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The introduction of circular partnerships for a transition towards circular economy

The case of retailers in the agri-food and electronics sectors

Author(s): Margaux Grognet
Supervisor(s): Constantin Blome
Academic year 2022-2023
Dissertation for the master 120 of Management Sciences
Subject and focus : Partnerships within the Circular Economy
Daytime schedule

Mémoire

Margaux Grognet

June 2023

Ackownledgements

I am deeply grateful to my supervisor, Professor Constantin Blome for his guidance, patience, and understanding throughout the writing of this thesis.

Furthermore, I would to thank my family and friends for their encouragement and support in the making of this thesis as well as my academic journey.

Lastly, I cannot overstate how much the constant moral support and attentive ear of my best friend Sophie Beaurain meant to me and helped me get through the toughest parts of this work.

Abbreviations

B2B	**B**usiness to **B**usiness
B2C	**B**usiness to **C**onsumer
CE	**C**ircular **E**conomy
EU	**E**uropean **U**nion
CEAP	**C**ircular **E**conomy **A**ction **P**lan
CEPS	**C**enter for **E**uropean **P**olicy **S**tudies
EMF	**E**llen **M**cArthur **F**oundation
EEA	**E**uropean **E**nvironment **A**gency
GSCM	**G**reen **S**upply **C**hain **M**anagement
GVA	**G**ross **V**alue **A**dded
SC	**S**upply **C**hain
SCI	**S**upply **C**hain **I**ntegration
SCM	**S**upply **C**hain **M**anagement
SME	**S**mall and **M**edium-sized **E**nterprises
SSCM	**S**ustainable **S**upply **C**hain **M**anagement

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Introduction

Our world possess a finite amount of resources; climate change, natural disasters, and resources scarcity are on the rise, and the environmental and social toll that our current consumption pattern has on the world is non-negligible and is only increasing its manifestations.

In the last decade, a lot of infatuation grew with the concept of sustainability and, in its tide, the idea of a Circular economy where the production of goods and services would be done sustainably and reduce the waste in resources as well as the creation of waste.

However, even with its popularity increasing, it seems as though implementing a circular economy is facing multiples consequential barriers. We can see this trend in fast-fashion, where more sustainably produced clothes emerge along with recycling or reusing movements, but the overall lack of circularity persists.

A substantial amount of literature has been published on the subject and what it could mean for our society. But the same barriers related to logistics, high costs, or lack of interest often seem to apply. That is, with the exceptions of circular businesses, which not only have overcome the circularity barriers, but have centered their business idea around the lack of circularity in the rest of the industry.

It is in this regard that we steered our research subject towards these circular businesses and how partnerships with external circular partners along the supply chain might be a solution towards a more effective shift for circularity. Sustainability innovations are not easily achieved by one organisation, and even major changes in a company's operations need the combined actions of the network of partners for it to be effectively implemented (w).

Moreover, as the 2022 Report from the Circle Economy on Circular Collaboration states (R), collaborating in a circular economy can bring advantages in the form of industry-wide changes in the industry, competitive advantages from resource sharing, financial advantages from lower costs (through shared research or economies of scale), and shared knowledge.

This concept of mutually beneficial circular collaboration led us to our research focus : The introduction of circular partnerships for a transition towards circular economy in the retail industry for both the agri-food and electronics sectors . Moreover, we will answer the questions: Which roles do these circular companies take depending on the sector and business ? Which barriers do these circular companies manage to overcome ? And can businesses use individual circular partnerships to improve their circularity ?

There are a lot of different partners in a circular economy such as legislators, competitors, or governments to name a few. However, we set our focus on smaller actors that have the ability to impact companies whilst not being as subjected to the barriers in place in a CE. A linear cultural mindset and high up-front investments costs for example are typical barriers that prevent businesses from enacting a circular change from within. The idea of our research focus is to gather existing circular businesses examples that collaborate with retailers and wholesalers of the agri-food as well as the electronics sector without the need for the retailer to implement major logistical, financial, or cultural changes in its organisation. We chose to focus on retailers given that are special actors of the value chain that have both power on their suppliers and direct contact with consumers, increasing their power to foster change when compared to up-stream or downstream actors. The variety of retailers as well as their potential for local circular economies was also a factor in our choice. Our goal is to gauge if external partners can effectively impact these sectors at their level and if not why. Coming back to our sub-questions, we will work to find out which roles these businesses take depending on the sector and retailer they work with, as well as if collaborating with circular businesses can be a way for companies to bypass the barriers they face. Finally, we'll see if businesses of these two sectors can in fact utilize external circular partnerships to improve their circularity.

We believe this subject to be an interesting point to add to the current literature review given that the focus is set outside of the value chain and towards this rather new phenomenon of innovative and creative circular business models emerging in response to the linear system that most established businesses currently thrive in.

In this study, we will try to get a better understanding of all of the aspects of a Circular Economy as well as the advantages and barriers related to it. In order to do so, we will be focusing on existing circular businesses within Western Europe, on how their integration into different supply chains could help the move towards a more circular society, and on how external circular businesses can have an impact on different types of supply chains.

Part 1 - Literature Review

Chapter 1

The Circular Economy

1.1 Definition

There is no universally agreed upon definition of a circular economy but rather a bundle of overlapping concepts that industries and societal environments individually define. The concept is thus ever-moving and fluctuates at the same pace as society puts it into practice.

Circular economy, in the recent years, went from being a growing popular concept to affecting all levels of society. Throughout governments and global organizations up to the private sector, the numerous versions of the concept of CE lead to the misuse and misinterpretation of the true purpose of the phenomenon and has led in some cases to greenwashing [1] amongst industries implementing their own tailored version of it ().

The french institute of circular economy defines it as a " sustainable production of goods and services limiting the consumption and waste of resources as well as waste production." [Translated from French]([?]) **1**, whereas the World Economic Forum goes a step further by stating that “A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems, and business models. ” **2**

[1] +Definition

Throughout the literature, the idea of reusing and refurbishing products, extending the life cycle of products (European Parliament, 2022) **3**, or closing the loop on the production of goods (MacMillan online dictionnary, 2022) **4** is commonly agreed upon. Some stem from the idea that the end product must be treated while others state that the whole line and production process have to be accommodated to plan for its end-of-life.

In a 2021 study of the different scientific definitions of CE, the authors state that each of the 5 top cited authors[2] on the subject had referenced the highly influential Ellen McArthur Foundation (Nobre Tavares, 2021) [**?**] **5** whose definition of CE is the following "A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems" (EMF, 2012)**6**. This adaptation of the CE concept tackles challenges such as climate change, biodiversity loss, waste, and pollution (Ellen McArthur Foundation Website, 2022)**7**.

1.2 Early history

"The linear economy invented waste, at least its massive accumulation, and pushed back traditional practices of reintegrating materials into economic cycles" [Translated from French](Aurez Laurent, 2016, p. 38)**15**. Before the industrial revolution it was actually common practice to operate a "circular economy", although it was not seen as such at the time. Craftsmen and farmers repaired their tools, recycled their materials and transformed them to extend their use, biological waste was used to fertilize the soil, and so forth. Resources were maximised to their fullest potential up until the industrial revolution and the migration of the working population towards major cities, such practices disappeared and the economy slowly shifted towards a linear economy.(Le Moigne, 2014) **16**

There is no clear indication that the concept of CE originated from a single source or author **7** but rather emerged from several works throughout different sectors in order to tackle their specific needs. Indeed, as we pointed out before in section 1.1., the definition of CE

[2]As of April 19th, 2021

is not set in stone, it can and was adapted to fit the situation in which they were proposed and/or applied. Depending on the basis of the need for a CE, its concept and application differ.

The concept of CE developed from the realization that the current linear model would not be sustainable in the long-run. One of the first noticeable authors to point out the fact that there was an unsustainable linearity **8** in our society was Thomas Robert Malthus, a 18th-century british economist who in his book "An Essay on the Principle of Population" (1798) theorized that barring disease, war, famine or any major event effectively reducing the population, it would continue to grow exponentially while our resources would suffer a linear growth, possibly leading to a collapse **9**.

His train of thought was backed up later on by another economist, Kenneth E. Boulding, who first introduced his Cowboy Theory at the "Sixth Resources for the Future" Forum on Environmental Quality in a Growing Economy in Washington, D.C. on March 8,1966.**10**. In it he states that the United States is a "cowboy economy" with a frontier ethic of limitless resources, as opposed to his suggestion of a "spaceship economy" where people reuse and sustain material and energy "like astronauts aboard an orbiting capsule" **11**. In this concept lies the famous quote attributed to Boulding "Anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist". [3]

Fast forward to 1972 with the publication of a book by Donella Meadows and Dennis Meadows named "The limits of growth".**13** The study behind this book pointed out that, even with advanced technology, the earth's interlocking resources will most likely not be able to support our current economic and population growth past the year 2100. They conducted their work through the variations of five basic factors that define and limit our growth: population increase, agricultural production, nonrenewable resource depletion, industrial output,

[3]The earliest strong match located by QI appeared in the Fall 1973 issue of the journal "Daedalus". The general topic of the issue was "The No-Growth Society", and the economist Mancur Olson who penned the introduction credited the remark to Kenneth Boulding.**12**

and pollution generation.[14]

Although gaining popularity in the 1960's, the idea of ecology met its peak in the 1970's which fostered publications on the subject and this idea of an ideal circularity.[8] In 1976, Walter Stahel and Genevieve Reday published a research report for the European Commission in Brussels "Jobs for Tomorrow, The Potential for Substituting Manpower for Energy" where they introduced a first sketch of an "economy in loops" influencing four factors: job creation, economic competitiveness, resource savings and waste prevention.[17] This report

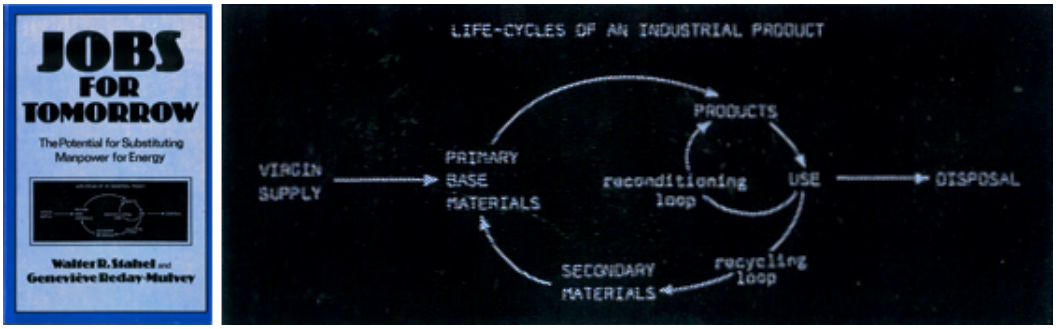

Figure 1.1: Early sketch of an Economy in loops (1976)

was a disruptive bombshell of the current system and was postponed until eventually published years later (Aurez et Georgeault, 2016) [15]. Walter Stahel also introduced the term "Cradle to Cradle", which was later developed by William McDonough in 2002, that "can be defined as the design and production of products of all types in such a way that at the end of their life, they can be truly recycled (upcycled), imitating nature's cycle with everything either recycled or returned to the earth, directly or indirectly through food, as a completely safe, nontoxic, and biodegradable nutrient."[18]

1.3 Concepts

1.3.1 *Circular economy seen as cycles*

CE has many different takes as we've mentioned, and is explained through several principles, cycles, and axes. One of the most famous and reliable sources when it comes to CE is the Ellen McArthur Foundation, whose butterfly diagram gives us an extensive view of the

circular economy system and its implications. This diagram illustrates the flows of materials within a circular economy, where materials and components are kept in use as long as possible and at their highest value at all times [19]. As presented in the next figure, here it's divided into two distinct cycles: the biological cycle (on the left), and the technical cycle (on the right).

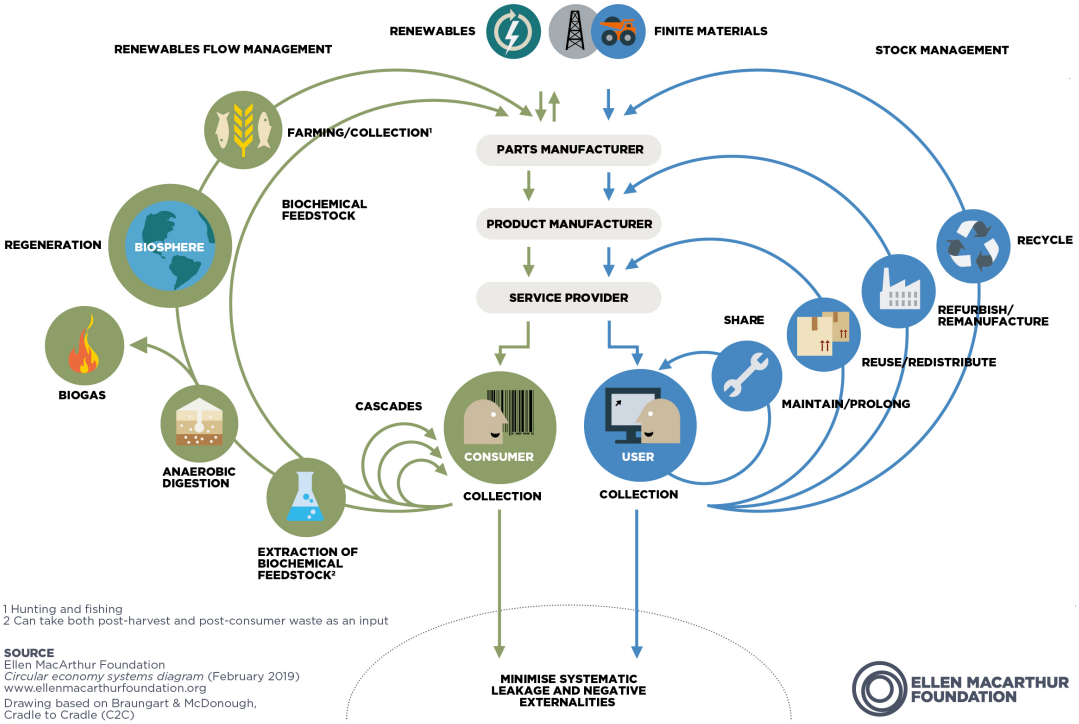

Figure 1.2: Butterfly Diagram (Ellen McArthur Foundation, 2022)

The Technical Cycle e products and components present in the technical cycle are kept in the economy for as long as possible as they are often non-biodegradable elements (such as metals) that are used instead of consumed and usually hold more value as the product they were made into rather than the material itself. In this diagram, the inner loops represent the action to be prioritised as they hold more value creation. The further out you go, the harder the task is to perform and the closer you get to the end-of-life of the product.

Sharing is a step rather different from the others given that it occurs during the first functional part of a product's life-cycle, before needing repairing or any other intervention to be used. A lot of products have a very short period of use compared to their longevity, in a 2016 podcast on "gadget ownership" it was mentioned that the average power drill only gets used 13 minutes in its lifetime**24**, these types of product produce a lot of waste for their actual use and are amongst the products that would be best fit to be shared instead of bought. There is a growing number of platforms that put forth initiatives towards increasing the intensity of a product's use: Airbnb (accommodation sharing), Rheaply (B2B asset sharing), Libraries (book sharing), MsParis (wardrobe sharing), and many more.

Maintaining, reusing and redistributing products effectively preserves their value in their original purpose and makes the most out of the product's life. Taking the example of a piece of clothing before it reaches the point of uselessness as is, taking care of it, reselling it or (in the case of clothing stores) marketing it to a different customer base will lead to a prolonged longevity. As well as buying a second-hand phone will be less resource intensive than producing another one or processing its components within the economy. The reuse market is booming with great initiatives such as Swapbox who provides restaurants with a reusable packaging alternatives for takeaway meals.

Once a product can no longer be reused in its current state, **refurbishing or remanufacturing** it allows it to retain most of its value. Refurbishing a product can usually be done by the customer himself whereas remanufacturing needs a professional touch and yields a safer warranty of use for the end consumer. The Right to Repair Movement **20** is an example of citizens pushing for a change in the manufacture of products, in that it would make it easier for consumers to repair their products by themselves and effectively extend their life cycles. Although not every advance is a victory, in 2022 Samsung launched a "self-repair kit" for users **22** but as it turned out, it created more e-waste than anticipated. The packs sold weren't made of independent parts to be replaced but rather of, for example, replacement batteries already glued to display screens that are really difficult to handle and can easily be

damaged. This tremendously increased the price of replacement as the display is one of the most expensive parts of the phone **21**.

Finally, once a product can no longer be used and its value as an end product is lost, the materials are **recycled** as a last step to prevent them becoming waste. "Recycling means transforming a product or component into its basic materials or substances and reprocessing them into new materials" (EMF, 2022)**23**. As recycling is resource extensive and not always an option, designing products for recycling is primordial, especially for products that do not fit in the other steps of the cycle such as single-use plastic.

The Biological Cycle this cycle, the strategy is to "restore the nutrients into the biosphere while rebuilding natural capital" **19**. Akin to the technical cycle, the biological cycle will move components from one step to the other to fully maximise their utility. Some biodegradable materials like cotton or wood will go through the technical cycle only to end up in the biological one once they have degraded enough to not be usable for further products.

Regeneration advocates for the restoration of soils and biodiversity as per the third principle of a CE according to the EMF [4]. Unlike in a linear economy where nature is used and degraded, a CE's regeneration principle improves and strengthens natural capital instead of just trying not to harm it.

Farming with specific practices to create a positive return from nature will help reduce the use of chemicals and pesticides in the soil, maintain a healthy balance in nature and improve our quality of life through better air, soil, water and general biodiversity. Different schools of thought can be used towards that goal such as "regenerative agriculture, restorative aquaculture, agroecology, agroforestry, and conservation agriculture" (EMF website). It's important that organic waste and thus nutrients be returned to the soil to avoid to use of fertilizers to artificially complete nature's cycle.

[4]The third principle is to "Regenerate nature" (Ellen McArthur Foundation, 2012)

Composting and anaerobic digestion can both be used to better the soil through the microbial breakdown of organic waste which results in a nutrients-rich residual matter. The difference lies within the fact that composting occurs with oxygen whereas anaerobic digestion does not, actively producing a biogas similar to natural gas in terms of a source of energy, and a "digestate" (solid residual) which can be directly used as a soil amendement [5]

Cascade comes into effect before the products reach the stage of going back to the soil, where they can still be reused within the CE. Examples can range from using fungi to produce coffins which make the decomposition process less toxic for the soil **26** to producing textiles from orange peels or ketchup from banana peels. The goal is to keep it within the economy as long as possible before it returns to the earth through the others steps of the biological cycle.

The **extraction of biochemical feedstock** is done with the used of biorefineries to produce, for example, high-value bulk biochemicals using post-harvest and post-consumer biological materials.

1.3.2 *Circular economy seen as pillars*

Unlike the EMF's conceptualization of a CE where we concentrate on the flow of materials within the economy, the pillar approach mentioned by several authors in the recent years opts for a broader stance by including pre-emptive measures to be taken before the actual production of items. Thus allowing for a blueprint towards better production for industries even before the products hit the market. As explained by the French Ministry of environment and strategy in 2014: "The circular economy is an economic system of exchange and production which, in all the stages of the life cycle of products (goods and services), aims

[5] "Soil amendments means those materials added by the operator to the replaced overburden or suitable plant growth material, or both, to improve the physical or chemical condition of the soil in its relation to plant growth capability." **25**

at increasing the efficiency of the use of the resources and at decreasing the impact on the environment while allowing the well-being of the individuals." (28)

In order for them to move towards a more sustainable activity, they must mobilize 7 key concepts regarding processes and products (ADEME, 2022) (See figure 1.3)[6]. **27**

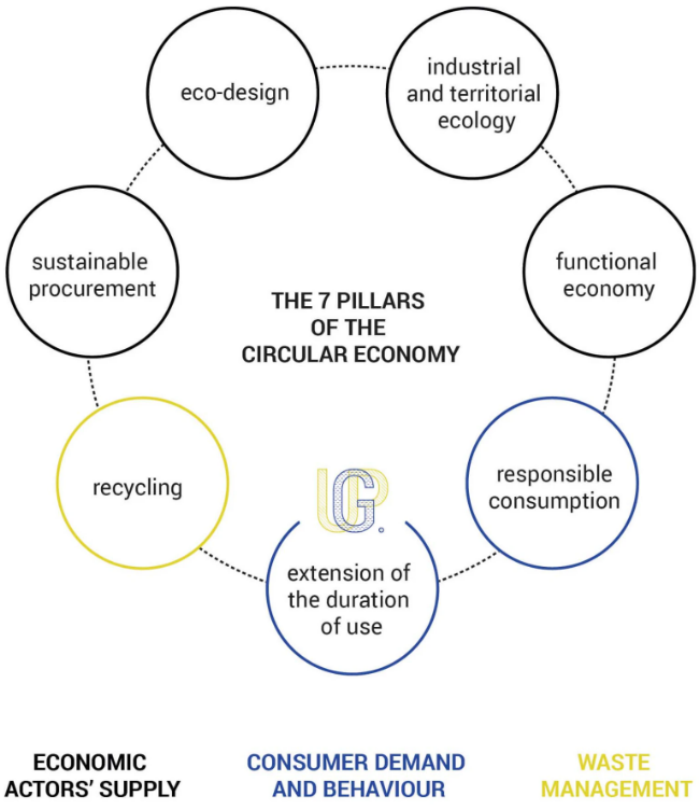

Figure 1.3: The 7 pillars of the Circular Economy (Up'Guymri, 2020 **28**)

[6]Taken from Up'Guymri's website as a redesigned and english translated version of ADEME's 7 pillars schematic (A.1)

Sustainable Procurement aims at instating an efficient and mindful way in which resources are acquired. Diminishing as much as possible the impact that the exploitation of resources has on the environment, especially for sectors such as energy or agriculture. 27 (ADEME, 2022) Preserving habitats and biodiversity will allow for less need for human interaction to help restore it down the line.

Eco-design shapes processes, goods or services by encompassing the entirety of their life cycle in a way that minimizes negative environmental and other external impacts they may cause (ADEME, 2022), akin to Walter Stahel's idea of a "cradle to cradle" approach to consumption. This preemptive take on conception allows for maximized utility at every step of its life-cycle. In other words, this pillar pushes for the production of items in which parts can easily be interchanged, altered or repaired and for which its components can be recycled as a last resort; effectively reducing its voracity for materials during production as well as the quantity of waste that will need to be handled at its end-of-cycle (29). This is particularly relevant in a society where planned obsolescence[7] is widespread.

Industrial and Territorial ecology also referred to as industrial symbiosis represents an optimization of resources between industries by either an "exchange of flows" or "need pooling" (ADEME, 2022). An pooling of need might include handling waste and placing orders for raw materials in a collective manner to reduce marginal pollution and cost to both the manufacturer and the recipients. An exchange of flows however implies that one actor will gather waste from another to use as raw material (32).

Following nature's example, an economic actor's waste can become raw material for another, either between companies or on a regional scale. Leaves falling from a tree will eventually become a fertilizer for the fauna around it, reusing waste to create new material is a growing phenomenon amongst young companies such as Coral Eyewear 30. This company

[7] "Planned obsolescence describes a strategy of deliberately ensuring that the current version of a given product will become out of date or useless within a known time period. This proactive move guarantees that consumers will seek replacements in the future, thus bolstering demand." 30 (Investopedia, 2022)

based in the United Kingdom identified a need that could be met all the while reducing a world issue, plastic pollution in oceans. With almost half of the United Kingdom wearing glasses, Coral Eyewear vows to "create stylish, sustainable glasses and sunglasses from recycled plastics and fishing nets rescued from oceans" (Coral Eyewear's Website, 2022).

A **functional economy** "favors use over possession and tends to sell services related to products rather than the products themselves" [Translated from French] (ADEME, 2022). As we mentioned earlier, tools such as a power drill are very often used way below their capacity, which is why in certain cases, offering a service based on use rather than selling a product avoids wasted production. In the recent years we have witnessed the rise of another form of functional economy based on transactions between individuals rather than B2C named "collaborative economy" (also referred to as "collaborative consumption" or "sharing economy").
"The Collaborative Economy is an economic model where ownership and access are shared between corporations, startups, and people. This results in market efficiencies that bear new products, services, and business growth" 34. Amongst these new services we can mention two successful examples: AirBNB, which allows you to rent out your accommodation to others people, and Blablacar, in which you can monetize your trips via selling one or multiple carpool spots in your vehicle.

Responsible consumption involves the consumer's (individual or economic agent) own buying behavior by them taking into account all of the environmental impacts within each phase of the life-cycle of the product they intend to buy (ADEME, 2022). An everyday example can be found in grocery shopping. Nutella spread is very popular, however it contains saturated fat that can lead to health complications as well palm oil who's harvest is know to be a main factor in deforestation (35). By choosing to move towards different brands or products more mindful or such issues, the consumer is actively reducing the demand and therefore these externalities.
Boycotts by consumers are known to have instigated major changes within companies. In

2006, L'Oréal bought the cosmetics brand "The Body Shop" and although the latter has been against animal testing since its creation the former is known for still practicing such measures. After a years-long boycott against the brand, L'Oréal finally agreed to enter into discussion on how to remove animal testing from its practices (36).

The **extension of the duration of use** is another pillar that also requires action by the consumer in addition to the manufacturer, encompassing several processes through which we can maximise the longevity of a product. Amongst these processes are (32): maintenance/repair, reuse (both to be done by the consumer) and re-manufacturing (to be done by the manufacturer).

- *Maintenance or repair* involves fixing the aspects of the product that needs to be tended to instead of modifying the whole product, producing less waste. In Belgium since March 2021, there is a "right to repair" (37) that forces manufacturers to provide essential components of their product to professional repair services for a minimum of 7 to 10 years after the last item was put on the EU market as well as provide to consumers spare parts that are do not require professional help.
- *Reuse* can be taken one of two ways, either through the secondhand market by selling an unused product to another consumer therefore maintaining its original value; or by reusing all or part of the product for an alternate use.
- The *remanufacturing* step comes into effect when the product has reached its end-of-life and manufacturers extract the components to re-inject them into the production loop.

Finally, **recycling** aims at using raw materials that stem from waste towards another use (ADEME, 2022). Recycling those materials can be done within a technical cycle, or a biological one (1.2).

1.3.3 *Difference with recycling*

According to the EMF, recycling "begins at the end" (56) it's the last stage of a product's life where we are trying to figure out how to take care of the waste that was created in order

to get rid of it whereas the CE starts from the beginning of the journey to prevent waste and pollution from ever being created in the first place.

"In a properly built circular economy, one should rather focus on avoiding the recycling stage at all costs. It may sound straightforward, but preventing waste from being created in the first place is the only realistic strategy."

-World Economic Forum (57)

Recycling is the most expensive step of the circular process and should be avoided as much as possible by "designing out" waste at the source. (56)

1.3.4 *Sustainable development, a related concept*

Companies and organizations have a growing concern and responsibility to address sustainability in their operations. The concept of sustainable development, although first fixated on the environmental side of things has now developed into what is called the "triple bottom line" (i.e. environment, economic, social)(53) 1.4.

Its most attributed definition is from a 1987 report named "Our Common Future", also know as the Brundtland Report (54):

1.4 Advantages of the Circular Economy

Many elements of our current consumption society would be and are currently favorably impacted by a shift towards a CE when well implemented. Throughout scientific studies, academic papers and articles, several areas of positive impact have been determined. Although this section goes more into detail on the explanation of these advantages, Figure A.3 lays out most of these benefits on the environmental, social, and economic aspect of the economy.

1.4.1 *Environmental*

Environmentally speaking, the linear economy consumption model that we mostly still operate on is a catastrophe. Although climate change and other environmental issues cannot fully be fixed by a CE there are two major areas where a difference has been and can be made: resources depletion and pollution.

Figure 1.4: The interconnection of the elements of the Triple Bottom Line concept (Research Gate, 2018)

Resources depletion cording to the website "The world counts"(41), which has a live countdown of when several key resources such as hectares of forest or seafood life will run out, the main causes for the depletion of our natural resources are: overpopulation, over-consumption and waste, deforestation and destruction of ecosystems (and thus biodiversity), mining of Minerals and Oils, Erosion, and pollution and contamination of resources. Moreover, the resources most affected and in decline are: Fresh water (which humans cannot survive without), Coal (the most used fossil fuel and non-renewable), Oil (essential to transportation), Natural Gas (estimated to last no more than another 58.6 years), Fish (a major part of our food supply), and Phosphorous (used as a fertilizer).

As seen in point 1.3.2., operating on a CE reduces the amount of resources extraction necessary for production instead reusing resources that are already in circulation within the economy thus curbing the disappearance of non-renewable resources. The CE model can lead to up to 70 percent of material savings compared to a linear model (40) and given the current

growth of our world population, reducing our material needs is paramount. It also reduces the need for landfills and recycling facilities by making our products life-cycles longer.

When consuming resources, an important concept to take into account apart from limiting the use of new raw materials is to adapt to the regeneration cycle of nature (EMF) and create a symbiosis between this cycle and our production processes. Each resources has its own regeneration timeline and process thus the mindset changes from "how quickly will it run out" to "how should we mine it to allow it to continue creating".

Pollution As a CE reduces the need for new resources, it also reduces the energy needed to extract them and thus diminishes the quantity of pollution linked to production. Between 2010 and 2020, industrial releases of air pollutants affecting both the environment and human health considerably decreased (39)(See Figure A.2) and contrary to what we might think, the value that that industry has generated for the EU has kept increasing up until the Covid crisis in 2019. These air pollutants include but are not limited to greenhouse gases, particulate matter, and heavy metals.

In addition, a product created in the spirit of ecoconception creates less non-recyclable waste which leads to less landfills thus less soil and water pollution. As mentioned earlier, anaerobic processes and composting return important nutrients to the soil and according to an EMF study, an European CE model on the food systems has the potential to decrease up to 80 percent of the need for artificial fertilizer and therefore regenerating the soil(40).

1.4.2 *Social*

As mentioned in the previous point (1.4.1), the decrease in air pollution improves the quality of life the population by lowering the risk to their health.

Putting in place new models of consumption and production inevitably leads to the creation of new employment opportunities (Le Moigne, 2014). According to the CPCP [8] (42) a CE leads to relocating activities on a more restricted territory effectively creating non-relocatable jobs. Working closely with flows of products (and their waste) and materials,

[8]Centre Permanent pour la Citoyenneté et la Participation (Permanent Center for Citizenship and Participation)

and applying a functional economy to our current model, implies more proximity between production and consumption. According to the World Economic Forum, the development of a CE model coupled with adapted new regulation such as taxation will increase local employment in entry-level as well as semi-skilled jobs(40).

The EMF published a report stating that a CE has the potential to create new services and new job opportunities such as(43):

- "Collection and reverse logistics companies that support end of life products being reintroduced into the system
- Product remarketers and sales platforms that facilitate longer lives or higher utilisation of products
- Parts and component remanufacturing and product refurbishment offering specialised knowledge"

That same report states that the average European household's disposable income could substantially increase through lower cost of products and services, and a "a conversion of unproductive to productive time (e.g. reduction in congestion costs)"(43). Allowing for the tailoring of products augments consumers' utility for said products and services, additionally, a smaller manifestation of obsolescence will bring down total ownership costs (See Figure A.4).

1.4.3 *Economic*

The EMF, SUN, and McKinsey collaborated to identify that if Europe were to take advantage of the technological shift they could create a benefit of €1.8 trillion by 2030 (i.e. €0.9 trillion more than with our current linear model of consumption and production)(45) (See Figure 1.5)

Overall, the reduction of costs subsequent to the implementation of a CE is closely linked to the advantages mentioned in the previous sections. Reduced need for raw material as well as energy consumption leads to less overhead and general costs linked to inputs when

producing. the same train of thought, a territory's output costs diminishes with a more circular approach as it leads to less waste management needs and less costs to make up for emission and environmental damage. In Europe, near half of all recyclable residential and industrial waste is either buried or cremated. Apart the obvious tens of thousands of harmful CO^2 tons released in the air such waste could represent billions of euros worth of usable material.(42)
Several industrial sites like steel factories are either derelict or under-exploited, CE can reinvigorate these areas and bring them to their full potential and both save a lot of secondary raw materials and revive neighboring communities.

Apart from the general economic growth that would benefit from emerging circular activities (45), the economy will simultaneously be less impacted by unforeseen natural events or price fluctuation that could impact input accessibility. Less virgin material and more recycled inputs reduces companies' risk towards raw material volatility (45), either linked to natural disasters as we've witnessed with the Covid crisis, or geopolitical crises (40) as with the Ukrainian conflict. The EMF has documented in 2013 (46) that the volatility in price for inputs such as food, metal, and agricultural materials were higher in the first decade of the 21th century than in any other decade in the last century.

1.4.4 *Technological*

Innovation is necessary to achieve a perennial CE system, to create products that are " circular by design" (45) and reverse logistics that take into account our externalities. This opens the door to a whole new paradigm of production leading to innovative technological development and more energy and labour efficiency in the future.

1.5 Barriers of the Circular Economy

Although the previous section displays many positives outcomes to implementing a CE in all areas of our economy, that is stemming from the idea that such a system is well designed and that it continues to spread at the rate that it has been the last few years. However, in reality, many barriers prevent or restrain its application. In a report published by Deloitte and

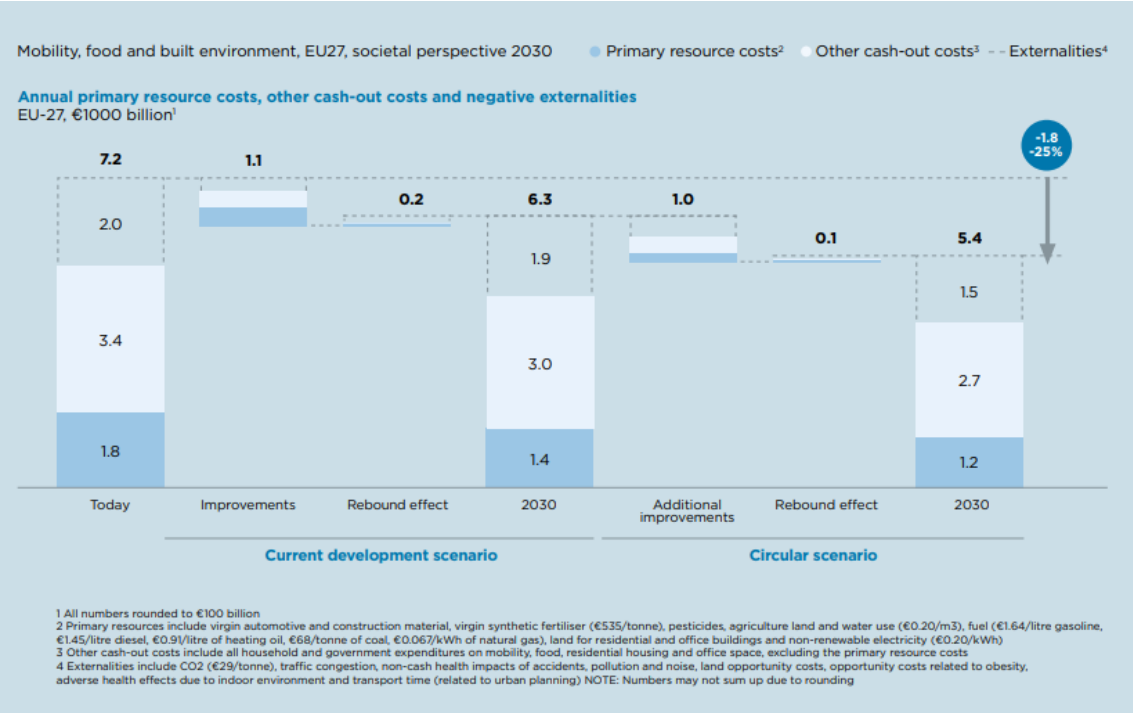

Figure 1.5: The Circular Economy opportunity - 2030 scenarios (EMF, 2015)

the University of Utrecht in 2017 named "Breaking the Barriers to the Circular Economy" (47), the authors identified four interrelated categories that impede the development of a CE: cultural, technological, market, and regulatory. This interrelatedness can lead to a CE failure, one barrier accentuating another which in turn worsens the first (See Figure A.5)

For example, (regulatory and market barriers) limited market funding for companies wishing to implement a CE because of an unconvincing business model leads to a lower number of successful CE examples in society which leads to less willingness for policy makers to provide support towards a transition which in turn creates more market barriers and the loop repeats itself. It's important to study in detail the root causes of failure in each category and target actions towards them to break down the chain reaction.

1.5.1 *Cultural*

There is a lack of awareness and/or willingness for consumers and businesses to engage with the circular economy. This barrier is considered to be the most prominent one to overcome, the subsequent barrier most mentioned by the interviewees was the fact that consumers

are lacking interest and awareness in CE. For example, producing a durable product requires a lot of efforts and planning however consumers' minds change very quickly following the trends, they often prefer a new phone to a refurbished one and thus create low demand for product linked to the CE. In a CEPS research report (49) on "barriers and enablers for implementing circular economy business models", 52 percent of electrical and electronics engineering firms stated that lack of interest was their biggest challenge, while 13 percent mentioned preference for cheaper and newer products to be an issue. these companies cannot profit from a durable product they will not invest into designing one and get stuck in the current linear economy model. Competing on price as is the case in our economy, industries implementing CE in a fast-changing environment would find themselves at a disadvantage and suffer the costs and loss of market share.

Another cultural aspect lies within the consumer's willingness and awareness to recycle. To achieve a circular economy model, the waste management plays an important role. However if the consumers do not process their waste correctly, companies will not be able to make sure that their products reenter the loop.

A hesitant company culture towards implementation of a CE also plays a major role in the cultural barrier, (49) in a 2018 survey on these barriers amongst businesses it is found that three of the five most pressing barriers for businesses are cultural ones, with "hesitant company culture" ranking number one with 48 percent of the 153 interviewed.

Lastly, even if companies manage to overcome the first two barriers, they face "operating in a linear system" where the entirety of their supply chain must be circular to deliver a circular product (47). In addition to the company's own willingness to change their supply chain, the supply chains of their supply chains have to too which is very difficult, especially when part of that supply chain is in another country or continent.

1.5.2 *Market and growth*

Overall, there is a lack of circular economy business models that have economic viability. Companies existing in a competitive market will be less likely to adopt a new business model if there is no record of it being successful in their context. This second category

raised the issue of raw material prices and ufront costs. Mentioned by 45 percent of the interviewees in the Deloitte report, low virgin material prices do not entice companies to opt for circular alternatives. In this competitive market, companies are not willing to pay more for sustainably gathered raw material when much cheaper alternatives are available. As one of the interviewees said "fossil-fuel based plastics are much less expensive than our bio-based plastics". In addition, some payments methods differ, one company involved in collection and refurbishment of EEE[9] stated that companies selling them their used equipment asked for full payment before receiving the products, where buying new equipment usually allows them to pay with a delay (48).

Regarding high upfront investment costs, the market is not yet ready for a full blown CE implementation and much is still to be learned about the ways in which companies can modify their business models to accommodate such changes. As an interviewee states ""the first one that will invest in learning will probably lose money and only the second mover will earn a fortune. Hence, many people are now waiting for each other". Our current market is one of short-term value creation while a CE system operates on the long-term.

In the spirit of inter-relatedness of these barriers, if virgin material prices where higher, more affordable circular products would appear and raise consumer interest and awareness which would in turn accentuate company interest in the circularity of their products and break down the barrier of "operating in a linear system" (49).

1.5.3 *Technological and infrastructural*

A lack of available and efficient technologies to implement CE might deter companies.

Luckily, technological barriers seem to be the least pressing and impactful of the four categories, which is a good thing considering that technological advances are slow.(47) One of the main issue considering the idea that material can be infinitely reused in the system is that physically speaking, material loose their quality the more they are used and modified thus throwing a wrench in the idea that most material can be reentered in the loop indefinitely (EMF,2022).

[9]Electrical and Electronic Equipment

Lack of consistency and predictability seems to be one of the more important issue in this category. As the variety of models, designs and technology increases, so does the infrastructure needed for putting into place remanufacturing and refurbishment processes (48).

Moreover, lack of time and internal resources to put this into place seems to impact both SME's and larger companies. With large companies noticing a difficulty to prioritize resources and SME's lacking time and resources. In addition, companies that did not start with a circular model but had or have to move towards that system later on lack knowledge on this new mindset, which creates tension between the departments, one company says (48).

1.5.4 *Political and regulatory*

Finally, an overall lack of policies that support a circular economy transition is put forth as a barrier. In this category, the most pressing barrier identified is "obstructing law and regulations" in which companies that wish to implement CE measures are blocked by legal requirements. As a road construction company states "in our asphalt we can't use recycled materials in our top layers because it is regulated (...) that this is not allowed" (47). Another points out "We want to recycle our bakelite that is waste, and we found a company in Belgium that can do this, but we are not allowed to transport this bakelite across the border". There is an issue of (49) "regulation preventing cascading material across international borders".

Another aspect of regulations impacts the recycling of plastics for example, with seven companies mentioning the REACH Regulation 1907/2006, RoHS Directive 2011/65/EU and Regulation (EU) No 2019/1021 on persistent organic pollutants (POPs) (48) which creates a lot of trouble in recovering and recycling plastics because of its policy requirements, which leads to it often getting incinerated instead of recycled.

1.5.5 *Implications*

In this figure are shown the core barriers hampering the construction of a CE and their chain reactions. Many aspects are important to unblock the vicious cycle between most of these barriers but a very important one is governmental intervention. The government can influence virgin material prices, modify limiting regulations, etc via financial incentives and

adapted taxation policies thus breaking the chain reaction and moving towards a successful transition.

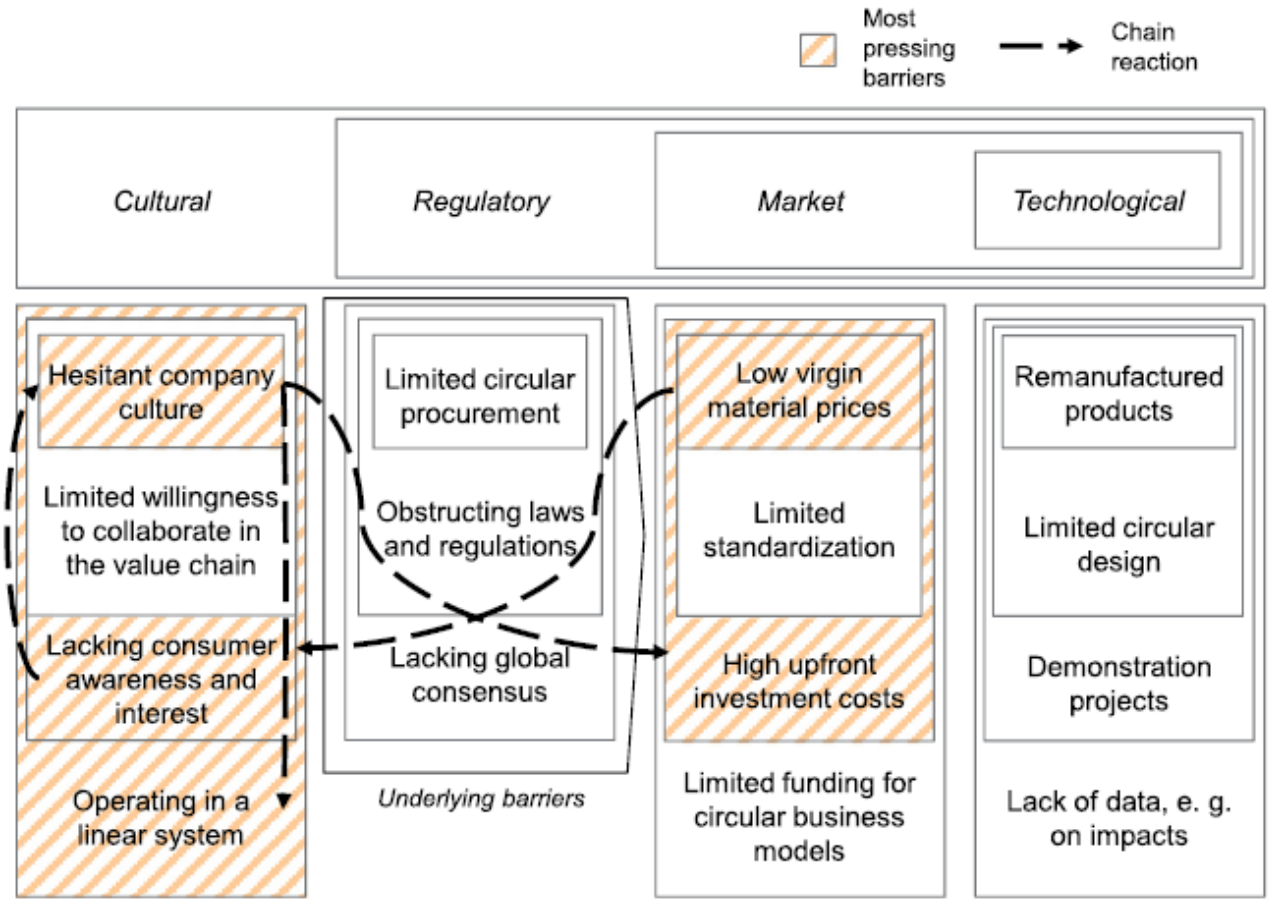

Figure 1.6: Key CE barriers and their reaction (Ecological economics 150 (2018) 264-272)

Chapter 2

Supply Chain Management

2.1 Definitions

In order to further dive into the concept of what a sustainably managed supply chain entails, we need to clarify some concepts. All accross the literature, the definitions vary but ultimately converge on some basic similar aspects that withstand changes in industry or complexity.

2.1.1 Supply Chain

Supply chains exist in every business environment whether they are managed or not (60), the distributions channels implement themselves following the economic activity in which they exist, but their efficiency and longevity are handled with proper management. Although definitions vary between industries and time periods, we can point out a few memorable ones.

Mentzer and al. defines a supply chain as *"a set of entities (eg.organizations or individuals) directly involved in the supply and distribution flows of goods, services, finances, and information from a source to a destination (customer)"*, (58) whereas predecessors wrote in 1999 that a *"Supply Chain is the group of manufacturers, suppliers, distributors, retailers and transportation, information and other logistics management service providers that are engaged in providing goods to consumers. A Supply Chain comprises both the external and internal associates for the corporate."* th of these definitions, although slightly different in their delivery, lay down the need for a flow of goods between a provenance and a point of consumption, from raw materials to transformed goods through a process adding value at every step.

Mentzer and al. offers a view of the supply chain broken down into three levels: Direct, Extended, and Ultimate Supply Chains.

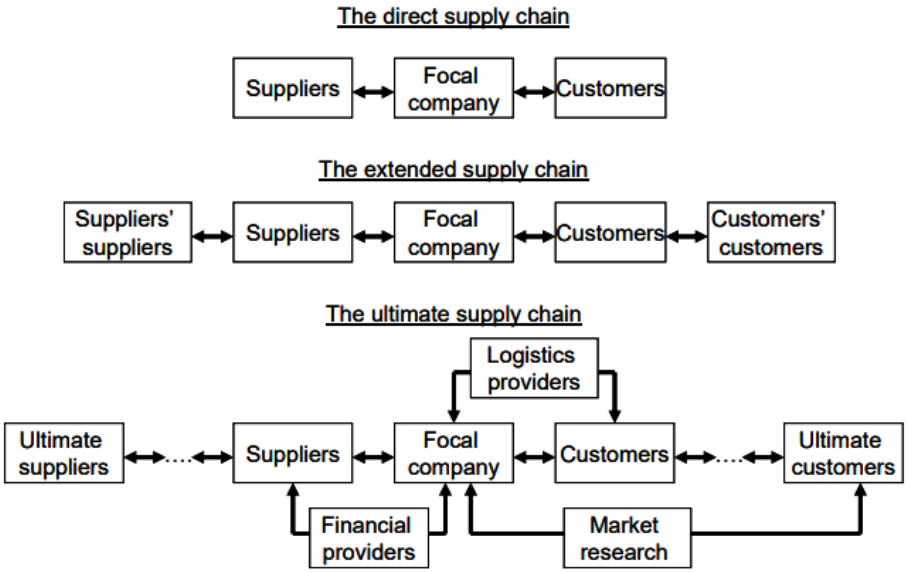

Figure 2.1: Different types of Generic Supply Chains, adapted from Mentzer et al. (2001) (Per Hilletofth, 2008)

A **Direct Supply Chain** represents a simple economy environment where the only three actors involved in the flow of products, services, finances, or information from upstream to downstream present in this equation are the suppliers, the company or organization, and its customers.

The **Extended Supply Chain** goes a step further by adding to its suppliers their own, and to their customers their own customers as well. All the while keeping every actor within the upstream and downstream flow of products, services, finances, or information. This speaks of a broader economy whether in terms of scale or territory where the complexities of a supply chains starts to appear.

Finally, the **Ultimate Supply Chain** paints the picture of a much more complex reality of flows between the ultimate suppliers to the ultimate customers. As the scope through which we see a market grows, so does its supply chain and with globalization and ever-increasing business connections overseas, the path drawn by the flows we previously mentioned becomes

blurrier and harder to follow. Companies are getting more specialized and (Bourdeaux, 2020) require more raw materials from other world regions where the ultimate suppliers might be harder to recognize. This is why SCM is more important than ever but also why its application is getting more difficult still.

2.1.2 Supply Chain Management

The intersections within the SC contribute to adding value to the goods and services that are flowing within it. If a connection does not work effectively then the effectiveness of the overall SC is compromised and reduced. (58)

Since its introduction in the early 80's, the concept of SCM has been linked to the planning and handling of materials, information flows, and logistics, both internally in the scope of a company as well as externally between seperate companies (53) (Cooper et al., 1997). Although first focused primarly on material flows, it has since broadened to encompass more intricate aspects such as risk, performance, and integration in addition to information flows and governance capabilities within the internal and external networks (53).

As every widely used concept in economy, SCM has had many different definitions and practical applications. In a *Journal of Cleaner Production* edition co-written by P. Ahi and C. Searcy in 2013, "A comparative literature analysis of definitions for green and sustainable supply chain management", the authors gather diverse definitions all around the literature of SCM to compare their key characteristics (Figure A.6). Several similar characteristics emerge, namely: managing flows of materials, services and information; coordination within and between firms; meeting stakeholder's needs (particularly customers); and managing internal and external relationships. The key here being to "create value, improve efficiency, and improve overall performance in the supply chain." (53). As is laid out in Figure A.6, the authors were able, based on the definitions, to express these characteristics as being:

- Flow focus
- Coordination focus
- Stakeholder focus

- Relationship focus
- Value focus
- Efficiency focus
- Performance focus

As it appears from that literature, the definition that comes to closest to enclosing all of the found characteristics, omitting the performance focus, is by Stock and Boyer in 2009 (53):

"The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction"

Following the conceptualization of SCM by these authors, there would be three major themes being activities, benefits, and constituents/components themselves subdivided into 6 sub-themes: material/physical, finances, services and information flows; networks of relationships (internal and external); value creation; creates efficiencies; customer satisfaction; and constituents or components (Stock and Boyer, 2009, p. 698).

Now as you may notice, all of these definitions point to the fact that there is a coordination happening throughout the supply chain, and that an efficient collaboration of the different actors within it is primordial to its proper functioning.

Finally, we would like to display the model for supply chain management constructed by Mentzer et al. (Figure 2.2) that emphasizes three of the above mentioned characteristics: coordination, stakeholder, and performance focus, and allows for a realistic yet less complex view of the supply chain actors and influencers. It concludes by joining customer satisfaction to the competitive advantage, as the supply chain's main focus is on their primary source of profitability: the costumers.

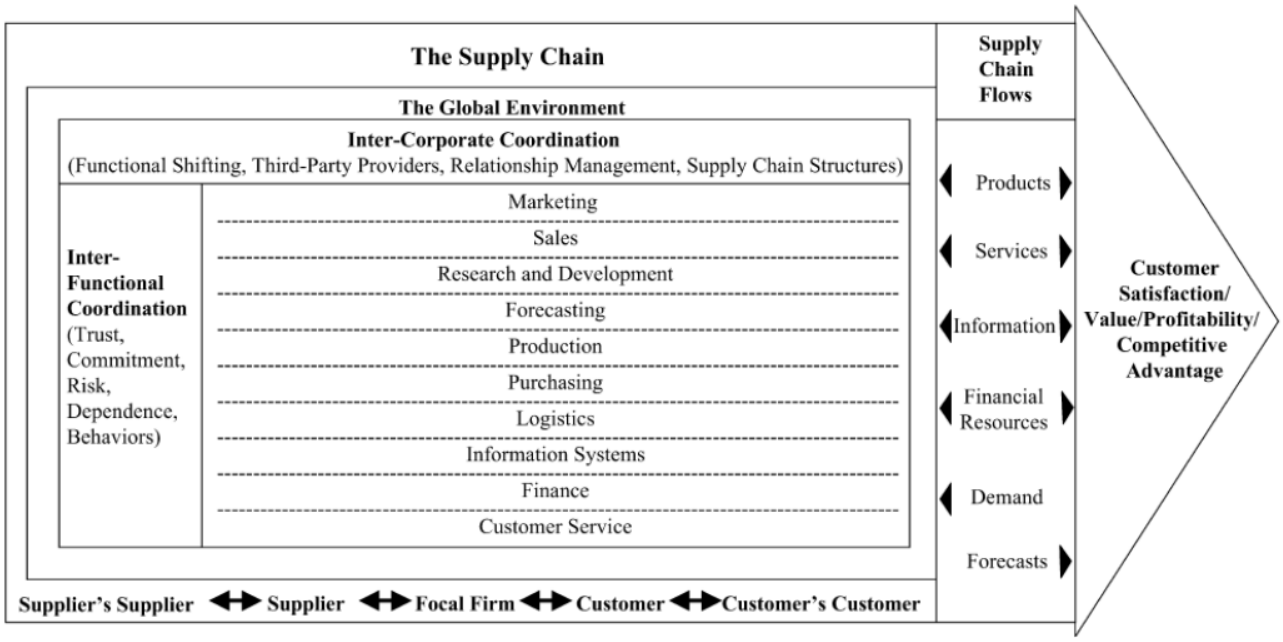

Figure 2.2: Supply Chain Management Model (Mentzer et al., 2001)

2.2 Green Supply Chain Management

In a comparative analysis of green and sustainable supply chains paper ((53), a lot of different definitions were found to be linked to the green supply chain concept which you can find in the Figure A.7. However, the definition most cited in Scopus comes from a 2007 paper on the literature surrounding green supply chain management (74) (p.54-55) and states the following:

"Integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life."

Chapter 3

Circular Partnerships

Sustainable and circular innovations are not actions that are easily done by a single organisation. Although changes in the business models can be a positive step towards sustainability, the effectiveness of the measures taken and their viability largely depends on an organisation's intricate network of partners and their actions. (Q)

In this chapter, in order to lay out the different types of collaborations, their characteristics, and their roles towards a circular economy, we will use the 2020 Report of the Dutch research center "Circle Economy" as a blueprint on establishing circular partnerships (R). In this report titled "*Will you be my partner ? Nine steps to identify and establish successful collaborations for a circular economy*", the authors aim at helping businesses implement a circular strategy through circular collaborations with a clear nine-step process, although they themselves states that its use will vary between firms and sectors. After internally preparing their organisation for change, the 14 different roles that businesses and partners will embody can help businesses assess internal capabilities and single out the areas that require support from said partners. Lastly, the right partners need to be found, and the nine partner characteristics can help them select the right collaborations for their business models in a way that safeguards long-term success.

3.1 Nine steps towards collaboration

According to the Circle Economy, there are nine steps that a business must go through to successfully begin a circular collaboration with partners.

Recognize the need to collaborate

Before ever entering a business relationship, businesses need to decide to embark on a circular shift in their organisation and realise that in order to perform successfully, collaboration is needed.

Understand the local market and material flows

Businesses need to understand the flows of materials and the local market that they operate in such as local legislation, consumer demand, and circular infrastructure and capacities already in place.

Create and align on the project's vision

Once the previous step is established, businesses need to define the outcomes they aspire to and put in place a clear strategy that combines ambitious circular principles and viability (logistically, technically, and financially achievable). Within that clear strategy they will target the areas where collaboration is possible and needed. In this step, management is highly needed for a successful outcome; where employees can start the process, there is a prevalent requisite for company-wide support given that a new circular business model will require radical internal changes and needs a supportive company culture to implement.

Assess own resources and existing gaps

At this stage, business must assess their internal capabilities and their available resources and compare them to the resources and capabilities needed for their circular vision (that they already established in the previous step). In doing so, the are able to point out the gaps that they are subject to and gauge which if not all can be fulfilled by partners. The 14 partner roles that we will develop later can help companies to see which tasks can be done by internally and which need to be outsourced through collaboration.

Form an internal team

In circular projects, companies need employees that have both knowledge of the product or service and the context in which they operate as well as circular knowledge to be able to lead the endeavour. This step differs depending on the size of the company; where larger companies may hire experts or have internal education programs for their employees to get familiar with the concept of circular economy, smaller-sized companies could opt for self-

education from their employees to gain expertise at a lower cost. Finally, to better set up and handle collaboration with partners, it is important that the employees that manage the link between the two possess skills such as collaborative, management, inter-personal, adaptability, and flexibility to adapt to the sometimes uncertain and complex nature of a major change in business model.

Reach out to potential partners

Once the previous steps are step-up, it will be time for businesses to reach out externally to potential partners. Then can favor existing relationships to still profit from their agreements, relation-specific benefits and investments, but new partners will still be required to advance towards circularity within their market context. There are many ways to get in touch with novel partners, whether through channels such as conferences and trade shows, active networks, circular non-profit organisations, etc. there are many mediators to link businesses and their potential collaborations. It is especially the case for smaller companies who do not have the time or resources to find their partners by themselves and need these types of local gatherings to increase connections.

Evaluate and select partners

To choose a suitable collaboration, open communication and trials are a good way to ensure compatibility. Further down in this chapter, we will discuss the nine characteristics that can be used as criteria to see if a partner (or the individual in the parnter organisation with whom they'll be working) can fulfill a businesses' needs. Of these nine, five are particularly important for circular partners specifically.

Formulate agreements

Before entering into an agreement with a partner, specific terms need to be laid out. These terms can be both formal (financial, logistical, confidential, etc.) and informal (mission, vision, other elements of the collaboration, etc.). It is important to note that, especially in a circular economy, the advantages that a collaboration creates can be (and often are) other than financial, there needs to be a win-win situation for both partners but it does not always entail financial gain. Moreover, having clear terms of collaboration regarding risk, joined management and administrative needs is paramount for a balanced partnership.

Begin the collaboration

Finally, once every other step has been completed the collaboration can start working towards their joint circular strategy.

Each step is very important in itself to ensure that collaborations are strong, and that no partner feels skewed because of the clear agreements made from the start.

3.2 Circular collaboration types

When trying to operate a circular business model, businesses must understand the specific context they operate in (location, scope, market, competitors, legislation, etc.) as well as the current development stage of the circular value chain network in their areas of work. Going forward, a circularity network will be referred to as "a network of value chain players aiming at the cycling of resources - either by extending the lifespan of a product via reusing, repairing, refurbishing, remanufacturing, or repurposing; or by converting used materials via recycling into secondary materials to re-enter the value chain" (R, p.13). In order for companies to better utilize the existing circular structure and avoid unnecessary investments or partnerships, understanding the development stage of the CE where they operate is paramount. The report from Circle Economy identified four types of collaborations depending on the development stage of the CE, these types separate the number and type of partners needed as well as the different focused efforts

- **Vertical networks**

  This involves all the players along the value chain in order to develop a circularity network from the extraction of materials all the way to the end-of-use stage and resource cycling (e.g. reuse and recycling).

- **Horizontal networks**

  This type of collaboration is two-fold, it's either done by using existing circularity networks or by developing new technologies or materials with players outside the value chain such as governments, knowledge institutions, or competitors.

- **One-to-one alliances**

  In these collaborations, the goal is to improve processes and/or products within a circularity network with outside partners along the value chain, such as suppliers for instance.

- **Knowledge exchange**

  Lastly, this collaboration involves a bigger network of partners by unifying strategies with competitors, retailers, municipalities, etc. through knowledge sharing and informal alignment towards industry-wide learning and impact for circularity.

For example, a business working in a sector where circular measures are already in place (e.g. PET water bottles in Europe are usually recycled if collected) should turn its focus on horizontal networks and one-to-one alliances to utilize this network and possibly improve their product or service in accordance to the system. However, for businesses working in a sector that does not have a working (or efficient) circularity network (e.g. high-quality electronic devices such as phones, computers, etc.) they should focus on vertical networks and help the development of a more circular system. Knowledge exchange collaborations are possible for every type of business and sector given that they can either strengthen existing systems or gather partners to move towards one.

3.3 Roles within a circular economy

During the process of realizing circular products and processes, businesses will need to assess their resources and the gaps in their strategy. It is during this step that the following 14 roles will come into play to assign which roles can be taken internally and which will require an external partner to be fulfilled. Said roles can be assigned to different phases of the circular change; either during the start of the project, its development, or its realization, or during one of the outside phases being collaboration or actions from external stakeholders.

According to the report, the relevance of these roles and their importance differ between businesses and projects, there are three factors that influence their importance: the product

(and its requirements), the company (where they stand in the supply chain and the leverage they exert on the value chain), and the circularity strategy (depending on the types of strategy such as reusing, reducing, or repairing, the roles will differ). As an example, a strategy turned towards reusing will require roles like a use-phase supporter, impact extender and promoter whereas a strategy aimed at recycling will turn more to end-of-life supporter, circularity expert, and financier roles.

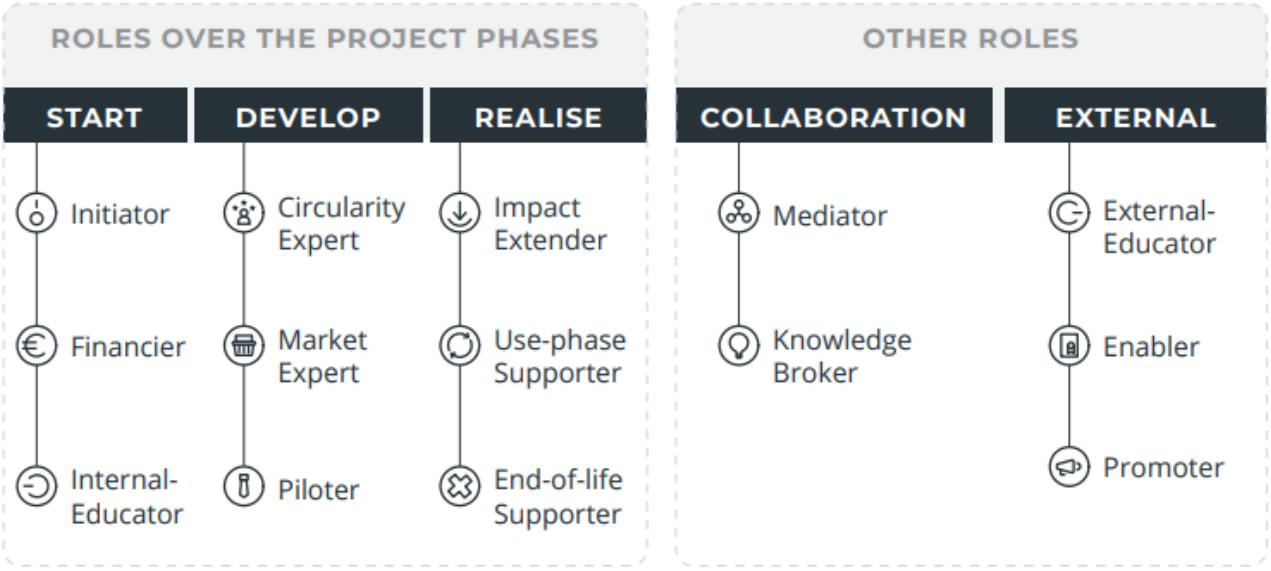

Figure 3.1: Roles in a circular economy (Circle Economy, 2022)

3.4 Nine partner characteristics for a successful circular collaboration

When it is time for companies to select partners for a successful collaboration, the nine characteristics laid out below need to be partially if not fully fulfilled by prospective partners (A.8). Once again, their importance and relevance is highly related to the sector and business or project in question.

Part 2 - Analysis

Chapter 4

Methodology

4.1 Research Question

The Circular economy has been rising amongst different sectors and industries in the last decades, but its implementation on a global scale is facing multiple challenges. In our literature review, we laid out among other things the 7 pillars that can be used as a blueprint for a circular economy, the barriers preventing its practice, as well as the types of partnerships present in a circular economy and the roles that partners can take in a circular collaboration.

The most pressing barriers that we found were the lack of consumer awareness or interest, high up-front costs, low virgin prices, and a company culture operating in a linear system. With the fact that these barriers were linked to the current state of the economy, we opened up the possibility for established supply chains to partner with innovative circular businesses, that do not share these barriers, as a conductor. This led us to refine our theme and sub-questions: **"The introduction of circular partnerships for a transition towards circular economy"**

- Which roles do these circular companies take depending on the sector and business ?
- Which barriers do these circular companies manage to overcome ?
- Can businesses use individual circular partnerships to improve their circularity ?

In order to answer our question, we conducted an inductive research based on a qualitative study of existing circular businesses within both sectors. With the data from these businesses, reports from existing partners, a sector analysis, and interviews with partners; we analyzed

how these businesses functioned and the advantages that they brought as well as the roles that they played in the collaboration.

4.2 Construction of the sample

We chose a specific region to focus on, Western Europe, because of the similarity of business culture as well as the easier possible flow of circular businesses between countries. Moreover, we decided to focus on two sectors, namely the Agri-food sector and the Electronics given the stark differences in their supply chain and the obstacles that they face. The inspiration for the choice of these two sectors stemmed from the Ellen McArthur Foundation's Butterfly Diagram representing the flows of materials in the Biological sector and the Technological sector (Figure 1.2).

Once we laid out the general supply chain organizations of both sectors as well as the challenges these sectors face, we selected actors within that supply chain that we estimated were the most likely to be positively influenced by circular initiatives with both logistical ease and limited financial impact: retailers. Indeed, retailers have both power over suppliers and influence on consumers, which are the biggest drive for companies to change. The reason we choose these actors is linked to the barriers that we've established earlier; we targeted this area of the supply chain and the innovative circular initiatives within it that in some way could overcome or at least erode said barriers. Moreover, we chose circular business that had different scopes of impact in order to enrich our sample, some companies have a more local impact such as De Clique or ComplemenTerre, whilst others tackle an international base such as 2good2go or Back Market.

After showcasing each selected circular business's mission, the problem in the sector that they were tending to, their business model, and the roles they took on in the circular partnership; we briefly resumed the main takeaways from this qualitative analysis for each sector. Eventually, it allowed us to arrive to a nuanced answer to our research questions.

The objective of this study is to analyze whether partnering with successful circular businesses is a way for the sector to more easily transition towards a CE. Because this is a general view of two prominent sectors of our economy, and because our purpose is to give a

general qualitative answer to our question, we chose to focus on status-quo analysis instead of a quantitative study of the effects of such partnerships. A later study could very well dive into this subject but this is not the case here. We used the barriers to the Circular economy (Section 1.5) and the 14 roles within a circular economy (section 3.3) as factors for our analysis.

Chapter 5

Circular Partnerships Opportunities for the agri-food sector

The food sector is vast and growing alongside the world population. As the need for food by-products increases, so does the complexity of its supply chain. Indeed, in an effort to reach demand, food producers and retailers will look for more efficient ways to produce as well as go further in procurement thus fragmenting their supply chain and reducing the traceability of products and transparency upon their supply chain.

The agri-food supply chain is comprised of different stages (50):

- **Production**, where the food is grown or developed and made ready for harvest.
- **Handling and Storage**, which concerns the steps that food undergoes after harvest to be ready to be processed.
- **Processing and Packaging** converts food in its raw form into edible material. It has to follow all food safety requirements and is sent to be distributed.
- **Distribution** transports edible food to retailers and suppliers.
- **Retailing** will deliver products into the hands of the consumers.
- **Consumption** occurs when a consumer has purchased his food by-product from a retailer.

Now a circular vision of the food sector's supply chain would add a last step to this process: **food waste management**.

Creating a sustainable circular supply chain and "closing the loop" in the food industry is particularly tricky considering the immensity of its supply chain actors. Indeed, a technological giant such as Apple for example, is itself in charge of a majority (if not all) of its supply chain; handling sourcing as well as design and conception all the way to packaging and retailers. However, a producer can mostly only influence the way he produces just as a retailer can mostly only influence the way in which he sells his food by-products although he can have more power in choosing where to source from compared to the producer can choose where his products end up.

As we have seen earlier, many barriers prevent the implementation of a CE within a given sector, economy or territory. The most prominent one being cultural as consumers tend to lack awareness or willingness to engage with the circular economy, however, the fickleness in people's minds when it comes to trends and lack of demand for sustainable products mostly refers to products that are not of the food variety.

On the contrary, in recent years the organic food consumption has skyrocketed in the EU with a 1.6 percent increase in the number of organic farmland producers between 2019 and 2020, reaching in the latter year 14.9 million hectares. (51) In May 2020, the European Commission laid out a "Farm to Fork" Strategy stating that "The market for organic food is set to continue growing and organic farming needs to be further promoted". This goes to show that consumers are growing more concerned with their food's ethical and environmental aspects and that the need for the food supply chain to integrate more circular economy principles is paramount.

As we've stated, in this industry the cultural barriers are less predominant than in others thus the second barrier for this industry to be faced with is higher upfront investment costs. Which is why for the sake of this opportunities analysis, we will focus on the area of the food supply chain that we believe can be the easiest for this supply chain's actors to render more circular with minimal need for costly and/or infrastructural disruptions by using existing and successful circular businesses to partner with: **retailing**.

5.1 Retailing practices

The retailing step in the food supply chain is especially promising for the Circular Economy. Whereas general food production and waste management are tremendous issues that need to be tackled at a global or at least continental level and that need huge capabilities to handle, the retailing actors in the food sector are offered so many options to support a more circular economy. Whether it be by limiting their pollution or their food waste, especially in cities, a lot of micro-solutions exist. More and more companies are sprouting by the day with the business version idea of a sharing economy and cooperation between end-consumers and retailers.

The two most frequent and reachable poles through which retailers can influence their local circular economy are food waste and packaging waste. Indeed, retailers do not only influence the manner in which their surplus of food is handled but also the way in which they choose to distribute their products which can have a huge impact on society, especially with the use of single-use plastics in the service industry.

5.1.1 Food waste

Food waste is a worldwide issue that has been around for quite some time and was especially accentuated by the development of the food sector's supply chain and it's globalization. Delocalizing food sources and ever-increasing actors at each step of the supply chain has led to less traceability and more waste than ever.

The Figure 5.1 represents the amount of food waste by sector in the EU, not counting food losses (food that was not harvested or not authorized to be marketed). As we can see, it is estimated that 127kg of food was wasted per habitant in the year 2020 which amounts to around 57 million tons of fresh mass, households waste representing more than 55 percent of that loss. In another Eurostat study, they estimate that for 2020, food waste kilograms per habitant represented around 10 percent of the food supply in kilograms per habitant, loosing nearly a tenth of the consumption.

There are several possibilities when it comes to food waste in supermarkets, restaurants,

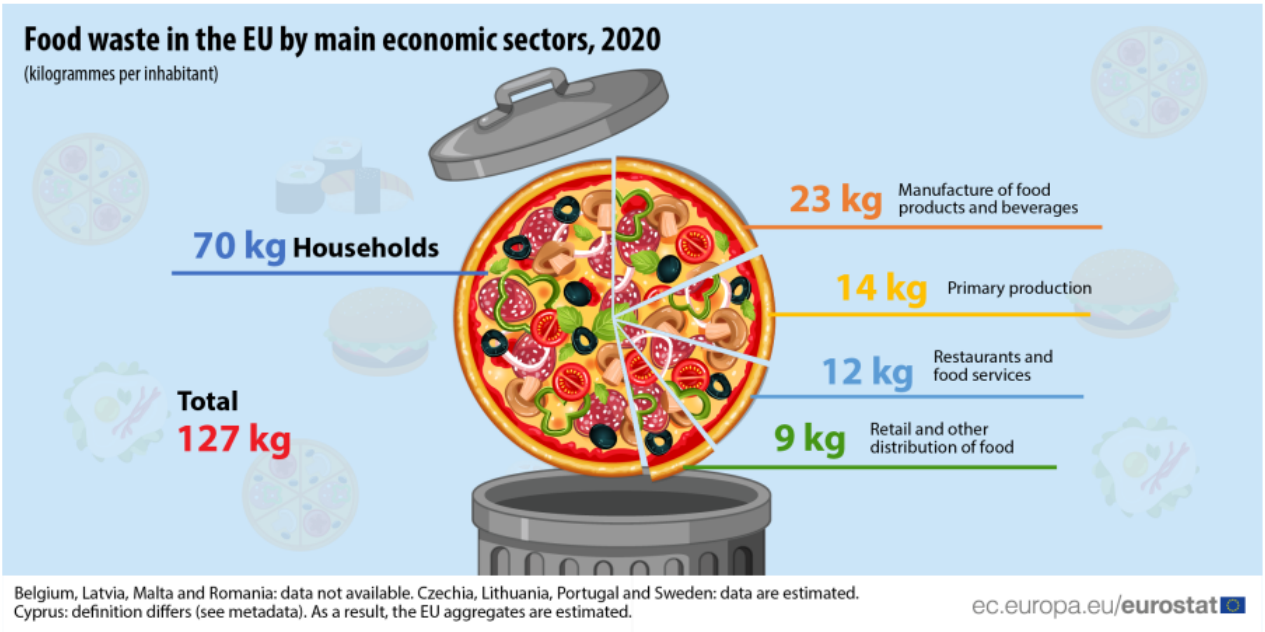

Figure 5.1: Food waste in the EU by main economic sectors (Eurostat, 2022)

grocery stores, hotels, coffee shops, and so forth. Said food can either be marketed some other way to another audience as a "last resort", or handled in a way that can still extract as much use from the ingredients as possible. However, whilst the first option can lead the business to an additional revenue, the latter implies an additional effort to be made from the business without necessary having direct monetary gain.

5.1.1.1 De Clique, upcycling retail food by-products

Founded in 2019, De Clique is a company based in Utrecht in The Netherlands that aims at reducing the waste of certain types of food by-products in order to transform them into higher value products. This both helps towards the food waste crisis and boost local economic partnerships, all the while needing minimal intervention from the retailing actors. According to them, they have already gathered more than 125 local actors, reuse more than 15.000 kilos of waste by-products per month, and avoid about 8.500 kilos of CO2 production per month.

Their main inputs are orange peels and coffee grounds, as well as some other bits and pieces of fruit and vegetables. The way this works is the following; the partners simply need

to put aside said inputs, which will then be collected by bicycle by De Clique's employees and brought to their production center in Utrecht. The orange peels will go on to become essential oils used in several others products ranging from cleaning products to beer and cookies, the pulp resulting from the process will end up as animal feed. The used coffee grounds, once collected and processed, will serve as soil for oyster mushrooms to grow which in turn are sold to local partners to transform.

Their client range from the catering sector with restaurants, hotels, cafeterias, coffee shops, etc. to other venues such as museum, schools, gardens centers, etc. all of whom can enjoy discounts on the products that they helped create with their waste. And with over a 100 partners, they are effectively reducing waste in their town (69).

For consumers, buying from De Clique's upcycled products does not offer monetary gain but does involve the consumer directly in the waste management of his region. Furthermore, the companies that De Clique sources from can become clients with the financial incentive of lower prices on the end products.

As a retailer, working with De Clique offers many advantages. In Utrecht businesses pay for the waste removal of their organic by-products, but by working with this company they actively manage their waste stream, which would be achievable alone, and create value for their local economy while transferring cost of removal to De Clique. As mentioned, partners also benefit from lower prices on the finished products made from their stream thus creating a local marketplace, De Clique even offers their partners impact reports on their raw material influxes and the CO2 that was avoided by this collaboration. Partners can then utilize this report in their advertising strategies at a lower cost as their previous waste removal system.

Their revenue stream is based on two sides: they establish a contract of waste removal with their local partners that is based on the quantity of resources they possess as well as the quantity of waste they produce, secondly they earn revenue from the sales of the end-products made from waste by-products.

However their are some down-sides to this, namely the increase need for organization. In order to work with De Clique, a company must handle a more complex waste removal contract, both juggling De Clique's removal and official city organic waste removal contracts

for the residual waste that the former does not collect. Moreover, the company must internally prepare the waste that is to be collected by De Clique, which entails additional training as well as time and space to store what is to be collected.

This collaboration type is a **one-to-one alliance** being that De Clique, as an individual partner, improves the processes and products of their local circular networks with technologies that are already available to them. They've entered in a win-win situation where, for the company, the gain is both indirectly financial (with no direct revenue but saving on costs) and social by working within their local circularity networks.

In this case, De Clique's roles are many, given that they actively search for their clients and offer other circular avenues to their current ways of working (e.g. waste removal), they can act as initiators and circularity experts amongst other things.

As the **initiator**, they are actively presenting their clients with a tailored option to a different business model thus creating the idea of circularity in that business. They can act as **internal educators**, a role typically performed by the business but De Clique's strategy involves training for employees on circularity and organic waste management. In this case, De Clique can act as both the **circularity expert** and the **piloter**, where bigger companies may in fact use in-house experts, smaller business such as De Clique's clientele will surrender that role to the external experts on the subject. Operating in a local economy, De Clique can utilize both their knowledge on local material flows and circularity networks, and their skills regarding waste removal and treatment. Finally, in the realizing phase of the circular project, they'll act as an **end-of-life supporter** by creating a second-life for the food by-products of their clients; including collection, treatment, and re-entry to the marketplace.

5.1.1.2 Get Wonky, avoiding "ugly" fruit waste

In the same vein as De Clique, this local opportunity handles organic products before their expiration to keep them from ever becoming waste.

Supermarkets often display fruits and vegetables that look eerily similar. That is in part due to the fact that consumers are less likely to buy a fruit that looks different from the

rest or "ugly" and misshapen which then leads supermarkets to throw them away although they're perfectly edible.

Get Wonky is a British company that turns these misshapen fruits into juices marketed to kids and school cafeterias. Not only does it create a sale for the supermarket that expected them to go to waste, but the company can source their fruits at a discounted rate and tackle food waste at the same time.

Akin to De Clique, this type of collaboration can be described as a **one-to-one alliance** for the same reasons, Get Wonky works in an already existing circularity network in which it tries to improve processes to reduce waste creation. The win-win situation is mainly financial here with both the client making a sale on a product that was expected to become a loss and Get Wonky sourcing local and cheaper raw materials for their final products.

The roles that Get Wonky tackle are as the **initiator** by

5.1.1.3 Winnow, preventing food waste altogether through technology

(70) This Londonian company established in 2013 uncovered an issue when it comes to food waste, Up to 20 percent of all the food purchased in a regular commercial kitchen is thrown away. Aside from the obvious issue, greenhouse gas emissions from the decomposition of organic waste are accountable for 5 percent of global emissions.

Their company, by using new technology that they developed, provides an easy way to weigh, categorise and then analyse the reason behind the waste of food in the establishment. In addition to raising the awareness of the staff in regards to the amount of food lost, the program accompanies the client in the decision of menu design and food preparation. Their clients include typical food retailers but also casinos, cruise ships, hotels, restaurants, caterers, etc.

The way they operate is quite unusual, with a weighted scale placed under the kitchen waste bin as well as a camera above it detecting the type of food thrown away (or a touch-screen in which to enter it manually for smaller businesses), Winnow is able to propose solutions to reduce waste.

It offers advantages to the retailers in the form of an indirect monetary gain where the benefits come from a reduced loss in purchasing costs and reduced waste production. According to them, clients can expect an average reduction of waste by 50 percent which, especially with the rise in prices for commodities, is quite an increase in profit. Ten years after their first steps, they've reached 1.400 clients and the equivalent of 36 million meals were saved, in other words, about 61.000 tons of CO2 never produced.

Following INGKA[1]'s group's publication in 2022, with the help of Winnow, they have managed to surpass their 2017's goal of a 50 percent reduction in combined production food waste in their stores by 2030 in 2021(S). Moreover, Club Med has been using Winnow technology since 2017 and has now implemented it in most of its Pacific Asia resorts (T).

Winnow's business model is based on a monthly fee to send regular reports on the analytics gathered and offer avenues for solutions to their clients. Hand in hand with information about sales and raw material purchases, they can calculated a more effective method of return on investment as well as a report on how much carbon emissions were avoided in the process.

Of course, this solution is not available to all, bigger businesses are targeted as it entails both considerable organizational changes as well as a considerable amount of input to be created for it to be most effective.

This type of partnership can be described as **horizontal network** collaboration, Winnow has been developing a new technology in collaboration with its clients within an existing circular network and improve decision-making to reduce waste down the line.

In these collaborations, Winnow acts as an **internal educator**, by providing reports and feedback on the waste creation within a business they actively train the employees on the importance of their actions towards circularity and thus operate a mindset shift within the business. Where the clients assume the role of market experts by possessing knowledge over the industry and consumer behaviour, Winnow takes on the role of **piloter** by handling the circular performance through insights and feedback as well as evaluating risks and guiding decision-making.

[1]They are the owners of the IKEA chain stores.

5.1.1.4 2good2go, targeting a different audience towards food

(71) This company was founded in 2015 and is now active in food waste prevention in 17 countries worldwide. Successful and downloaded all over the world, 2good2go is an easy-to-use app that connects food retailers to all sorts of clients within a given perimeter. As consumer, you can view which retailers offer food baskets nearing the end of their expiration date at a very discounted price. As a retailer, you can easily get rid of food that you will no longer be able to sell an still make money off of them as well as reduce the waste of your establishment.

Restaurants nearing their closing time, supermarkets which products expired day-off, hotels having an excess of the breakfast buffet, the possibilities are endless and profit everyone.

Their business model consists of charging a fixed order-based fee for every basket sold as well as a yearly fee for every partner taken from the total profits of that year. In other words, the cost never falls on the consumer and the partner still makes a profit. We sat down with two businesses that use 2good2go to learn more about the platform from the user's side.

Our first interviewee is Maxime, an employee from Torrefactory, a startup in artisanal coffee roasting for B2B and B2C clients. According to him, using the platform has boosted their notoriety in the sector, they do not use the platform often as their product (coffee beans and ground coffee) have a long expiration date; but almost every time they did, he states that the client previously did not know his company. Moreover, some of these clients came back later on after having tried their product. For this company, the gain was not only monetary but promotional and increased their visibility. However, when asked about challenges or difficulties regarding the implementation of the process, he states that revenues from the platform do not fall under regular sales when accounting for revenues, and that for a smaller company like them, it takes an additional effort to settle their accounting records to encompass that revenue.

Our second interviewee is François, an employee from Färm, a local, zero-waste and organic store located in Louvain-la-Neuve. They have been using 2good2go for several years now and report mainly good outcomes from this partnership. According to François, they

sell between 3 and 7 baskets for 4,99€ every day at closing time depending on the amount of soon-to-be expired products that day. As he explains, it has tremendously decreased the losses from food waste in the store, they would usually share the remaining food between the employees at the end of the day. A negative point he brings up is regarding the feedback he received from consumers, the impossibility for them to know the contents of the baskets beforehand as well as the very short windows for pick-up (between 19h and 19h30 here) have led some of them to stop using the platform altogether.

This type of partnership can be described as a **one-to-one alliance**, where 2good2go acts a a medium between individual retailers and consumers in order to improve the processes regarding food waste management by reducing food waste at the base.

In this particular collaboration, the platform does not create or modify circular products but create the link between specific consumers and retailers. Thus we can argue that 2good2go acts as a **piloter** by handling the circularity network between buyer and seller as well as a **promoter** by promoting the circular products (in this case products near their expiration dates that can still be consumed) and the circularity and visibility of the partner that sells his products. Finally, the platform also acts as an **external educator** by allowing consumers to make informed decisions and support the lifetime extension of the products they consume.

5.1.2 Reusable packaging against single-use plastics

Single-use plastics and packaging waste are a prominent issue in the food retailing sector, whether it be restaurants offering single-use takeaway packaging or supermarkets overwrapping fruits and vegetables in plastic for transport, the problem has been a subject of discussion for quite some time. Accordign to the European Parliament Research Service, between 2009 and 2020, the total weight of packaging waste in the EU increased by 20 percent (73).

The "Packaging and Packaging Waste Directive (PPWD) - Directive 94/62/EC)" offers avenues of solution to prevent to production of packaging waste and to put forth reusable and/or recyclable packaging. It also lays out the conditions and requirements to meet for the

introduction of packaging in the EU market.

In November 2022, following the update of the European Green Deal and the New circular economy action plan, the Commission revised the PPWD and set a goal for 2030, date at which all packaging must be reusable or feasibily recyclable. Thus, amdist protests about the new directive, retailers and distribution are now more than ever forced to look for alternatives to their single-use packaging.

Most retailers have already started to adopt the movement. With supermarket chains offering paper bags instead of plastic, selling reusable tote bags made from recycled materials to their consumers, or even restaurants opting for bio-degradable packagings and bars serving you with paper or pasta straws.

5.1.2.1 Swapbox, a functional economy for packaging

(72) Perfectly encompassing the concept of a functional economy, Swapbox offers reusable packaging to food retailers in order to tackle the issue of singe-use packaging in the Benelux[2] region. Amidst the new regulations in the EU concerning packaging, Swapbox offers a solution with no upfront costs and minimal changes in the retailer's organizational need.

The way this works is by offering their reusable packaging as a service instead of a product, in accordance with the values of a functional economy. Their services aim to "streamline operations, reduce waste, and improve sustainability, all while providing cost-effective options tailored to your specific requirements".

Their **packaging rental** is adaptable for any type of businesses and event needs, offering a range of containers: food packaging including bowls/soup containers/pizza boxes/..., coffee cups, festival cups, and crates for transport. They function on a financing basis of single event fees or monthly rental arrangements adapted per-use of the packaging.

In addition to the rental, Swapbox offers the collection and professional washing service of the rental items to alleviate the client of further need for organization and storage space. The whole process is more reliant on the consumer than the business, where the app allows the consumer to choose the packaging in which he'd like to be served in advance, scan the

[2]Belgium-The Netherlands-Luxembourg

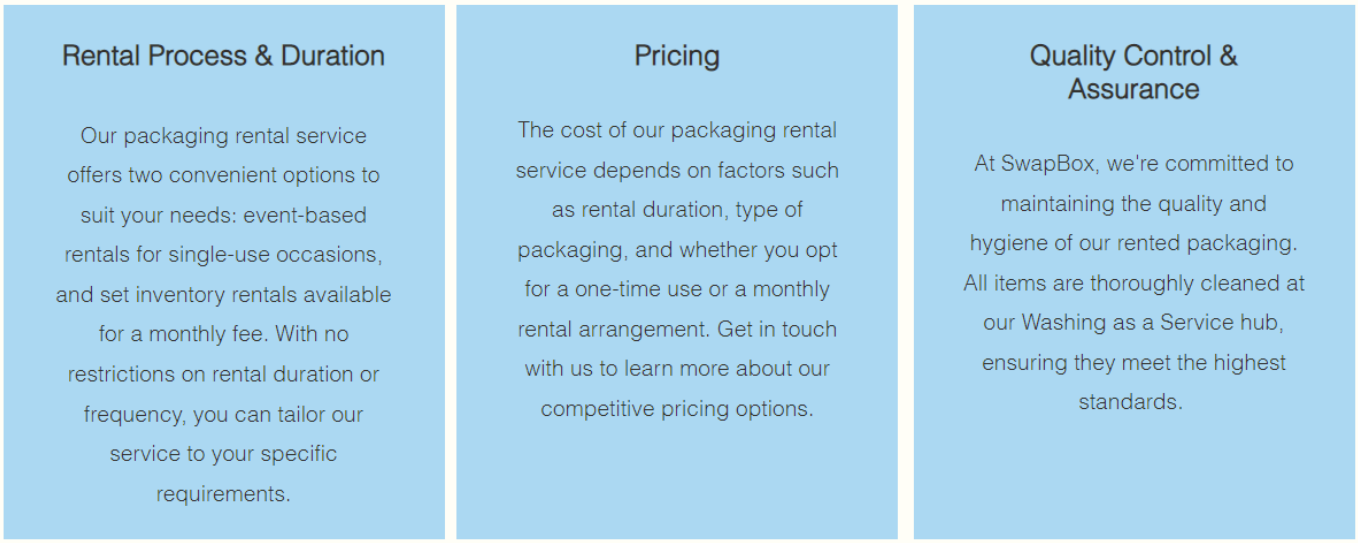

Figure 5.2: Swapbox's Rental Process (Swapbox Website, 2023)

item and return it in a certain time-frame in either a participating retailer's establishment, smartbins, or simply buy the packaging by keeping it. Their tracking technology allows Swapbox to know in real-time where collection of used packaging is necessary and which establishment is in need of a refill.

This business initiative effectively closes the gap between the upcoming legislation and environmental need, and the retailers' logistical block.

To gain some inside perspective we sat down with Palmer, the manager of "Chez WaWa", a californian-mexican restaurant in Brussels. He began his collaboration with Swapbox at the beginning of 2021, unfortunately at the beginning of 2023 that collaboration ended. Palmer told us that the collaboration started after Swapbox reached out to restaurants in the area offering a solution to single-use take-away boxes. After negotiations and a resources analysis from Palmer, he decided to start the process of offering the reusable packagin to his costumers. Unfortunately, although at first consumers were curious and often downloaded the app Swapbox, he tells us that the use of the packaging quickly fell from a few dozens per month to about 6 or 7 per month. Eventually, in the beginning of 2023, Swapbox decided to stop working with smaller restaurants and retailers in Brussels because of a lack of users and instead focus on bigger events and venues. Palmer added that he was left with a lack of

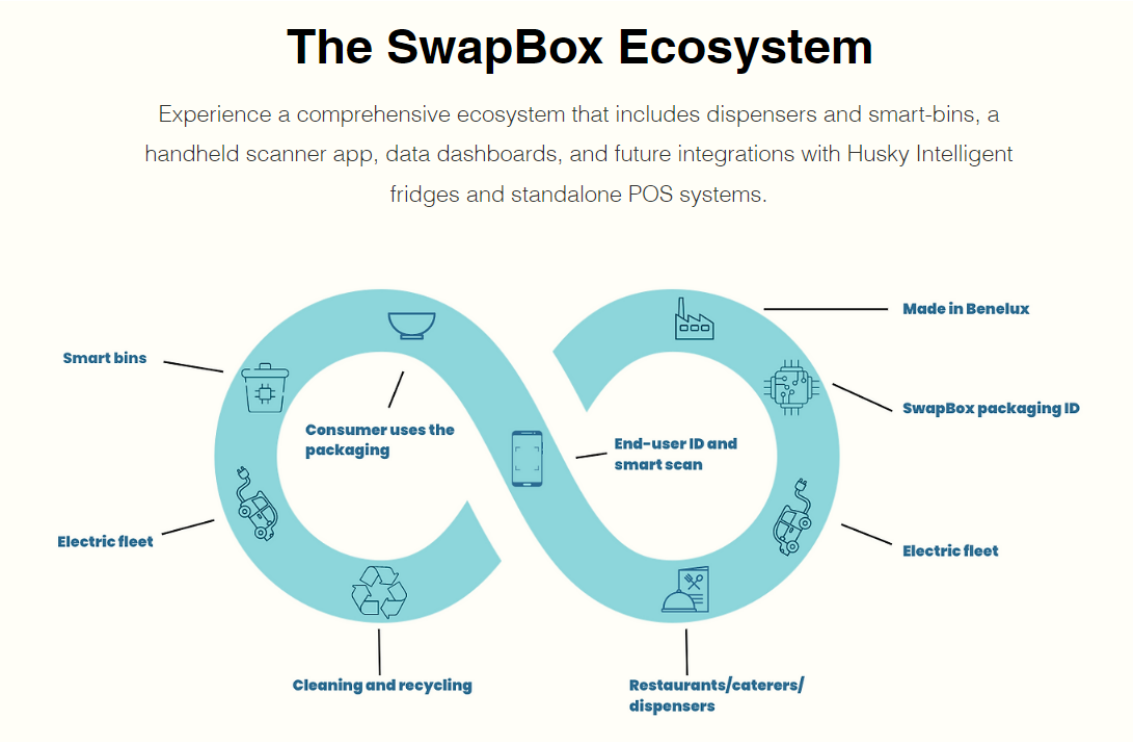

Figure 5.3: Swapbox's Ecosystem (Swapbox Website, 2023)

packaging options to choose from and had to revert to single-use packaging since. As we can see from his experience, individual partnerships can be more volatile and quickly falter when the strategic fit is not optimal anymore. Moreover, consumers have the power to support circular opportunities and their lack of support can prove fatal to these partnerships.

We have here a case of **horizontal network** collaboration in which Swapbox utilizes a circularity network of competitors and other retailers to work together to offer reusable packaging to their costumers.

Swapbox acts here as a **piloter** in the way that it connects circularity network actors together and takes on most of the risk of introducing a new way of consuming on the market. Moreover, Swapbox works as a **use-phase supporter** by building a network to reuse packaging at a local level.

5.2 Key takeaways

All of the opportunities listed above have their own financial model and logistical processes, but what they all have in common is that at the center of their business ventures lies the need to link profit and circularity; they have managed to link their newly founded circular economy to their "suppliers"'s.

As we've stated, one of the most difficult barriers to overcome when it comes to the CE is cultural with the lack of consumer awareness and interest. But in the recent years it seems to have affected this sector less and less with the rise of the demand for organic products and the legislation towards packaging for retailers. Closely behind is the hesitance in the company's culture and the apprehension towards upfront costs. Instating a reverse supply chain or simply more circularity in it might be very resource and financially intensive with little monetary return on the short and medium-term. What these companies managed to do is simply to erode these barriers by removing the main blockages. In a partnership with these initiatives there is little to no need to implement a radically new logistical way of working but instead delegate tasks to these new forms of business. Whether it be legislation, societal shift or consumer behaviour, they have seen a gap in the market and filled it by chipping away at an issue while still creating economical value.

The types of partnerships we've seen here are either horizontal network collaborations or one-to-one alliances given the fact that a circularity does exist in this sector and that companies can thus focus on utilizing said network and improving products and processes to fit existing structures. In terms of the roles these companies seem to take in their collaboration, we've seen that a smaller and more local client base push circular companies to act as both educators and developers of the circular network.

Chapter 6

Circular Partnerships Opportunities in the electronics sector

Contrary to the agri-food sector, the Electronics industry has been around for only a century. From the creation of vacuum tubes in the early 1900's used to boost electrical signals up to now, the electronics sector has been thriving like no other sector could have. (C)

According to Precedence Research's 2022 market report, the global industry is expected to reach more than one trillion dollars 6.1 [1] with a compound annual growth rate of 5.1 percent between 2022 and 2030 (D).

First of all, let's specify what is meant by the electronics industry. (B) "The Electronics industry is made up of companies that design, manufacture, assemble, and service electronic products. These products consist of materials parts, components, subassemblies, and equipment that use the principles of electronics to perform their major functions." We can divide the products involved in the electronics sector by;

- Semiconductor supply and Manufacturing services
- Industrial Equipment
- Networking and Communication Equipment
- Consumer electronics and home appliances
- Medical devices

[1] About 0,907 trillion euros in the conversion rate of March 2023

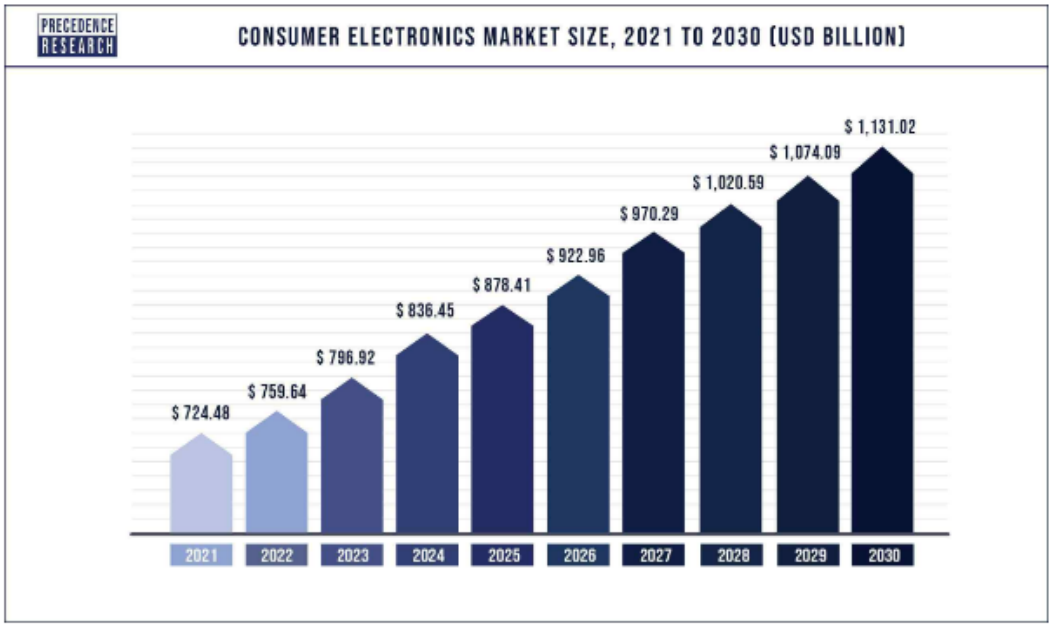

Figure 6.1: Global Consumer Electronics Market Size, 2021 to 2030 (Precedence Research, 2021)

- Computer and Office Products

Thus the range of action of the electronics industry is quite vast but also more controlled. Indeed, specific materials and products may only be directed at certain ends which makes it more difficult for this sector to reuse or redirect a material or product when compared to the agri-food sector.

To better understand the ways of working of this sector, let's take a closer look at a general electronics supply chain representation published by the Corporate Responsibility Research Conference in 2013 (Figure 6.2).

In this schematic representation of the flows within the electronics supply chain you can see that it all starts at the vendor's level with the creation of the product via RandD and Design, which then leads to the request amongst suppliers to supply the components needed for the creation of the product (raw materials, substances, parts, devices, etc.). This step is already quite broad and complex considering that the sourcing of all the components needed for a single product will likely transcend countries and continents as well as companies and

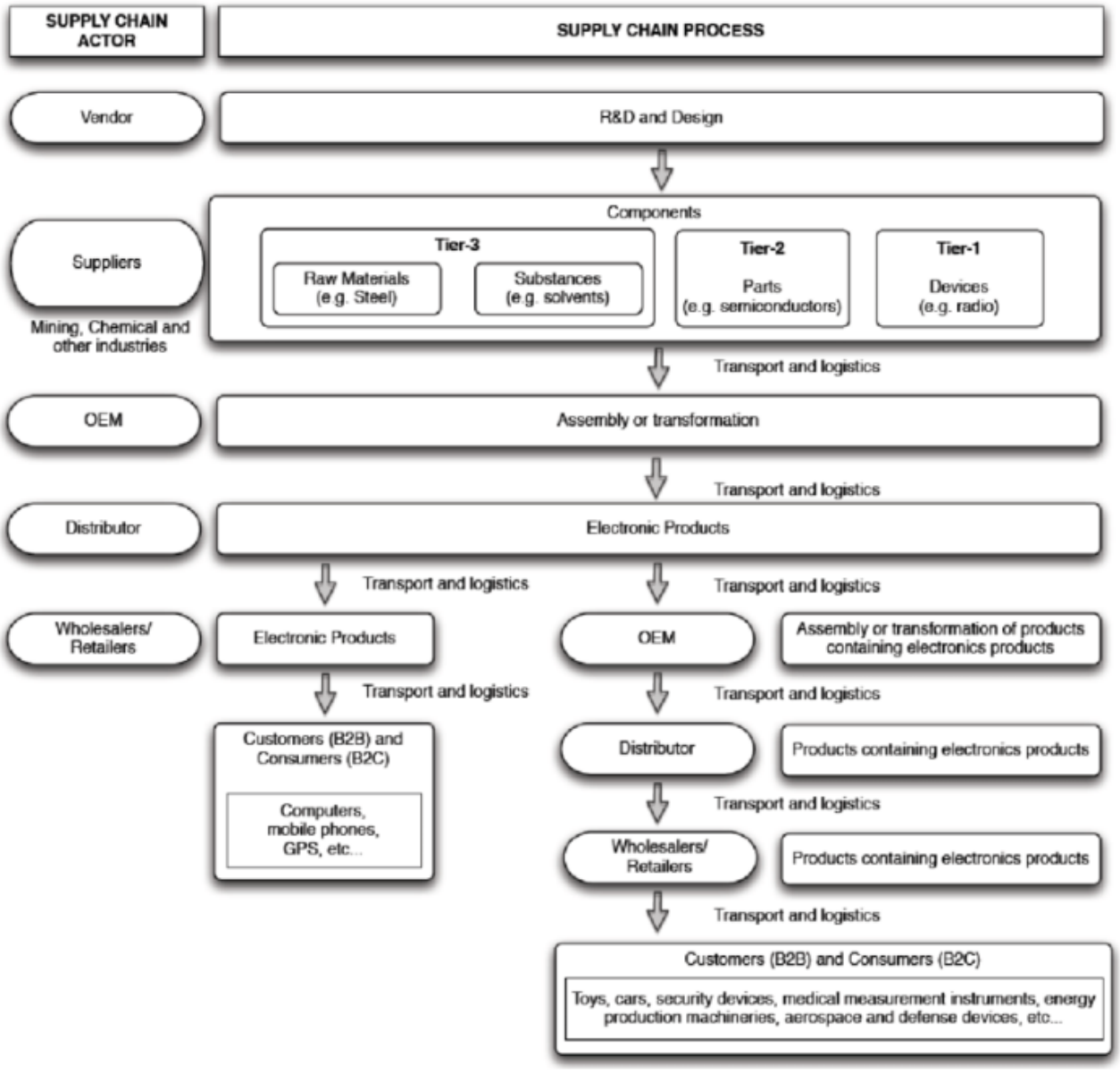

Figure 6.2: Representation of the Electronics Industry's Supply Chain (Corporate Responsibility Research Conference, 2013)

supplier's suppliers, making it that much more difficult to implement guidelines regarding circularity or even reliable traceability.

After the gathering of components, they are sent to the original equipment manufacturers (OEM's) for either assembly or transformation. This is where reliable traceability really

comes into play with every assembled or transformed item is given a specific tracing number, this is the last step where the most products are regrouped in a common location. Once again, this step poses the issues of frontiers, with a lot of OEM's being in different countries or continents than where the products will end up. Once ready, they are handed to distributors that will either distribute them as-is (if the product is in its final form such as a computer) to retailers or back to secondary OEM's (if the product is a part for a greater product to be made such as a microchip to be built within a toy) to further assemble the part into another product and then follow the rest of the chain [2] (distributors then retailers).

Finally, the product will end-up in the hands of either costumers (B2B) or consumers (B2C) where the opportunities for circularity are much more present, but also more difficult to implement in this sector. Now, akin to the agri-food sector, in a more circular supply chain, a ideal last step would be to link the end and beginning of this supply chain to break it's linear motion (although the reality is much more complex). is vision has been put forth in writing by the International Telecommunication Union (ITU) in 2022 through their Circular Electronics Partnership.

(G) "The Circular Electronics Partnership (CEP) brings together key leaders in private sector to drive a coordinated transition towards an economically viable circular industry. In enabling a circular economy, the partnership enshrines the principle of maximizing the value of products, components and materials throughout their full life cycle, using safe and fair labor and depending only on circular resources." According to them, in order to fulfill their mission towards circularity, the industry must leverage:

- Circular design principles
- Material, component or product loops
- Data driven systems
- Responsive business models

[2] Between each actors, there are also transport and logistics actors to take into account.

- Advanced partnership

Which is a quite extensive and resource intensive move towards circularity. As they themselves state, a lot of decisions need to be taken along the value chain and no less than an extensive stakeholder collaboration is needed to create that positive chain reaction. The pathway laid out towards a more circular electronics industry is summarized through 6 steps (Figure A.10) being: Design for circularity, Drive demand for circular products and services, Scale responsible business models, Increase official collection rate, Aggregate for reuse and recycling, and Scale for secondary material markets (F). To dive into further details concerning the meaning and objectives behind each step, Figure A.11 is quite educating.

The electronics industry is a difficult industry to integrate circularity into for several reasons. This is a sector that has an extremely high competition and race for innovation, thus needing a lot of dynamic capabilities. As we've mentioned in the barriers preventing the implementation of a CE, the lack of consumer awareness and interest towards circularity and sustainable products is prevalent in this particular industry. Allocating resources towards circularity thus removing resources in other areas of the supply chain can prove fatal for companies in such a competitive market. There are of course exceptions, although few, to this high competitiveness such as Apple; they have built such a brand that a change in price would not impact their clientele as much as a lesser know brand. However, they would not benefit from an extended product-life, as they frequently release newer models. The race towards innovation also infringes on circularity being that companies wanting to stay "on-top" of the market and capture the maximum market share will need to quickly adapt to new trends and technologies thus having a small time-frame to design and release a product and will most likely not take time to integrate more Eco-design or find secondary materials.

In order for things to change in this sector, according to the CEP's Roadmap towards circularity in electronics, a global partnership between electronics companies, the public sector, and civil society needs to happen. As the report states when talking about fostering

multi-lateral actions for circularity:(F) *"Despite their market power, individual electronics companies cannot act alone in transitioning towards responsible circularity. Given the global nature of the electronics supply chain, a "coalition of the willing" is needed across companies and value chain segments. The companies that demonstrate their willingness to act early in embracing circularity, can ultimately be better positioned in tomorrow's market. Beyond the private sector, the collective transition towards a circular electronics industry will require partnership with the public sector and civil society. In a post-COVID-19 world, governments may choose to restart struggling economies as circular economies".*

Now, the object of this analysis is to point out sections and/or actors of the supply chain that can add more circularity while avoiding as much as possible the most prominent barriers being lack of consumer interest and awareness, high up-front costs and hesitant company culture. However, as we've just seen, this sector is much more co-dependent and restricted than the agri-food sector which leads to less opportunities to integrate innovative circular initiatives. In the process of producing electronical devices or items, the vendor (company who designed and set in motion the creation of the product) has power over the whole supply chain, meaning that actors within that chain have little to say or do considering the product in itself and can mostly just influence the way in which they produce (and in some cases sell) or the suppliers that they source from. It falls on the vendor to integrate most circular actions.

Finally, existing circular initiatives that actors within the electronics supply chain can actively partner with without high upfront costs or drastic logistical changes are few and mostly fall on the consumer demand and behaviour and the pillars "Responsible consumption" and "extension of the duration of use". However, if we look beyond the lens of the electronic product in itself and see the industry as a whole, there are opportunities for the "Functional economy" pillar to be put into place, as you'll see later.

In this regard, we will be focusing on the actors of the supply chain that we believe are the less costly and logistically taxing to render more circular with the help of existing and

successful circular businesses to partner with: **Wholesalers** and **Retailers**.

6.1 Wholesalers and Retailers

As previously stated, retailers and wholesalers don't have much leeway when it comes to circularity concerning the electronic products they're selling. The packaging, design, advertising, etc. has been decided upstream by the vendor. However, there's room for them to help towards extending the duration of use through refurbishment, recycling through waste collection, or opening up a more functional economy within their business. Although all of these steps need to be taken with the prior agreement of the vendor. Morever, other actors need to be implicated in these actions, namely consumers (B2C) and customers (B2B).

6.1.1 Refurbishment

Although refurbishing products thus putting into place a reverse logistic woul be extremely resource and time intensive for retailers to operate, supporting and partnering with already established and successful businesses reduces the severity of that issue.

6.1.1.1 Back Market, a marketplace for reconditioned mobile devices

(H) Back Market, established in 2014 by a french entrepreneur, is an online platform who's goal is to make refurbished devices the norm. According to them, in 2019 alone, 53.6 million of metric tons of electronic waste (I) were made with only 17 percent of those being adequately recycled.

What back market does is to offer a platform for refurbished products to be sold while offering the buyer a guarantee on the refurbished product. They do not refurbish the product themselves but instead work with trusted third-parties. There are three kinds of seller who work with Back Market :

- **Classic sellers** being companies that refurbish products. Refurbishing factories and businesses (Largo, Recommerce, Smaart, etc.), Repairers (small stores), Recyclers (selling components), Traders (who buy reconditioned items and resell them), Wholesalers

(selling batches of reconditioned products to businesses), and Leasing companies (selling the returned products from their leasing activity).

- **Retailers and distributors** which includes Product manufacturers, Mobile operators, Major retailers. These seller don't take part in the refurbishing process but instead sell unsold products and devices that were returned by the customer but stayed unopened.
- **Second-hand resellers**, these are the businesses that buy from individuals then test the products and resell them.

The website makes money off of a regular fee from its partner companies in addition to a percentage of the sale that has been made. The process to be added as a new sellers is quite strict to protect their customers but amounts to a financial gain for the seller in the end with minimal logistical shift. Retailers and wholesalers have an opportunity here to integrate such initiatives to reduce the amount of unsold products returned to the vendor while still making a profit or breaking even. Back Market's way of working is straightforward and does not need for the retailer to make any kind of binding contract with the platform. What is meant by that is that the retailer is in charge of its inventory on the website and is only asked to send the product to the final costumer when a sale happens, they can change inventory at any time and do not need to surrender their products to a third party beforehand (Figure A.12).

In addition to the opportunity that retailers and wholesalers have to take care of returned or unsold items, is the opportunity to positively influence the processing of refurbishable items. Through Back Market there are companies and factories specialized in the refurbishment of electronic devices buying directly from B2C consumers. Retailers are at the forefront of the sale of new devices, meaning that a former device is often no longer needed, this gives them a privileged position when it comes creating the link between consumer and refurbisher. By promoting the use of such initiatives in their stores/websites or going even further, by offering consumers the option to leave or sell their old devices in the store in which they intend to buy a newer devices (through a previously established partnership between refurbisher and retailer) they are actively participating in a more circular economy without the

need for reverse logistics to set up themselves. However, an increase in second-hand mobile devices would mean a decrease in sales for manufacturers, and such a poor strategic fit could be one of the reasons behind a lack of willingness to collaborate.

Although the collaboration is not here in application (except with the types of sellers mentioned above) it would be a **vertical network** collaboration. As recycling and reusing systems with high quality outcomes are not common place within the sector at this time, partnerships are made towards developing a circularity network, in this case through life-extension of the products and end-of-life treatment.

The roles that Back Market is enacting here are as an **initiator** by developing a new business model centered around a wide-scale marketplace for refurbished mobile devices thus being action-oriented in its approach. As a **piloter** by developing and piloting the circularity network that regroups here all the actors involved in the refurbishment of products to its sale, Back Market takes on risk and trial and error when it comes to dealing with a new clientele. As an **impact extender** Back Market has positioned itself as a possible competitor to manufacturers, without the need for design, extraction of materials, or production costs from the conception of the mobile devices it has overcome the obstacles that block manufacturers from implementing circular products. They are stimulating the circular learning curve of the industry by showing that a market exists for circular products and that it is profitable. As we've discussed in the literature review, barriers to a CE are often interlinked and locked in a vicious cycle where, for example, the lack of successful circular business models is not an incentive for companies to implement major changes towards circularity and thus do not in turn create successful circular models. What Back Market and others alike are doing is breaking away at this cycle by display of a working and profitable circular system. As a **use-phase supporter** they are creating a circularity network in which products' life-time are extended and opening-up a new market. Finally, as an **external educator** and a **promoter**, Back Market is educating the public on possibilities within the circular economy whilst promoting circular products, increasing their credibility amongst consumers as a viable option. Consumers are, especially in such competitive markets, a force of change that is arguably the most effective at changing systems.

6.1.1.2 ComplemenTerre, reuse and refurbish industrial conditioning equipment

Moving from mobile devices towards industrial equipment, ComplemenTerre is a company from the North of France that offers reconditioned industrial equipment to factories or, in the event of an end-of-life product, takes care of dismantling it (reusing parts and recycling the rest). It's a great opportunity for companies wishing to test a product before deploying it on a larger scale and reduces equipment costs for local authorities and businesses.

The way they operate is by offering to buy, repair, or collect equipment from factories then selling them to customers with possible changes to fit the customer's needs.

Once again, industrial equipment wholesalers do not have the capacity to collect or process these items themselves, but being at the forefront of the sale of new equipment, they can offer these types of solutions to costumers that might be oblivious to the existence of this possibility (J).

This type of collaboration is a **vertical network**, akin to Back Market the circularity network is not well developed in this sector thus partnerships like this are aimed at developing such a network. In this case, the network is developed through life-extension of the products and resources cycling.

The roles that ComplemenTerre is taking on in this collaboration are **circularity expert**, **use-phase supporter**, and **end-of-life supporter**.

6.1.2 Waste management

In this sector, waste management is particularly complex and regulated. A lot of e-waste ends up in landfills without ever being properly processed for reusable components.

6.1.2.1 R.E.I Industry, the valorisation and reuse of obsolete of industrial equipment

L In the industrial sector, the equipment can very quickly become obsolete. Whether by a newer technology emerging or by a change in production need, equipment often finds itself

being stored indefinitely. Processing obsolete or broken equipment for companies can very quickly become resource-intensive and costly. This is the focus of this initiative, which buys said equipment and takes care of collection, decontamination, dismantling and rebuilding new equipment with reused components, and recycling the rest. This is a win for companies whose equipment would have otherwise been stored waste and becomes a financial gain with almost no logistical need. Once more, retailers can be the link between the sale of a new product, and the collection of the old.

This type of collaboration is also a **vertical network**. In this case, the network is developed through end-of-life treatment for the obsolete or broken equipment via recycling.

The roles that R.E.I Industry is taking on in this collaboration are both **circularity expert** and **end-of-life supporter**.

6.1.3 Functional retail economy

Another avenue of change towards more circularity in the electronics retail sector is a partial shift towards a functional economy. As previously stated, a lot of products have a very short use-life, meaning that they are bought but very rarely used and thus produce waste (both in production and end-of-life) without being profitable to the user. Retailers can, for some products, establish a leasing program within their businesses [3] to both boost the profitability of use of the product, and of revenue for the company.

However, we do realize that this involves a bigger logistical shift in the retailers' organization and might trigger bigger push-backs.

6.1.3.1 Lizee, moving businesses towards functionality

(M) Lizee is a business that created a data-driven Rental Management System (RMS) to help companies install a rental cycle (as well as second-hand items sales) within their business. The one-size fits all platform that integrates all of the company's retail tools takes care of the logistical aspects of in-store or online rental through all the steps (shipping, returns, possible refurbishing, etc.).

[3] Still, this cannot be done without the previous consent of the vendor.

They have already had a lot of success with their partnership with Decathlon, their rental service has increased margins by 2.4 percent after one season in 2021.

Taking this leap is a great step in the direction of a more circular sector, all the while catering to a new category of consumers that will prefer to opt for the price of use of a device instead of the investment that is buying one.

Although this company does not yet collaborate with the electronics sector, its potential collaboration would be categorized as a **vertical network** collaboration aiming at developing the circularity network for the extension of use of a product with multiples consumers in the value chain.

The roles that Lizee embodies here are; **initiator** by presenting an action-oriented plan to companies for circularity development through a functional economy, **internal educator** in the way that they accompany companies internally through the changes they need to make in order to achieve a successful rental option for their clients, **piloter** by enhancing customer experience and circular economy performance through the development of an adapted technology and the management of the circularity network, and **use-phase supporter** through by establishing a service-oriented reuse model that extends the use of a products.

6.2 Key takeaways

The electronics supply chain is very competitive and subject to a lot of control by the vendor and the regulations surrounding the products and their recycling which makes it so much more difficult to introduce independent partnerships into. The area where we found the most opportunities for partnerships is at the retailer or wholesalers' level.

With the exception of the company "Lizee", the opportunities listed above do not actively involve the main supply chains actors as they would in the agri-food sector. Here, retailers can almost only act as a conductor between these innovative initiatives and the consumers and costumers. The pillars of the CE most impactable in this sector with minimal upfront costs and logistical shift are the "Functional economy" of the vendors and retailers, the "responsible consumption" of the customers and consumers, and the "recycling" pillar of these initiatives.

We've established that one of the most pressing barriers of the CE is the lack of consumer awareness and interest. The rise of companies such as Back Market showcase that the mindset is slowly but surely changing but sadly takes time. If not to modify their supply chain, companies have a duty to inform the public of the existence of such initiatives and publicly endorse and support such endeavors to boost the mindset shift of the population, and allow for similar business models to emerge in a supportive market. nsidering the barrier of high upfront costs and low virgin material prices, we've seen that no less than a global change in the sector is needed to change the status-quo. And that if the industry as a whole needs to invest in supply chain logistical changes, no singular company will be the "sacrifice" towards circularity.

The type of partnership that we've seen here is vertical network collaboration, businesses within this sector are highly connected and an efficient circularity network is not put in place which forces companies to find collaborations to develop that circularity. As the competitivity in the sector does not allow for change at the top of the supply chain withouh major changes in the industry, opportunities for collaboration are located down stream in reuse, end-of-use and recycling. In terms of the roles that are taken by the circular businesses we've analyzed, we can see that they act as either circularity experts holding knowledge to develop circularity networks, or use-phase and end-of-life supporters.

Chapter 7

Conclusion

7.1 Results and limitations

After our analysis of the challenges each sector faces and the opportunities for partnership present for both of them, we have a better understanding of the implications such partnerships can have for the Circular economy in these sectors. In this section, we will look through the different roles that these circular businesses have taken on and what they could mean for the circularity in these sectors, as well as the different advantages that these partnerships bring forth for the supply chain actors.

We will then observe the impact that these initiatives can have on the barriers that we previously talked about, and what that could mean for the transition towards a CE in these sectors. Lastly, we will further dive into the limitations of this analysis.

Firstly, in the agri-food sector the collaborations studied where either horizontal networks or one-to-one alliances because of the fact that circularity networks where already in place in the sector. Partnerships in this sector will then utilize this network and if possible improve processes or products within that framework. This also means that there is less pressure on businesses to change given that a structure already exists, which may be why direct and short-term win-win agreements are prevalent here. In the partnerships with circular businesses analyzed earlier, the win for the supply chain actors was often either a direct monetary gain or reduction in costs or losses. In the particular case of Swapbox, one of the incentives to partner may be linked to the increasingly tough legislation on single-use packaging and the need for an alternative solution that is easily implemented, although it presents an additional

logistical organization and no particular monetary incentive. Regarding the roles that the opportunities played in their collaboration with retailers, we can see that at a more local level, companies take on the role of initiators, piloters, and educators (both internal and external) meaning that they are highly implicated in filling the capabilities gaps of their clients when it comes to circularity.

In the electronics sector, collaborations with external partners are scarce, innovative circular businesses do exist in this sector but they do not seem to interact with the supply chain before the consumer. With the exception of Lizee, all of the businesses we've analyzed interact directly with consumers after the products have left the upstream supply chain, leaving circular businesses to act within the confines of resources cycling and end-of-life treatment but not interacting upstream. The collaboration type in this sector is vertical network meaning that, lacking an existing efficient circularity network, collaborations with outside partners will need to develop the circularity along the supply chain. The issues with possible agreements between collaborators in this sector are that direct gain is not necessarily possible at this stage. The long-lasting aspect of electronic devices makes it so that an increase in the functional economy and reconditioned or refurbished products in this industry will inevitably lead to a decrease in sales for the manufacturers. The actors in that supply chain are so intricately linked that a change could not be brought by outside partners but instead needs to be made industry-wide and pushed by legislation. Nonetheless, the roles that these potential partnerships tackle are either as educators and use-phase or end-of-life phase supporters when they act as a conduit between retailers and individual end-consumers, and circularity experts when they directly deal with consumers themselves.

In this last section of our results, we will look at the barriers to the implementation of a CE that we studied in Chapter 1 and how these opportunities may or may not have reduced them. We'll take Figure A.5 as a guide.

Cultural

This barrier is less prominent in the agri-food industry when it comes to lack of consumers interest or awareness, as these initiatives have showed, people take an interest in a more circular and less wasteful food industry. The sector has to gain as more of these initiatives

pop-up, the more consumer are taking part in the movement and the most actors within the supply chain need to stand out by taking action. Following along the consumers, the company culture and willingness to interact with the value chain grows.

As for the electronics sector, company culture has not been clearly moved by these initiatives. Their supply chain is very linear and closed-off to outside influence or partnerships mainly because of the high competitive market and the lack of interest from costumers when it comes to circular products. We do not believe that these initiatives can influence this barrier in this sector at the moment.

Market and growth

In the agri-food sector, we believe that the opportunities listed above do help to reduce high upfront costs for companies by providing them services that they could not implement themselves on a low budget. The actors of the supply chain and the partnerships interact to increase each other's value, whether it be by financial gain for both or by waste management for one and low priced raw material for the other.

However, although our opportunities do help reduce the amount of e-waste produced thus reducing the need for the electronics sector to implement a complex and costly reverse logistics, this sector is not yet legally liable for the end-of-life of most of its product. Meaning that because they are not yet being forced to find a solution to that waste, by themselves or through partnerships, they do not have an incentive to act and "endanger" their competitive advantage.

Technological and infrastructural

Our initiatives do erode this barrier in the agri-food sector in the sense that successful partnerships showcasing a working business model provide the supply chain with both the proof that such as system can work, and the option to join their model through little to no technical need on their side.

Once again, we do not believe that this barrier was positively impacted by these innovative businesses given the fact that a sucessful circular product was not proven to be profitable enough at the moment, our opportunities do help towards the end-of-life of devices but do not interact with most of the supply chain before the sale of the product.

Political and regulatory

The regulatory barrier is not prominent in the agri-food sector to begin with but they are quite limiting in the electronics sector such as regulation surrounding medical equipment that cannot be from a recycled source. Our opportunities do not directly interact with politics and regulations except in the sense that influencing the market and consumers will eventually lead to changes in policies.

7.1.1 Limitations

Throughout the making of this thesis we've stumbled upon several limitations to our analysis.

The range and capacity of these opportunities can be quite restricting and cannot apply to every company, most of these innovative businesses work on a certain region thus not everyone can access such partnerships. Moreover, the capacity of these businesses is often not extensive and could not support a shift towards them by a great number of actors thus the access to these opportunities is not very large. More often than not, SME's or smaller actors like independent retailers are more suited to partner with them.

Secondly, a lot if not most of the burden of circularity relies or is conditional on the implication of consumers, making it very influenced by the market.

Lastly, regulations limiting circularity are blocking partnerships from emerging which in turn does not offer viable options for circularity and limit its funding, creating a vicious cycle of barriers.

7.2 Conclusion

The Circular Economy, although a relatively new concept to the general public, has been around for a few decades and has slowly but steadily grown to become the talking point that it is today. However, even through climate crises and virgin material shortages that ought to increase interest in the idea, it seems to suffer a slow rise amongst supply chains. Throughout this thesis, our goal was to provide an answer to the question of whether introducing circular partnerships into the supply chain at the retailers' level could be efficient in transitioning

towards a circular economy.

Our literature review allowed us to lay out the concept of circular economy, from the different definitions over time to a mostly agreed upon interpretation. We saw it's growth as an attractive concept throughout history, and the several concepts of circularity that can be used as a guide for companies to adhere to. The Ellen McArthur Foundation provided us with the concept of a Circular economy system as flows of materials (Figure 1.2) where, through the Biological or Technical Cycle, materials and components are being kept in use as long as possible and at their highest value at all times.

Stepping outside of the flows of materials that the EMF's diagram proposes, the french Environmental and Energy Management Agency (ADEME) introduced a blueprint for companies to navigate in which preemptive steps are taken towards circularity even before production. These 7 pillars (Figure 1.3) are the following: Sustainable procurement, Eco-design, Industrial and territorial ecology, Functional economy, Responsible consumption, Extension of the duration of use, and Recycling. Next, we dove into the advantages and barriers of the Circular economy, and the concept of supply chain management. Finally, we laid out the categoriation of circular partnerships with the Circle Economy's report "Will you be my partner ? Nine steps to identify and establish successful collaborations for a circular economy" with which we established the types of collaborations to exist in a circular economy, the nine steps for companies to go through to achieve a successful collaboration, the roles which actors can take in a circular economy, and the nine characteristics for companies to identify the right partner.

In order to answer our main question, we analyzed the supply chains of two different sectors whose choice was influenced by EMF's Butterfly diagram's duality: the Agri-food sector and the Electronics sector. These two sectors being influenced at different degrees by the barriers we put forth. The aim was to establish in which areas of these supply chains could innovative circular partnerships be introduced that would both erode the barriers to a CE and foster change towards a circular economy. After deciding that retailers and wholesalers

were the most susceptible to be partnered with with logistical or financial ease (based on the most prominent barriers) in the supply chain, we began looking for already existing circular businesses in Western Europe that already worked within these sectors.

What we found was that both sectors are subject to very different conditions when it comes to partnering with outside circular partners. The agri-food sector is an open sector with actors in the value chain that are not restricted by strict competitive markets or lack of technology to implement a circular strategy with external help. Indeed, the opportunities are many and the unique position of retailers in the supply chain allows them to exert power over suppliers while having the ability to influence consumers towards sustainability. The short life-span of food by-products allows for actors to gain direct and regular financial incentives from their partners such as financial revenues (from the sale of products that reach their end-of-life) or cost and loss-reductions (by reducing food waste at the source and offering alternate ways to dispose of organic waste). Moreover, these partnerships have proven to actively tackle the issues that plague this sector such as food waste and single-use packaging issues. Lastly, these initiatives almost always involve a local partnerships which boosts both circularity and circular employment in these areas and can foster more change a a smaller scale. In regards to the electronics sector, the opportunities for this type of external collaboration are scarce. The sector is highly competitive and closed-off to outside influences. The circular business we analyzed all, with the exception Lizee, involved working with end-consumers once the products had left the retailer stage of the supply chain. It could be linked to the fact that the strategic fit is not optimal in this sector, the longer life-span of the products entails that an increase in reuse (e.g. secong-hand phones) and functional economy will most likely impact overall sales of newer products. An industry-wide change is needed in order for this sector to move towards circularity and individual external partners are not the key to that. However, initiatives such as Back Market showed that there was profitability in the reuse of mobile devices and companies such as Apple (V) or Samsung (U)have started to sell reconditioned mobile devices themselves, there may be an avenue of thought here as to whether Back Market and others alike acted as an Impact extender by presenting themselves

as competitors.

In conclusion, after analyzing the different ways in which our chosen innovative circular partnerships influenced circularity in both sectors's supply chains and to which extent, as well as their effect on the barriers against a CE, we believe that introducing these partnerships within a given sector's supply chain can very well unlock or at least foster the implementation of a circular economy and hinder the chain reaction between the barriers, but not in every sector. In our analysis, we discovered that a sector such as the Agri-food sector is much more open throughout its supply chain and the opportunities for circular partnerships are much more present. The actors are more independent in their decisions and can foster circularity at their level. However, a sector such as the electronics sector does not react to nor allow much circular partnerships to enter its supply chain. Most of the actors are restricted by an upstream decision concerning products. Moreover, the sector's constant technological motion and high competitivity doesn't allow for established circular businesses to emerge and thus the sector isn't presented with a successful circular option to entice change.

An avenue to be taken in the future could be to dive deeper into a specific sector or actor within a sector and closely analyze the ins and out of circular opportunities within that framework. This thesis is meant to give a general answer to this phenomenon but a more specific lens could very well reveal insightful.

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Appendix A

Appendix

A.1 Les 7 piliers de l'économie circulaire

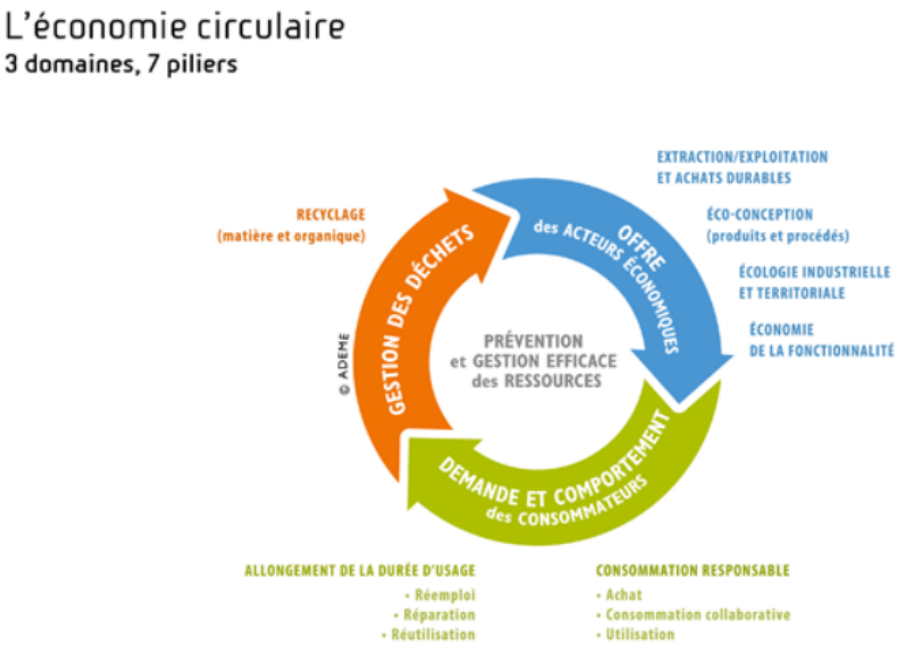

Figure A.1: Les 7 piliers de l'économie circulaire (ADEME, 2022)

A.2 Industrial releases of pollutants to air and economic activity in the EU-27 (2010-2020)

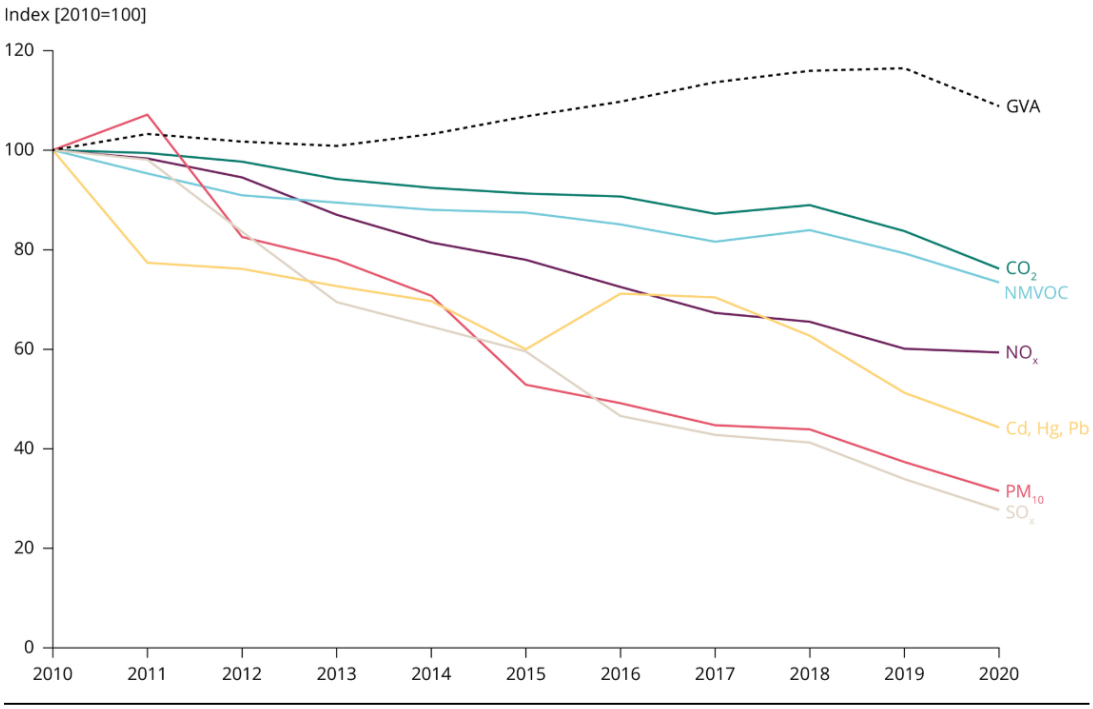

Figure A.2: Industrial releases of pollutants to air and economic activity in the EU-27 (EEA, 2022)

A.3 The win-win potential of circular economy (2018)

A.4 Qualitative employment effects of a circular economy transition (EMF, 2015)

A.5 Heatmap of Circular Economy Barriers

A.6 Representative definitions of Supply Chain Management

A.7 Definitions of Green Supply Chain Management

A.8 Nine partner characteristics in a circular economy

A.9 Pigmento Naturale waste Management Representation

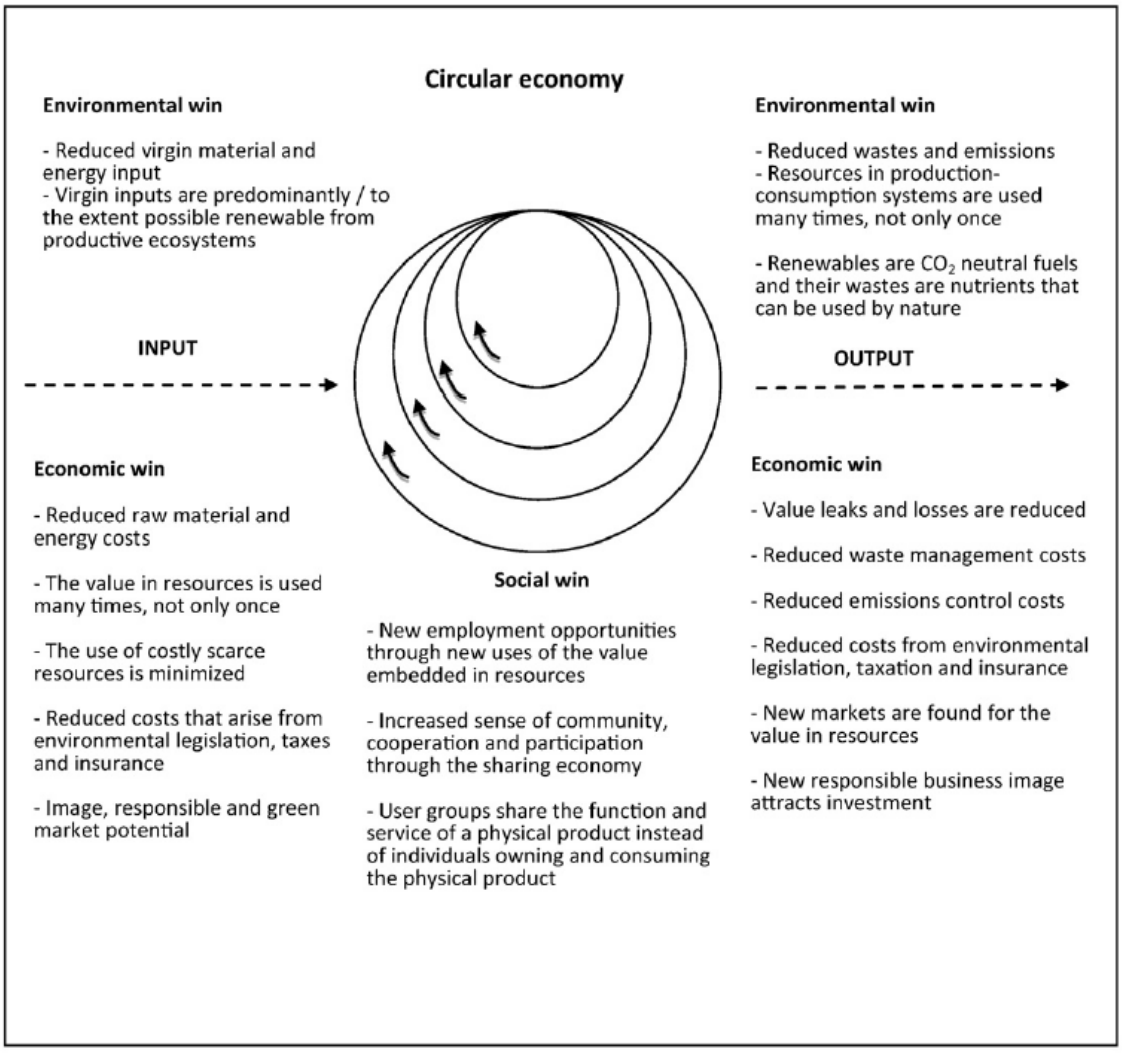

Figure A.3: The win-win potential of circular economy (J. Korhonen et al. / Ecological Economics 143 (2018) 37–46)

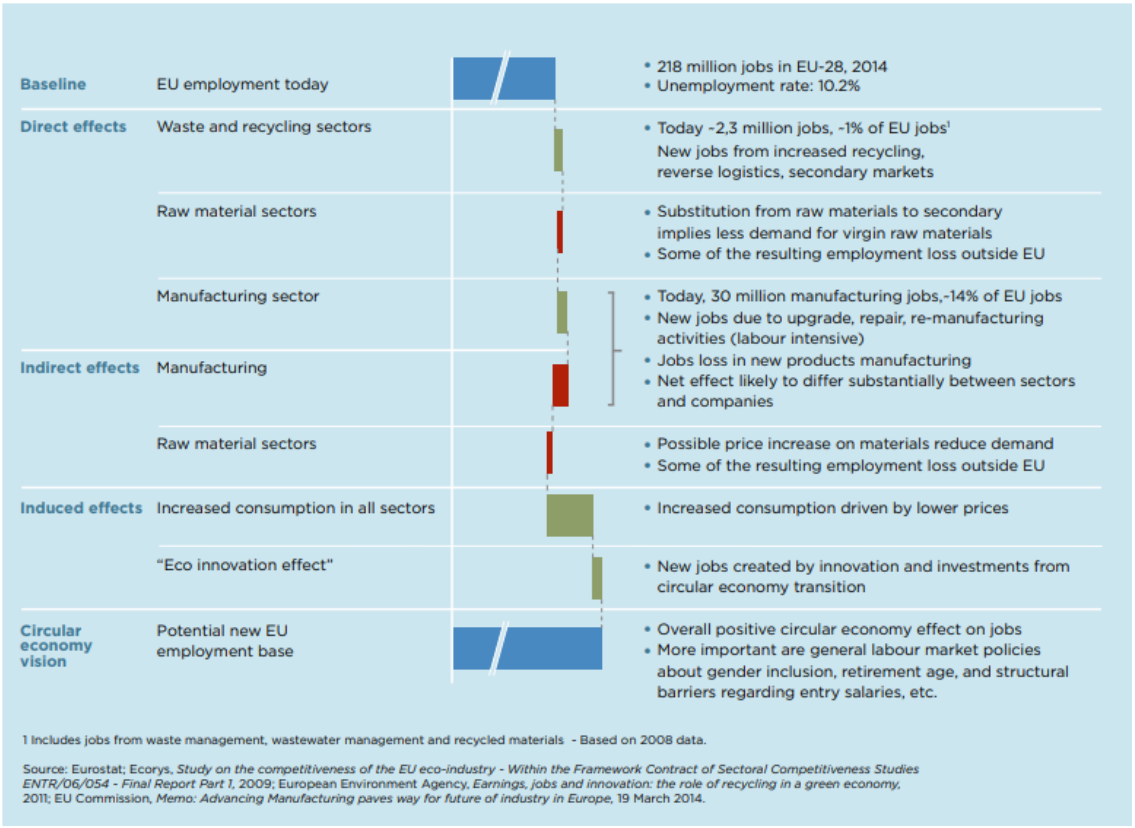

Figure A.4: Qualitative employment effects of a circular economy transition (EMF, 2015)

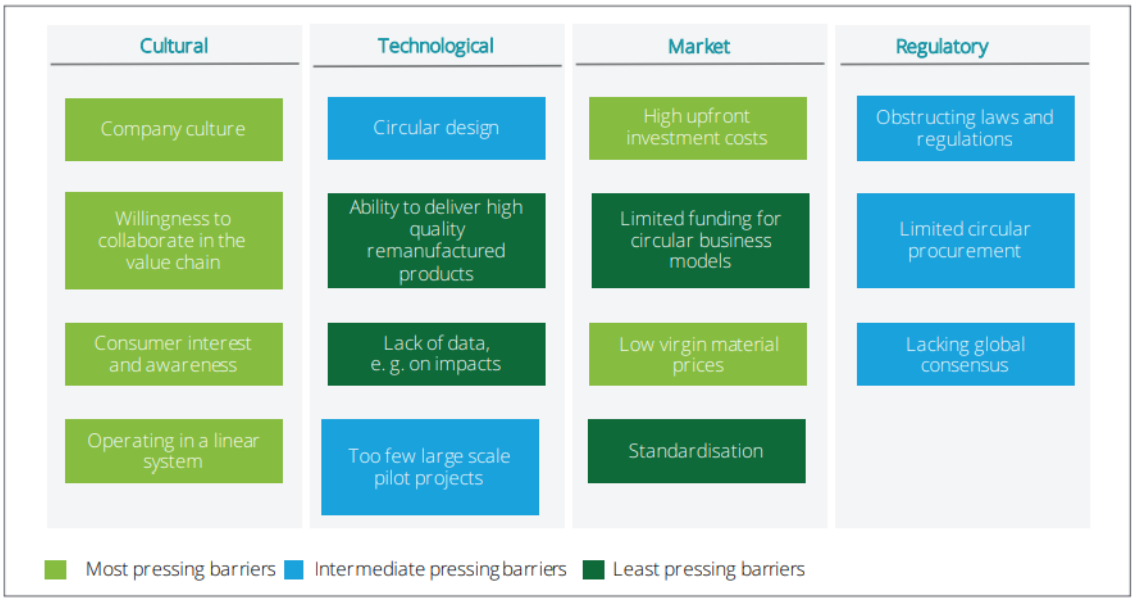

Figure A.5: Heatmap of Circular Economy Barriers (Deloitte, 2017)

Definition source	Definition	Characteristics exhibited[a]						
		Flow focus[b]	Coordination focus[c]	Stakeholder focus[d]	Relationship focus[e]	Value focus[f]	Efficiency focus[g]	Performance focus[h]
Lambert et al., 1998, p. 1	The integration of key business processes from end-user through original suppliers that provide products, services, and information that add value for customers and other stakeholders.	■	■	■		■		
Larson and Rogers, 1998, p. 2	The coordination of activities, within and between vertically linked firms, for the purpose of serving end customers at a profit.		■	■		■		
Walters and Lancaster, 2000, p. 160	The management of the interface relationships among key stakeholders and enterprise functions that occur in the maximization of value creation which is driven by customer needs satisfaction and facilitated by efficient logistics management.			■	■	■	■	
Mentzer et al., 2001, p. 18	The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.		■	■				■
Lummus et al., 2001, p. 428	All the activities involved in delivering a product from raw material through to the customer, including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities.	■	■	■				■
Gibson et al., 2005, p. 22	Encompassing the planning and management of all activities involved in sourcing and procurement, conversion, demand creation and fulfillment, and all logistic management activities.	■	■					
Eng, 2005, p. 4	Managing the inputs of goods or services including a range of activities not only within a single department in an organization but also from different departments and outside the organization, for final users from procurement of raw materials through to the end of the products' useful life.	■	■	■	■			
Stock and Boyer, 2009, p.706	The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction.	■	■	■	■	■	■	

[a] The identification of the "characteristics exhibited" was inspired by the approach in Stock and Boyer (2009).
[b] *Flow focus*: The definition includes language related to the flows of materials, services, or information. Reference to the supply chain was considered to implicitly refer to this focus area.
[c] *Coordination focus*: The definition includes reference to coordination within the organization or between organizations. Reference to the supply chain, the product life cycle, or activities across channels was considered to implicitly refer to this focus area.
[d] *Stakeholder focus*: The definition includes explicit reference to stakeholders, including (but not limited to) customers, consumers, and suppliers.
[e] *Relationship focus*: The definition includes reference to the networks of internal and external relationships. This includes mentioning the coordination of inter-organizational business processes.
[f] *Value focus*: The definition includes reference to value creation, including increasing profit or market share and converting resources into usable products.
[g] *Efficiency focus*: The definition includes reference to efficiency, including a reduction in inputs.
[h] *Performance focus*: The definition includes reference to performance, including applying performance measures, improving performance, improving competitive capacity, monitoring, and achieving goals.

Figure A.6: Representative definitions of Supply Chain Management (Journal of Cleaner Production n°52 p.329-341, 2013)

Definitions of green supply chain management (GSCM).

Definition source	Definition	Scopus citations	Used by
Handfield et al., 1997	Application of environmental management principles to the entire set of activities across the whole customer order cycle, including design, procurement, manufacturing and assembly, packaging, logistics, and distribution.	132	
Zhu et al., 2005, p. 450	An important new archetype for enterprises to achieve profit and market share objectives by lowering their environmental risks and impacts while raising their ecological efficiency.	91	
Hervani et al., 2005, p. 334	Green Purchasing + Green Manufacturing/Materials Management + Green Distribution/Marketing + Reverse Logistics	81	
Sheu et al., 2005	Combination of both the product manufacturing supply chain and used-product reverse logistics chain.	85	
Srivastava, 2007, pp. 54–55	Integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life.	170	Shang et al., 2010; Caniato et al., 2012; DeGiovanni and EspositoVinzi, 2012
H'Mida and Lakhal, 2007, p. 6	The practice of monitoring and improving environmental performance in the supply chain during a product's life cycle.	0	
Lakhal et al., 2007	Olympic green supply chain characterized by five-circled flag of the Olympics as zero emissions, zero waste in activities, zero waste of resources, zero use of toxic substances, zero waste in product life-cycle, in addition to green inputs and green outputs.	2	
Srivastava, 2008, p. 535	Integration of sound environmental management choices with the decision making process for the conversion of resources into usable products.	70	
Lee and Klassen, 2008, p. 575	A buying organization's plans and activities that integrate environmental issues into supply chain management in order to improve the environmental performance of suppliers and customers.	11	
Albino et al., 2009, p. 88	A strategic approach addressed to extend environmental measures to the whole supply chain.	17	
Wee et al., 2011, p. 603	Integration of environment considerations into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, and end-of-life management of the greening products.	0	
Gavronski et al., 2011, p. 875	The complex of mechanisms implemented at the corporate and plant level to assess or improve the environmental performance of a supplier base.	0	
Lau, 2011, p. 874	Integrating environmental thinking into closed-loop supply chain management.	0	
El Saadany et al., 2011, p. 1203	Reducing energy and virgin raw material usage and waste generation, and increasing product recovery options. Greening usually refers to the forward supply chain functions such as production, purchasing, materials management, warehousing and inventory control, distribution, shipping, and transport logistics.	0	
Wu and Pagell, 2011, p. 578	The environmental dimension of sustainability in a supply chain context.	2	
Gnoni et al., 2011, p. 129	An approach that aims to integrate environmental issues into SC management procedure starting from product design, and continuing through material sourcing and selection, manufacturing processes, the final product delivery and end-of-life management.	0	
Yeh and Chuang, 2011, p. 4244	Management between suppliers, their products and environment, that is to say, the environment protection principle is brought into suppliers' management system. Its purpose is to add environment protection consciousness into original products and to improve competitive capacity in markets.	1	
Sarkis et al., 2011, p. 3	Integrating environmental concerns into the inter-organizational practices of SCM including reverse logistics.	9	
Kim et al., 2011	A set of practices intended to effect, control and support environmental performance by allocating possible human material resources and redefining organizational responsibilities and procedures.	0	
Parmigiani et al., 2011	The impact of supply chains on environmental performance.	0	
Buyukozkan and Cidci, 2012	A way for firms to achieve profit and market share objectives by lowering environmental impacts and increasing ecological efficiency.	0	
Andic et al., 2012	Minimizing and preferably eliminating the negative effects of the supply chain on the environment.	0	

Note: These 22 unique definitions of GSCM are from a total of 124 identified articles analyzed.

Figure A.7: Literature review of Green Supply Chain Management definitions (Journal of Cleaner Production n°52 p.329-341, 2013)

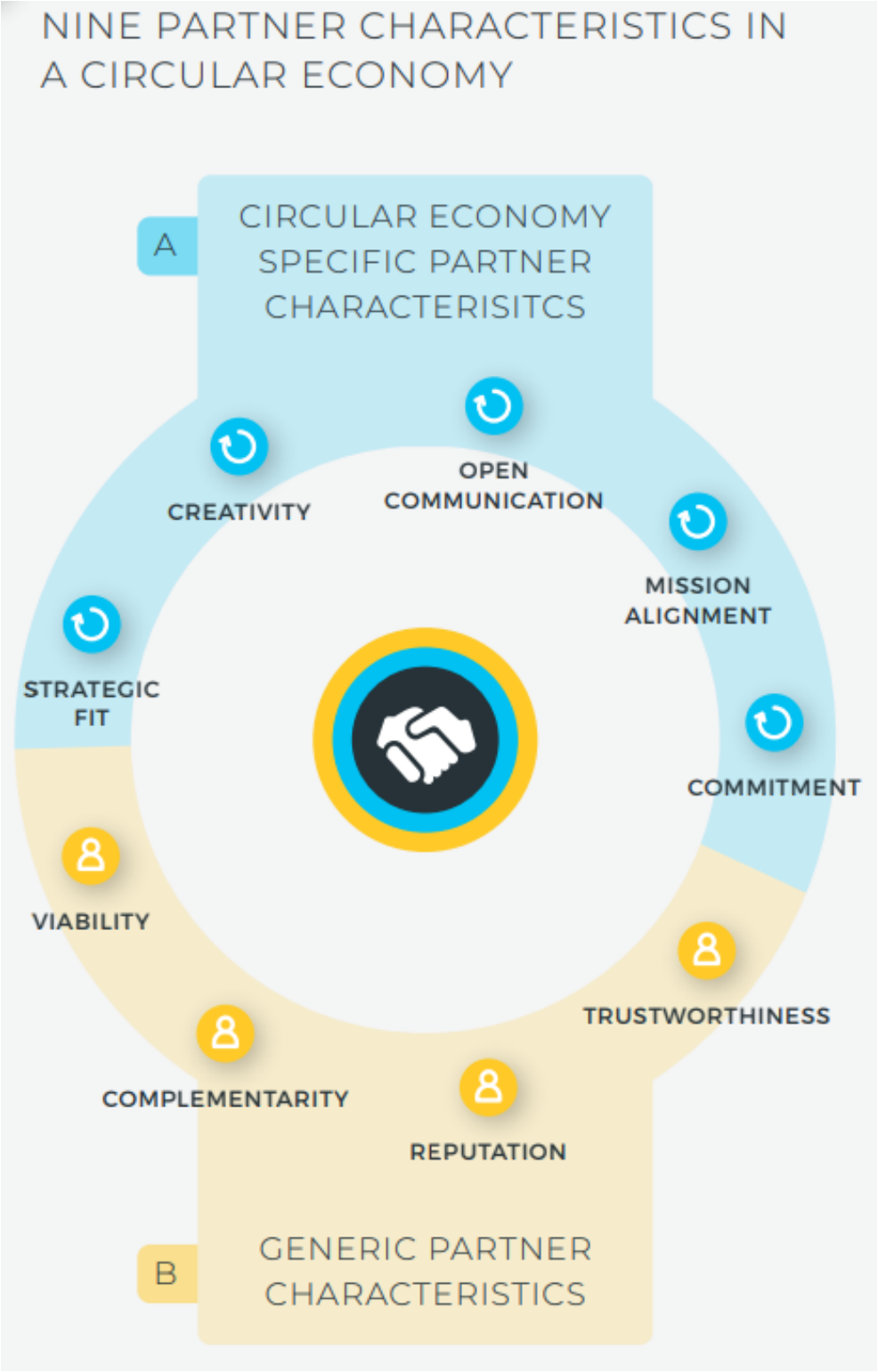

Figure A.8: Nine partner characteristics in a circular economy (Circle Economy, 2022)

Figure A.9: Pigmento Naturale waste management model, (Pigmento Naturale Website, 2023)

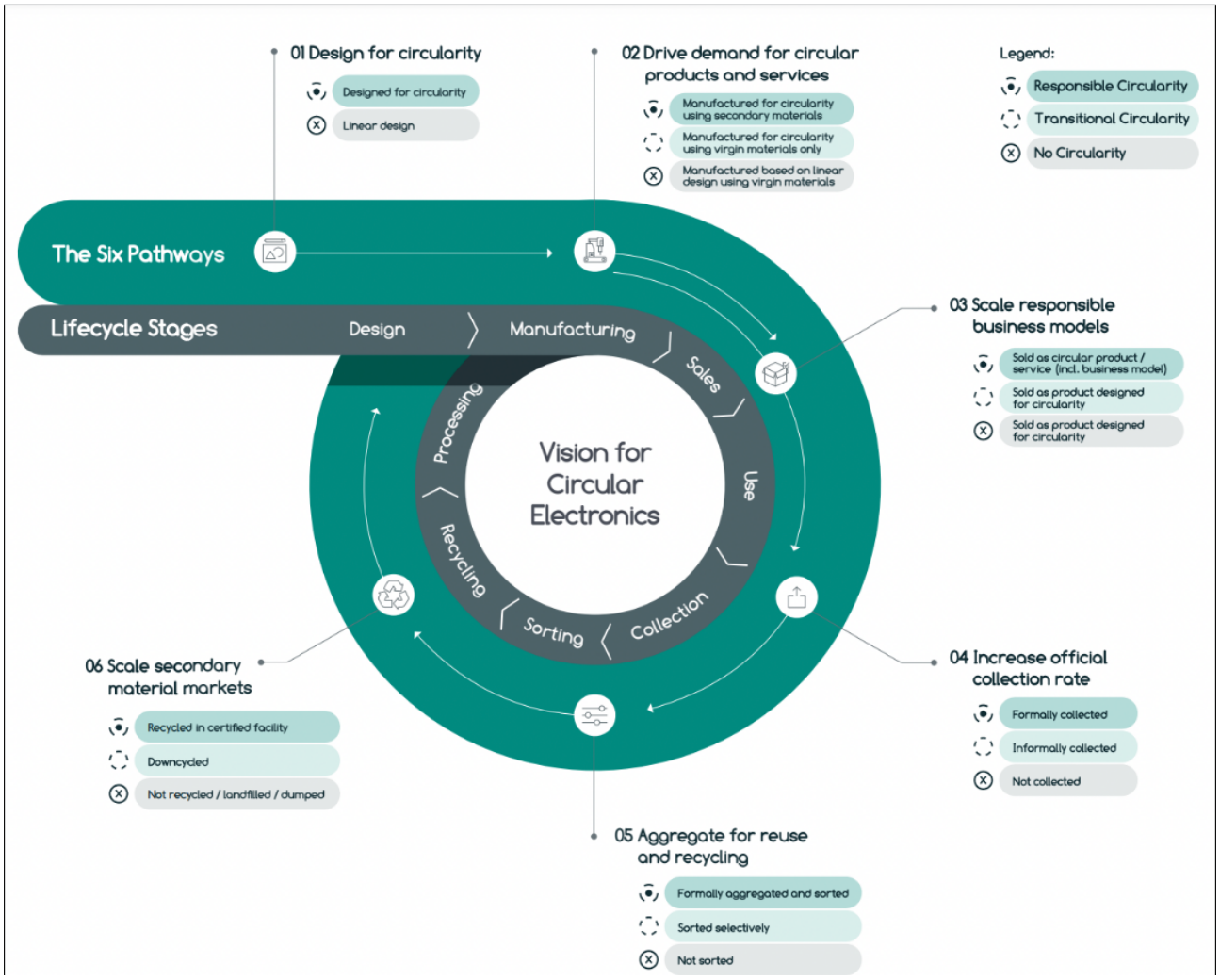

Figure A.10: Vision for Circular Electronics, (Circular Economics Roadmap, 2022)

Figure A.11: Explore the 6 pathways of our Roadmap, (Circular Economics Roadmap, 2022)

Figure A.12: The relationship between Back Market and its merchants, (Back Market's website, 2022)

	Sustainable Procurement	Eco-Design	Industrial and territorial ecology	Functional economy	Responsible consumption	Extension of the duration of use	Recycling
Agri-food sector							
CCM Tech	X	X	X				X
De Clique							X
Winnow	X	X					
Get Wonky					X	X	X
2good2go					X	X	
Swapbox	X	X		X	X		
Protix	X	X					X
Pigmento Naturale							X
CelluComp							X
Electronics sector							
Back Market					X	X	X
ComplemenTerre					X	X	X
Re-Tek				X		X	X
R.E.I Industry							X
Lizee				X			
Ahrend	X						
Signify	X						
Textifloor	X						

Figure A.13: Initiatives analysis through the 7 Pillars of the CE

UNIVERSITÉ CATHOLIQUE DE LOUVAIN
Louvain School of Management

Place des Doyens, 1 bte L2.01.01, 1348 Louvain-la-Neuve
Boulevard Emile Devreux 6, 6000 Charleroi, Belgique
Chaussée de Binche 151, 7000 Mons, Belgique

www.uclouvain.be/lsm