem is, the more links the network consists of, the more stress it can survive before it breaks down entirely. Environmental degradation cuts those links and oversimplifies the natural ecosystem which should eventually lead to collapse (Commoner, 1971).

The second law of ecology: Everything must go somewhere.

Based on the core law of physics that matter is indestructible, there is no such thing as waste - what is seen as a waste of one organism is another organism's food. However, the industry has been transforming natural resources to such extent that nature can no longer process them. Until recently, not much thought was given to the matter of where the products will end up at the end-of-life cycle. We think that plastic goods ending in the oceans are bad, but the truth is they most often end up on our plates: as everything must go somewhere, the microplastic in the ocean gets eaten by the fish and the latter is served in our restaurants (Commoner, 1971).

The third law of ecology: Nature knows best.

Until Commoner's Closing Circle (1971), it was believed that industry has 'improved' the natural world and that human action is superior to that of nature. But the third law of ecology contradicts such belief - as ecosystems are self-stabilising, any human interference in the ecosystem is rather detrimental (Commoner, 1971).

The Fourth Law of ecology: There is no such thing as free lunch.

The last, fourth law is borrowed from economics to show that every success has its costs. It embodies all previous three laws: "Because the global ecosystem is a connected whole, in which nothing can be gained or lost and which is not subject to over-all improvement, anything extracted from it by human effort must be replaced" (Commoner, 1971, p. 69).

Appendix 3: Most common polymer types used in plastic packaging

Table_Apx 1: Most common polymer types used in plastic packaging

Polymer type	European (EU28+NO/CH) plastics converters resin demand in 2019 (used in other sectors as well, not packaging only)	Common Packaging Applications	Properties
High Density Polyethylene (HDPE)	6.3 million tonnes or 12.4% of all European plastic resin demand in 2019	- Films and bags for groceries, retail purchase (lower thickness) - Bottles for milk, water, detergents, cosmetics, household cleaners - Industrial wrapping	- Density range of 0.93 to 0.97 g/cm3 - High strength-to-density ratio thanks to strong intermolecular forces and tensile strength - Heat resistance up to 120°C (short period) - Perfect resistance to most solvents - stiffness
Low Density Polyethylene (LDPE)	8.6 million tonnes or 17.4% of all European plastic resin demand in 2019	- Foils and bags for food and household garbage (higher thickness) - Stretch film - Container lids - Squeezable bottles	- Density range of 0.910–0.940 g/cm3 - Heat resistance up to 80 °C continuously and 95 °C for a short time - Perfect resistance to acids, oils and bases - Toughness and flexibility
Polyethylene Terephthalate (PET)	4.0 million tonnes or 7.9% of all European plastic resin demand in 2019	- Bottles for soft drinks - Salad containers, dressing containers - Food jars for jam, jelly etc. - Microwavable food trays	- Density of 1.37g/cm3 - Great heat resistance - Perfect barrier to water, oxygen, carbon dioxide and chemicals

(table continues)

Table_Apx 1: Most common polymer types used in plastic packaging (continued)

Polymer type	European (EU28+NO/CH) plastics converters resin demand in 2019 (used in other sectors as well, not packaging only)	Common Packaging Applications	Properties
Polypropylene (PP)	9.8 million tonnes or 19.4% of all European plastic resin demand in 2019	- Containers for food delivery, yoghurts, etc. - Microwave containers - Bottle caps and closures - Snack wrappers	- Density range of 0.895 to 0.92 g/cm³: commodity plastic with lowest density - Greater thermal resistance compared to PE - Lower chemical resistance compared to PE - Though and flexible
Expanded Polystyrene (EPS)	1.5 million tonnes or 3.1% of all European plastic resin demand in 2019	- Food delivery containers, cups, plates	- Light weight, strength and durability - Perfect moisture barrier - Perfect temperature insulation properties in foamed form - Low density and high stiffness in foamed form

Source: Plastics Europe (2021); Plastic biopolymers (2015); Hahladakis & Iacovidou (2018).

Appendix 4: Single-use Plastics Directive Measures by product groups

Table_Apx 2: Single-use Plastics Directive Measures by product groups

Category	Products included	Obligatory measures	Enforcement deadline
A	- Cups for beverages, including their covers and lids - Food containers intended for immediate consumption without any further preparation (on-the-spot or take-away)	Consumption reduction	3 July 2021
B	- Cotton bud sticks - Cutlery (forks, knives, spoons, chopsticks) - Plates - Straws - Beverage stirrers - Sticks attached to support balloons - Food containers made of expanded polystyrene (with or without a lid) intended for immediate consumption without any further preparation (on-the-spot or take-away) - Beverage containers made of expanded polystyrene, including caps and lids - Cups for beverages made of expanded polystyrene, including covers and lids	Restrictions on placing on the market	3 July 2021
C	- Beverage containers with capacity up to three litters, including caps and lids (but not glass or metal or the ones intended for medical use)	Product requirements and Separate collection	3 July 2021
D	- Sanitary towels (pads), tampons and tampon aplicators - Wet wipes (personal care and domestic wipes) - Tobacco products with filters - Cups for beverages, including covers and lids	Marking requirements	3 July 2024

(table continues)

Table_Apx 2: Single-use Plastics Directive Measures by product groups (continued)

Category	Products included	Obligatory measures	Enforcement deadline
E	- Food containers intended for immediate consumption without any further preparation (on-the-spot or take-away) - Packets and wrappers made from flexible material containing food, intended for immediate consumption without any further preparation - Beverage containers with capacity up to three liters, including caps and lids (but not glass or metal or the ones intended for medical use) - Wet wipes (personal care and domestic wipes) - Balloons (except for professional use) - Tobacco products with filters	Extended Producer Responsibility	3 July 2021
F	- Food containers intended for immediate consumption without any further preparation (on-the-spot or take-away) - Packets and wrappers made from flexible material containing food, intended for immediate consumption without any further preparation - Beverage containers with capacity up to three litters, including caps and lids (but not glass or metal or the ones intended for medical use) - Cups for beverages, including covers and lids - Wet wipes (personal care and domestic wipes) - Balloons (except for professional use) - Tobacco products with filters - Lightweight plastic carrier bags - Sanitary towels (pads), tampons and tampon applicators	Awareness resing	3 July 2021

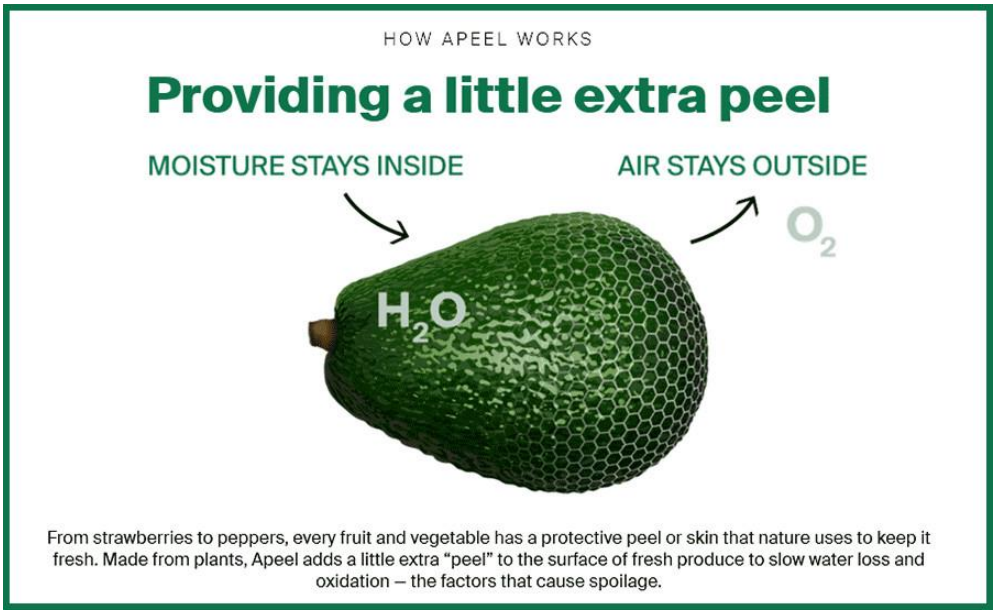
Source: European Parliament & Council of the European Union (2018b).

Appendix 5: Examples of successful implementations of plastic packaging elimination trends

Figure_Apx 1: Apeel protective coating

Source: Time (n.d.).

Figure_Apx 2: How Apeel protective coating works



Source: Labs (2019).

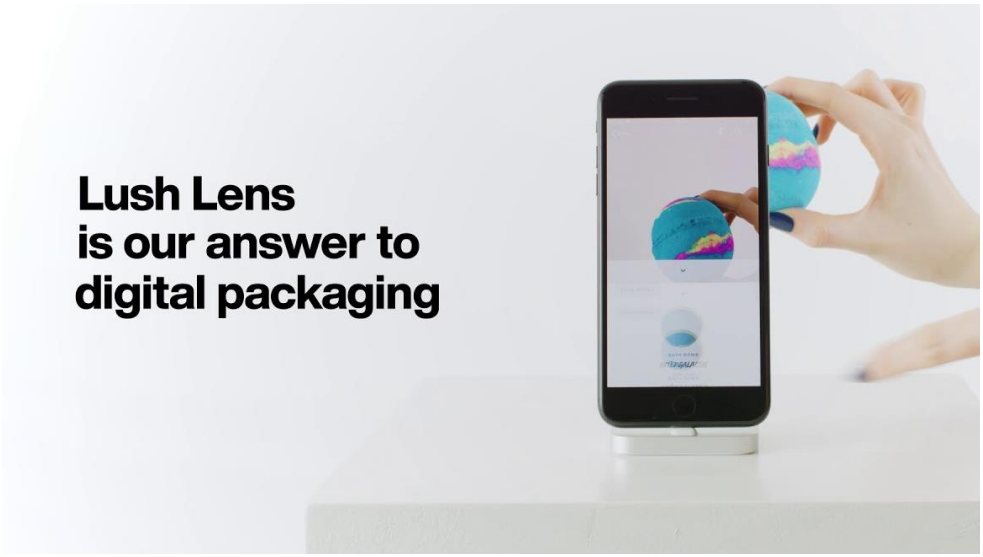
Figure_Apx 3: Monosol films that dissolve in water

Source:Plastics in packaging (2019).

Figure_Apx 4: Lush offers a wide range of products without packaging

Source: MDS (2019).

Figure_Apx 5: Lush lens app provides customers with all the information that would otherwise be printed on the packaging



Source: Lush (n.d.).

Figure_Apx 6: Danone Aqualife label-free bottle from recycled PET

Source: The Jakarta Post (2019).

Figure_Apx 7: Carlsberg Snap Pack glue dots glue the aluminium cans together

Source: Carlsberg (n.d.).

Figure_Apx 8: E-branjevka fresh produce delivery with minimized plastic packaging

Source: E-branjevka (n.d.).

Appendix 6: Examples of successful implementations of reusable packaging trends

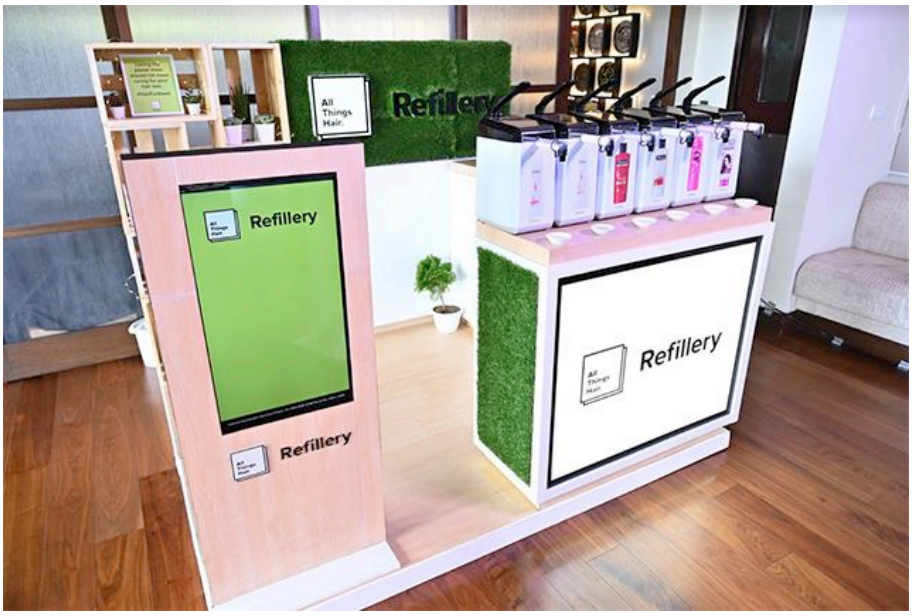
Figure_Apx 9: Lancôme by L'Oreal refill cosmetics packaging

Source: Kilkeary (2020).

Figure_Apx 10: Nestlé pet food refill station in Switzerland

Source: Packaging world (2020).

Figure_Apx 11: Unilever shampoo refill stations



Source: Martelino (2019).

Figure_Apx 12: Vytal reusable packaging system (app based, no deposit)

Source: Vytal (2021).

Figure_Apx 13: LOOP's reusable packaging is available for more than 500 products (from Nestlé, P&G, Unilever, Mars to Coca.Cola)

Source: Daley (2020).

Figure_Apx 14: CupClub reusable coffee cup system (app based, no deposit)

Source: Ubuntoo. (n.d.).

Appendix 7: Examples of successful implementations of plastic packaging recycling trends

Figure_Apx 15: Coca-Cola's South Africa new clear Sprite bottle

Source: Food Business Africa (n.d.).

Figure_Apx 16: Magnum 100% recycled PP ice cream tubs

Source: Magnum (n.d.).

Appendix 8: SWOT analyses of successful circular business models examples

Table_Apx 3: Solubag SWOT Analysis

Strengths	- Innovative patented technology: first-mover advantage - Many advantages of Solubag PVA material over the biodegradable or compostable alternatives - No special machinery needed for production: current producers can simply switch from PE resin to PVA resin - Both government and legislation are highly supportive of innovative approaches to elimination strategy
Weaknesses	- While innovative technology is the key competitive advantage, it can also backfire as there is still a lot to learn about the material - Lack of certification (food conformity, degradability, etc.) which may lead to doubt and trust issues - Lack of experiences in the EU market which can be very different from the US - While some clients are willing to pay the price premium for such innovative technology, the vast majority of the market is still very unlikely to do so - Geographical distance from EU (production in Chile) may also be a problem as the shipments of raw materials are huge and the transport is getting more and more expensive
Opportunities	- Same PVA material will be needed for other products in different industries - Solutions similar to Solubag PVA material are increasingly being asked for in other parts of the world as well - Strong government and legislative support (excluded from the SUP Directive and the EU Packaging Levy), which means there should be many financial initiatives available for further innovations (LIFE programme, Horizon Europe, Innovation fund, Interreg Europe, EIC Accelerator and others)
Threats	- Quite strong competition: huge R&D investments from several big players - Local (especially EU) resin suppliers have already gained the trust which is very important when producers are switching to new materials - Recyclable and reusable packaging are gaining momentum and both are highly supported from the government – once their market is fully established, they might endanger Solubag technology as they will be much more affordable

Source: Solubag (2021); Own work.

Table_Apx 4: ReCup SWOT Analysis

Strengths	- Simplified system that does not require an app account and is therefore available to everyone - Internal production of the packaging - Using 100% PP material makes the packaging easy and profitable to recycle - Huge network with over 8500 partners - Brand recognition thanks to great marketing and lots of PR - Both governmental and legislative support is extremely inclined towards reuse (Germany has already adopted a law that requires all the take-out restaurants to offer reusable packaging at least as an alternative by 2023)
Weaknesses	- While the simplified system is a great advantage, it does not enable 100% reliable tracking - The logistics are very difficult to arrange as the app does not show the in-time location of the packaging - With no scanning through the app, the restaurants are charged a monthly fee and not per used packaging, which might be unfair to the smaller partners that do not use as many - The employees in the restaurants are very reluctant to offer this kind of packaging as the system means additional work for them (cleaning, explaining how it works, etc.)
Opportunities	- If similar legislation to the German one will be accepted in the other countries as well, restaurants around the whole world will be looking for a service that ReCup offers - Similar solution will be needed in several other business environments, like events for example - Governmental and EU support: German legislation enacted a law that requires all take-away restaurants to offer reusable packaging as an alternative from 2023; furthermore, reusable packaging is excluded from the SUP Directive and encouraged by Circular Economy Action Plan and EU Strategy for Plastics in The Circular Economy
Threats	- Growing competition: Vytal and Relevo are two examples of the fast-growing companies that are aggressively winning new markets - Hygiene concerns that have come up in the previous years might be raised again in the future - BYO or bring-your-own models are growing in the packaging sector: some consumers might find it easier to just bring their own packaging instead of paying for deposit

Source: ReCup (2021); Own work.

Table_Apx 5: Waitrose & Partners »Recycle the rainbow« SWOT Analysis

Strengths	- Innovative approach which clearly distinguishes the coloured trays from the conventional ones (that most competitors still use) - Clear 2023 targets and a straightforward plan on how the initiative is going to help achieve them - Recycled PET offers several advantages over the conventional black PET and over biodegradable options, without sacrificing any of the functionality or eye-pleasing appearance - The fact that packaging varies in colours makes it more fun and enjoyable for the end consumer - Great marketing and PR (and plenty of resources for further improvements of both)
Weaknesses	- Outsourced production which means that the similar product might be sold to competitors as well - The initiative only includes trays, but the company uses several other packaging products
Opportunities	- Improved PET collection system and extremely high recycling targets are key parts of the EU SUP directive, which means that recycle PET will become widely available and more affordable - The same recycled PET will be needed for other products as well - Recycling PET material is highly supported by the EU legislation, predominantly the Circular Economy Action Plan and the EU Strategy for Plastics in The Circular Economy
Threats	- Incredibly harsh competition: all retailers are trying their best to offer similar alternatives - Even if trays get recycled again, the cycle cannot continue forever, which is why some customer still prefer other alternatives (like reuse or compostable materials) - Once the collection and composting facilities will improve, the compostable packaging might become a more suitable and sustainable alternative - Reusable packaging system and BYO models also pose a threat to recycled PET trays as the legislation is very inclined towards them

Source: Waitrose (2021); Chadwick (2018); Own work.

Table_Apx 6: BioPak SWOT Analysis

Strengths	- The first company with own collection and composting system that ensures their compostable packaging is truly circular in practice - Lots of local partners in Australia and New Zealand - Great marketing and extremely customer friendly approach - Cloud-based enterprise resource planning (ERP) platform monitoring and analysing trends in demand to ensure company always has at least one month's worth of stock for each client - First carbon neutral company in New Zealand and Australia
Weaknesses	- Despite that they try their best to make the production as environmentally friendly as possible, paper and certain other biobased materials production is still very harsh on the natural world (lots of water needed, etc.) - Compostable packaging, especially combined with collection and composting system, is extremely expensive compared to conventional or recyclable plastics – while the customers in Australia and New Zealand might be willing to pay a premium, many others (including parts of EU and US) are unlikely to do the same
Opportunities	- Partners in other parts of the world (predominantly US and EU) are already looking for solutions like BioPak - Expanded organic recycling options, like converting organic material into biochar and using the organic waste as a feedstock for worm and insect farming, are increasingly being asked for - Future availability of innovative material sources like feedstock from by-products (agricultural or industrial); or grown in marginal areas helping restore degraded land; or cultivated using 'regenerative practices' which activate soil biology, enhance biodiversity, increase water storage, and sequester carbon - Strong government and legislative support (predominantly Circular Economy Action Plan and EU Strategy for Plastics in The Circular Economy), which means there should be many financial initiatives available for further expansion to areas where composting is not available
Threats	- Recyclable and reusable packaging are gaining momentum and both are highly supported from the government – once their market is fully established, they might endanger compostable packaging - Intense competition in the global market: big players that were producing the conventional plastic packaging in the past are investing heavily in compostable options

Source: BioPak (2021); Ellen MacArthur Foundation (2020d); Own work.

Appendix 9: Current PRO EMBA Business Model Canva

Table_Apx 7: Current PRO EMBA Business Model Canva

<table>
<tr>
<td rowspan="2"><u>KEY PARTNERS</u>
- PE resin suppliers
- Production machinery suppliers and technicians
- Finished plastic packaging suppliers
- Logistics companies
- Software providers
- Webpage designers</td>
<td><u>KEY ACTIVITIES</u>
- Production of PE films and bags
- Sales of both internally produced goods and imported product range
- Logistics</td>
<td rowspan="2"><u>VALUE PROPOSITION</u>
- Excellent price/quality ratio of conventional plastic packaging
- Reliable products
- Quick delivery
- Short production times
- Accessible central location (Slovenian and also EU market)
- Customization possibilities</td>
<td><u>CUSTOMER RELATIONSHIP</u>
- Phone/email contact
- Customer website interactions
- (Rare) personal interactions</td>
<td rowspan="2"><u>CUSTOMER SEGMENTS</u>
Mass market B2B:
1. Customers looking for simple, cheap and durable plastic packaging
2. Customers looking for customized plastic packaging</td>
</tr>
<tr>
<td><u>KEY RESOURCES</u>
- Production machinery
- Employees
- 30 years expertise and know-how in the plastic packaging industry
- Customer data base
- Warehouse
- Truck</td>
<td><u>CHANNELS</u>
- Webpage
- Direct email list
- Partner recommendations
- Internet text/image search</td>
</tr>
<tr>
<td colspan="3"><u>COST STRUCTURE</u>
- Production machinery and infrastructure (5%)
- Costs of raw material (40%)
- Cost of imported finished goods (40%)
- Employees (5%)
- Energy sources (4%)
- Production machinery maintenance (2%)
- Logistics (1%)
- Other (3%)</td>
<td colspan="3"><u>REVENUE STREAM(S)</u>
- Product sales: approximately 65% from the 1st customer segment and 35% from the 2nd customer segment
- Customers can pay up-front or through financing (once partnership is at least somewhat established)</td>
</tr>
</table>

Source: Own work.