X-Economies: Multiple Value Creation in the Food Industry

A Comparative Case Study

Picture 1. University College Maastricht (Wikipedia, n.d.)

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Abstract

X-economies are alternative economic models that have emerged in response to our unsustainable consumption habits which have resulted in resource depletion and climate change, among other pressing issues. These alternative models aim for more sustainable and resilient economies by addressing and changing unsustainable consumption patterns as well as managing resources more responsibly. The need to change unsustainable consumption habits is predominant in the food sector as food systems have a huge environmental footprint and are responsible for a large share of greenhouse gas emissions. Therefore, our current food system must change immediately and rapidly. Too Good To Go, De Clique, and AeroFarms are three food businesses that integrate different X-economies, namely the circular, green, social, digital, and data economy, thereby advancing the sustainability of the food sector and creating multiple value for the environment, society, and economy. It is key to adopt and integrate X-economies in more and more businesses and corporations within the food sector and beyond to move towards a more sustainable future.

Keywords: X-Economies, alternative economies, sustainability, food industry, multiple value creation, comparative case study analysis

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Part I:

Introduction and Literature Review

1. Introduction

"The economy of the future might be called the 'spaceman economy', in which the earth has become a single spaceship, without unlimited reservoirs of anything".

– Kenneth E. Boulding (1966, p.7)

The spaceman economy is an idea coined by Kenneth E. Boulding (1966) to stress our planet's limited resources and the desperate need for efficient management of them. We must treat our planet as if it were a ship traveling through the vastness of space with only finite amounts of resources on board (Boulding, 1966). We have what is on the ship, waste cannot leave, and resources cannot come, so we must manage it adequately. To succeed in the mission to ensure the future functioning of our spaceship earth, alternative economic models are essential to properly manage our system of resources. To address our unsustainable consumption pattern and the economic impact on depleting natural resources several new and alternative economic models have arisen to propose solutions. All of these so-called X-economies intend to fix the various flaws our current economic system has created. Existential global challenges such as climate change are a "booming wake-up call" (Gibson-Graham & Roelvink, 2011, p.29) that our economy can't continue with business as usual. Hence, these alternative models aim for a more sustainable, resilient, and responsible economy in line with the Sustainable Development Goals (SDGs) proposed by the United Nations (UNU-Merit, 2020). We must aim for growth without economic growth.

X-economies include a wide range of elements aiming to steer our spaceship in the right direction, such as technological innovations, new policies, and cultural transitions. The 'X' symbolizes the unknown amount of alternative economic models since we only have limited knowledge about their existence (UNU-Merit, 2020). Hence, the X-economy is an umbrella term for all of these economic models and how they interact with each other. The latter point must be stressed, as their synergies are just as important as their individual existence – they help bring

about the sustainable and resilient future the X-economies aim for. With our research, we aim to investigate these synergies in greater detail and fill potential research gaps.

This report reveals the value of the interaction of the circular, green, social, digital, and data economy by analyzing three case studies operating within the food sector. The cases include 'Too Good To Go', 'De Clique', and 'AeroFarms'. This focus was chosen since changing our food system is one of the most impactful tools to address key issues our society is facing (The Ellen MacArthur Foundation, n.d.). Particularly the food sector is one of the hardest to transform, as it is essential to our day-to-day life and consumption patterns are difficult to change. Nevertheless, a more sustainable food system offers opportunities to create a positive impact for the environment, society, and the economy. This includes a reduction of greenhouse gas emissions, the preservation of livelihoods, as well as the protection of biodiversity (United Nations Environment Program [hereafter: UNEP], 2021). It is thus imperative to investigate current implementations of X-economies within this sector and examine the synergies to evaluate their success. For the analysis, the Multiple Value Creation Framework [hereafter: MVC] is chosen to address the value the interaction of these X-economies creates for our planet. Therefore, the following research question guides our report*: How do the interactions of the circular, green, social, digital, and data X-economies create multiple values within the food businesses Too Good To Go, De Clique, and AeroFarms?*

This research proposal is structured as follows. Firstly, the literature review provides an explanation of each X-economy used in this report. It also discusses the relevance of the food sector in greater detail. Secondly, the methodology for the data collection and data analysis is discussed, as well as the MVC framework guiding this report. Thirdly, the three case studies are elaborated upon and analyzed followed by a comparative discussion. Lastly, the report concludes and discusses limitations and future research directions.

2. Literature Review

In the following, this literature review firstly assesses and analyzes previous research in the field of X-economies. Secondly, the 5 chosen alternative economic models used in this report are defined. Finally, the review concludes with an elaboration of the relevance of the food sector as the focus of this report.

2.1. Previous research

Various theoretical research in the realm of X-economies already exists. This report ties in with previous research by Türkeli et al. (2021), Schlömann (2020), and Ranjan and Scheibe (2022) by conducting a qualitative analysis of X-economies within three different case studies. Türkeli et al. (2021) and Schlömann (2020) both conducted quantitative analyses on the interaction of different economies. While Schlömann (2020) focused on a citation analysis by evaluating a correlation of keywords between the digital and circular economy, Türkeli et al. (2021) conducted research in finding commonalities among keywords from different X-economies. This research was important for Ranjan and Scheibe (2022), as it provided them with a foundation for creating a quantifiable code that analyzes articles according to the different X-economies. Their work produced a glossary of all alternative economic models that currently exist, which provides a fundamental basis for this report. However, Ranjan and Scheibe (2022) neglected the analysis of the interaction between those different economic models and whether these kinds of synergies could successfully create value. Given this previous research, the current report aims to use it as a basis and begin to expand the pool of literature on X-economy interactions. In doing so, the report assesses the interaction of 5 key alternative economic models - the circular, green, social, digital, and data economies. Their synergies are applied to and analyzed in three different case studies.

2.2. The Circular Economy

The circular economy aims to extend the life cycle of materials through the four R-framework. The four R's refer to reducing, reusing, recycling, and restoring materials and products instead of throwing them away (Ranjan & Scheibe, 2022). When implementing circularity, it is advised to follow the respective order of the framework. First, one should reduce the use of a particular product, and if this is not possible, try to reuse it. If both options are not feasible, then one should aim to recycle and restore that product (Ranjan & Scheibe, 2022). Through the four R's, the circular economy wants to transform the "take-make-consume-throw away pattern" (European Parliament, 2015, para. 8) of our current linear economy by reducing waste to a minimum and keeping material goods in circulation.

The circular economy received increased attention from academics as well as the private sector as climate change forces us to reconsider our resource usage. We only have a limited number of raw materials available on our planet and with a growing population and increasing demand, it is crucial to reuse these resources (European Parliament, 2015). Therefore, the circular economy and its idea of material circulation are important as it objectifies sustainable development to the advantage of present and future generations (Ranjan & Scheibe, 2022).

2.3. The Green Economy

The green economy provides a potential solution to environmental destruction and resource scarcity. To put it differently, the green economy is a low-carbon, resource-efficient, and socially inclusive construct. Although differing definitions exist, for Ranjan and Scheibe (2022) green economies follow resource efficiency while prioritizing environmental protection in exchange for economic growth. Accordingly, this definition recognizes resource scarcity produced by economic growth. Consequently, technological innovation becomes an important driver to renew the classical image of economic growth through resource protection. As a result, an interdisciplinary approach is necessary, using investment opportunities toward renewable energy, biodiversity conservation, resource efficiency, recycling, and green infrastructure (Newton & Cantarello, 2014).

Following the conceptualization of the United Nations Environmental Programme (UNEP, 2011), the green economy aims to stimulate human development over economic growth. The United Nations Conference on Trade and Development (2010) emphasizes human equity to protect future generations from (social) inequalities and environmental threats. Different from neo-classical perceptions of economic growth, this definition provides a foundation for social justice, intended to protect future societies from resource scarcities.

2.4. The Social Economy

Actors operating within the social economy are driven by principles of solidarity, equality, and redistribution of profits to guarantee basic human needs (Ranjan & Scheibe, 2022). Institutions

and companies within the social economy put people over capital and intend to reinvest profits back into the community (OECD, n.d.). Therefore, they aim at social welfare instead of profit maximization. Moreover, the social economy is often described as an interaction between the public, the civil, and the private sector (Ranjan & Scheibe, 2022). An example of this interaction is voluntary organizations and social enterprises that cooperate to create a positive impact on the environment collectively (Ranjan & Scheibe, 2022).

The social economy should be embraced as it aims for social justice and cohesion. Our society relies upon social capital which is often seen as trivial in our current capitalist economy. Therefore, the social economy is important for fulfilling basic human needs and embracing an inclusive society (Ranjan & Scheibe, 2022).

2.5. The Digital Economy

Through the developments of information technology, the digital economy has changed production systems across industries. As Ranjan and Scheibe (2022) have found in previous work, the digital economy is driven by real-time data that is exchanged through information technology. In line with the definition by the International Monetary Fund (IMF, 2018), the digital economy processes real-time data through digital process systems. Indeed, the IMF (2018) frames any economic activity to be digitized in this context. Hence, any (economic) activity, inter alia fixed-capital formation, finance, and cross-border flows, transforms business transactions towards being computerized. Through the prism of X-economies, the digital economy causes network effects being catalyzed by 'big-data' that stimulate the emergence of multidimensional business models. Although, as the OECD (2015) argues, the digital economy calls for technological change

towards ‘smart-tech’ that intends to find solutions to everyday challenges. According to the United Nations Tech Report (2019), this may include implementing cloud computing in educational sectors or adjusting sustainable development in the agricultural sector through smart technology (Türkeli et al., 2021).

2.6. The Data Economy

Within the world of ‘big-data’, as referred to before, the data economy creates multi-value for the global economy in innovative, productive, and communicational dimensions. As Ranjan and Scheibe (2022) state, the data economy maximizes decision-making through greater informational resources, as collected from customers. According to Rantanen and Koskinen (2020), data compromises network effects through the exchange of data. From a business perspective, data is the source for network opportunities among customers, share- and stakeholders. Although the exchange of data enables businesses to stimulate their (economic) value chains, their misuse can cause privacy issues for all parties involved.

2.7. Relevance of the food sector

We choose to focus on the food sector for one major reason. Transforming our food sector into a sustainable system is one of the most impactful things we can do to address climate change (The Ellen MacArthur Foundation, n.d.). Why? Because food systems have a huge environmental footprint. According to the World Economic Forum’s Global Risks Perception Survey 2019/20, “climate-related issues dominated the top five long-term risks, all of which have a direct or indirect link to the global food system” (UNEP, 2021, p.11). Our food systems occupy about 50%

of habitable land, consume about 70% of available fresh water, and are responsible for up to 37% of global greenhouse gas emissions (UNEP, 2021). The latter issue is largely caused by food waste and loss, as one-third of all food produced ends up in landfills (McCarthy & Liu, 2017). As food degrades on these sites, it becomes a significant source of methane, a greenhouse gas that is more than 25% as potent as carbon dioxide (United States Environmental Protection Agency, 2022).

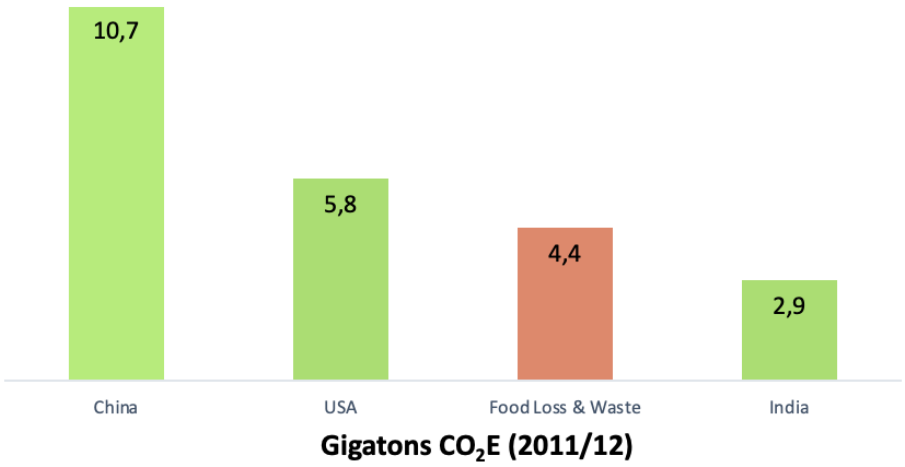

Figure 1: Graph of biggest greenhouse gas emitters

As can be seen in figure 1, if food loss and waste were its own country, it would be the third-biggest greenhouse gas emitter worldwide, according to the Food and Agriculture Organization of the United Nations (2011). Food loss therefore significantly contributes to anthropogenic climate change and global warming. Not only that, but food waste is also a source of valuable resource loss in our food system (UNEP, 2021).

The environmental impacts of our current non resilient and unsustainable food system are evident. However, the irresponsible management of the food sector also has grave repercussions for society. Social burdens such as food security issues and the unequal distribution of food may lead to an unprecedented worldwide food crisis if our current food system is not transformed (Huang et al., 2021). As the world population increases, more and more innovations

are needed and agricultural output must be expanded to satisfy the growing demand for food (Boyaci-Gündüz et al., 2021).

The transformation of the food sector into being more regenerative and resilient is urgent and constitutes a growing concern for many countries. Financial burdens are also addressed by transforming our food systems, as particularly food waste costs the EU an estimated 143 billion Euros per year (Fusions, 2016). To make this urgent transition, (technological) innovations are highly important since they are key to solving some of the challenges the food sector is facing. Some examples of current innovations in the food sector include the "digitalization of the sector [...], an increased focus on production management techniques, [...] and the adoption of new product and packaging development" (Lazaro-Mojica & Fernandez, 2021, p.163). To implement these innovations, forward-thinking businesses that want to change our current food systems can play a crucial role according to UNEP (2021). The chosen case studies all contribute in their own way towards changing our food systems by combining different alternative economic models that provide solutions to our current food economy.

As a business-to-consumer (B2C) network, Too Good To Go creates deep awareness amongst consumers and their partners about the issue of food waste. By offering an accessible, digitized way to decrease this waste both on the business and household level, TGTG enables a way to directly take action against this issue, which is a key way in which businesses can contribute to changing our food systems as argued by UNEP (2021). This incentivizes consumers to change their consumption in an easy way, as well as encourages businesses to integrate more sustainability into their business models. The young start-up De Clique makes a positive impact on our food sector by aiming for a regenerative system. By tackling food waste and loss at the production, processing, distribution, and retail level, the business is taking important action in making our food sector more sustainable. AeroFarms uses a combination of data science, machine learning, and artificial intelligence in order to predict and discover the mechanisms of plant growth in a sealed and therefore constant environment. Together with major strides in automation within these plant factories, efficiency in cultivation within both the mechanical, biological, and technical cultivation is elevated to a level that was unknown in regular agriculture. Resulting in a 390x productivity per square meter, 95% less water usage, no pesticides, and no

need for deforestation or land infertility. All the while being closer to the growing urban population.

For all of these innovations to succeed, these businesses to grow, and the food sector to transform, we need a fundamental shift in mindset. This needs to happen at all levels – from the policy and stakeholder level to the consumers themselves. Our collective responsibility for the sustainable management of resources and the resilience of our food system must be taken seriously. This report aims to provide insight into businesses that have already started taking this responsibility seriously and implemented X-economies into their business model. Working with innovations that can transform the food sector, the chosen case studies show what the future of our food system can look like.

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Part II:

Methodology

3. Methodology

In the following, we elaborate on the methodology used during the data collection and data analysis phases of our research. Firstly, the data collection is explained. As that is heterogeneous for each case study, information about the data collection in each case study is separately elaborated on. Following, the theoretical framework, namely the Multiple Value Creation Framework is explained.

3.1. Data Collection

In this project, the data collection is heterogenous for each case study. However, there are common characteristics to this data collection process. The collected data shall be of qualitative nature. The possible sources of this data are materials such as but not limited to academic articles, impact reports, statements on companies' websites, press releases, and interviews with companies' employees.

For this case study, we opted for a data collection that is twofold, including both a systematic literature review and interviews. For the first part, we reviewed different databases, such as Jstor and Scopus, to get an overview of the existing literature on Too Good To Go [hereafter: TGTG] and its link to alternative economic models. The search on these databases employs a query string using Boolean operators and terms such as 'Too Good To Go', 'X-econom*', as well as 'alternative' and 'economic model*'. The results were reviewed to find some relevant articles; however, the quantity of them was not satisfactory. Hence, building on this academic literature search, we conducted Google searches to access more recently published articles and information that is not included in academic literature. This turned out to be crucial since we

found relevant impact reports and published interviews with employees of TGTG. For instance, EU-Startups (2019) published an interview with TGTG's CEO Mette Lykke about their business model and mission to fight food waste. Important impact reports include the United Nations Environment Program's (2021) report on the role of business in transforming food systems. Results like these show that the Google searches constitute an important addition to our literature review.

For the second part, we conducted speed interviews with Maastricht-based businesses that are working with TGTG to get insights into their experiences and opinions with the app. We decided who to interview based on a systematic process of elimination. In our first step, we eliminated all businesses that are not local to Maastricht, which cut our pool of available businesses from 45 to 12. In our next step, we eliminated similar businesses to remain with one business of each kind, such as hotels or bakeries, since we aimed to interview different businesses to highlight multiple perspectives. This is how we narrowed down our list and came to interview the co-founder of the restaurant 'SoupBros', the front desk manager of 'Mabi City Centre Hotel', and a saleswoman at the bakery 'Bakkerij Voncken'. While this is a small sample, it gave us an interesting and versatile insight into how and why different businesses work with TGTG, what they think of the concept, and how it helps them incorporate sustainability into their businesses. The transcript of each interview may be found in Appendix A-C.

These interviews, alongside our systematic literature review, are imperative for the further analysis of the MVC framework, as we gained important insights into how TGTG creates value with the synergies of the different X-economies.

de CLIQUE

For De Clique, the data collection largely relied on the qualitative aspect of it. Since it was only established in 2019, it was clear that the pool of literature surrounding this case study would not be very large. During our systematic literature review, we were thus unable to find a satisfactory

amount of relevant and current academic articles. Hence, we employed Google searches to find more recently published articles, impact reports, and interviews with the company. After collecting some data this way, we contacted De Clique to schedule an interview to gather more information directly from the source.

As De Clique is a rather small company, we were able to get a tour of their hub based in Utrecht and conduct an interview with an emergent design. During the tour, two employees showed us around the facilities and explained the different recycling processes. Moreover, we were able to ask their processing specialist Max a couple of questions about the process of using coffee grounds to grow oyster mushrooms. The tour lasted around 30 minutes and gave us an interesting insight into how their business works. Afterward, we interviewed De Clique's logistics and sales officer Teun for another half hour. Specifically, we focused our questions on the company's mission, contribution to circularity, and future plans. The combination of these methods gave us important insights from a practical and theoretical viewpoint and helped establish the basis for further analysis with the MVC framework. The transcript of these interviews may be found in Appendix D-E.

AEROFARMS

AeroFarms is headquartered in New Jersey, the United States. This posed a challenge when trying to get in touch with them to schedule an interview. In order to better understand their operations, we sent an interview invitation via email to their team; however, we did not get a response. Nevertheless, various executives of the company have participated in multiple interviews, which are available online. We consider these interviews as secondary data for our later MVC analysis.

In addition to online interviews, we also employed a systematic literature review on different databases. Yet, in contrast to TGTG, AeroFarms is not as well-known, with less

international recognition. Hence why we also opted to largely rely on resources such as the company's website, investor presentations, and impact report to further our analysis.

3.2. Data Analysis for Comparative Case Studies - The Multiple Value Creation Framework

In order to carry out comparative case studies, we chose to employ the multiple value creation framework as its main analytical lens. Kemp (2020) indicates that the MVC is a general identifier for various approaches aimed at ensuring that the main purpose of companies is not mere profit maximization. Their business models should rather aim at creating value for society as well as the environment, not just for the economy. Some examples of these various approaches are Corporate Social Responsibility (CSR), the Triple Bottom Line, Shared Value Creation, and Sustainable Business Model Innovation (SBMI).

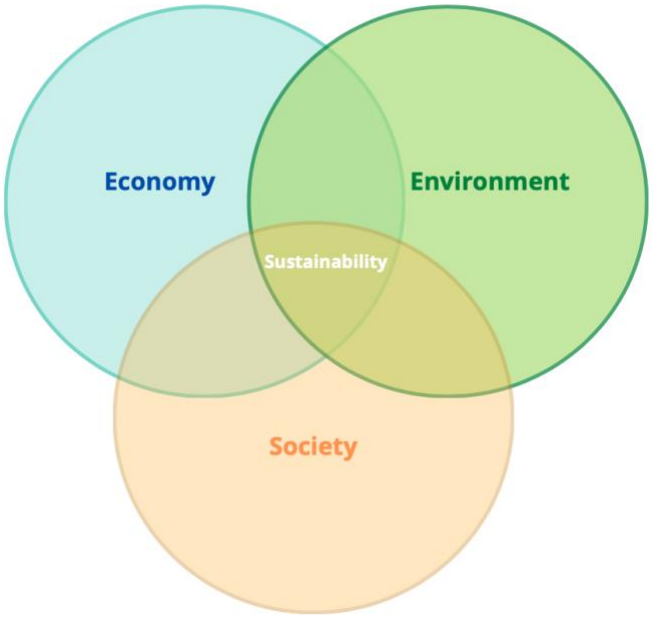

Figure 2: The Multiple Value Creation Dimensions

Despite their different names, these approaches share the same issue categorization of three domains: society, environment, and economy. Regarding the CSR approach, Schwartz and Carroll (2003) show that the CSR model can be broken down into economic, legal, or ethical domains; however, their examples have the pattern of economic profit-maximizing corporate actions being stopped due to either environmental or socio-ethical concerns. The triple bottom line approach follows the same issue categorization by breaking sustainability into the three social, environmental, and economic domains (Rogers & Hudson, 2011). The same case applies to the SBMI and its associated canvas (Gerlach, 2015). However, it is important to notice that these different approaches aim to zoom in on the mechanisms that help solve the identified social or environmental issues while maintaining the economic approach.

In general, MVC is an umbrella term for various approaches with each approach highlighting a mechanism for corporations to obtain sustainability. Therefore, in order to highlight how an enterprise can obtain sustainability through a combination of multiple X-economies, researchers of each case study shall implement the MVC under the *X-economies procedure*. We define the *X-economies procedure* as a series of questions as follows:

- Which X-economies does the discussed enterprise pursue?
- How are these X-economies combined within the discussed enterprise?
- What are positive synergic (un)intentional outcomes of the discussed enterprise? Does the enterprise's combination of X-economies help obtain these intentional outcomes?
- What are negative synergic (un)intentional outcomes of the discussed enterprise? Does the enterprise's combination of X-economies produce these unintentional outcomes?

The finding of these questions for each case will be systematically represented in the model table below in order to facilitate the comparative discussion. The outcomes shall also be categorized into the three spheres of environment, society, and economy. The evidence, however, shall not be included in this table for brevity.

X-economies	Value creation	Outcomes	Intentional	Unintentional
	Environment			
	Society			
	Economy			

Table 1: Model table for each case's summary of findings

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Part III:

Case Studies - Too Good To Go, De Clique, and AeroFarms

4.1. Case Description

Founded in 2016 in Copenhagen, Denmark, Too Good To Go is a B2C platform that has revolutionized the way we can contribute to fighting food waste (Condamine, 2020). Being the world's number one marketplace for surplus food and the largest food waste app worldwide has given it an enormous reach to generate a positive change in society (Too Good To Go, n.d.a).

Figure 3: TGTG How it works

Figure 3 shows how TGTG works. The network connects its 50 million users to restaurants, supermarkets, stores, and other businesses that have food leftovers at the end of each day (Too

Good To Go, 2021). They allow customers to browse for unsold food items in their city and purchase them at a discounted price. All while giving their 150,000 partners the chance to make money off their leftovers by enabling them to add their food surplus to the app, which would otherwise be thrown away (Too Good To Go, 2021; Condamine, 2020). This encompasses TGTG's vision: a planet with no food waste achieved by „inspiring and empowering everyone to save food" (Condamine, 2020, PAGE). *"We're really a service that everyone can use"* says CEO Mette Lykke in an interview with EU-Startup's Thomas Ohr in 2019 (para. 13). This is an important factor in their food waste movement, as it allows them to make the impact that they want to achieve. Building on this mission to inspire others and make their platform accessible to everyone, they have created four pillars around which they have set their company goals.

Figure 4: 4 Pillars of TGTG

Pillar 1

Targeting households is crucial as almost half of the food wasted in Europe happens at this stage. More specifically, the average European citizen wastes around 92 kilograms of food every year (Condamine, 2020). With this first pillar, TGTG aims at providing tips and tricks for better buying, storing, and cooking that can help to reduce food waste on a daily basis. It is their mission to make people gain or regain an understanding of the value of food products (Condamine, 2020).

Pillar 2

With the service they offer, businesses are imperative for TGTG, but also vice versa, since their engagement with the app provides great opportunities for the businesses themselves. TGTG

enables their partners to make additional profit off of food surplus that would have otherwise gone to waste, while also extending their customer base (Too Good To Go, n.d.b). It gives businesses the opportunity to become a player in the global food waste movement and implement sustainability into their business if they haven't already done so. *"It suits our DNA"* says small business owner and Maastricht local Tom *"I think it's also nice that […] we don't have any waste and the customer […] pays just a little amount. It's win-win-win"*[C1]. Indeed, the app provides a win-win-win solution for not only the businesses but also the consumers and the environment. Particularly the ease of use and efficiency of the app is an attractive feature for businesses. *"It's really easy to work with for us because we don't have to do a lot […] with it"*[C2] states Maastricht-based hotel front desk manager Chris. Because the entire process occurs online, and the pick-up process is quick and easy, Chris notes that they *"have to throw away much less than [they] did before"*[C2]. The simplicity of service is a great upside for this pillar.

Pillar 3

The third pillar constitutes TGTG's impact on society. As a B2C network, they create deep awareness among consumers and their partners about the issue of food waste. TGTG is aware that education on food waste plays a critical role in the actual reduction of food waste (Too Good To Go, n.d.c). Together with schools and universities, TGTG aims at teaching the next generation sustainable values, such as protecting our planet. On their website, free teaching materials are offered for children, teenagers, and university students to test their knowledge on the subject of food waste. This is an impactful way to create awareness about the issue, as food education at the primary level can have one of the most long-lasting impacts on an individual's food choices and food consumption behavior and thus, the environment (UNEP, 2021).

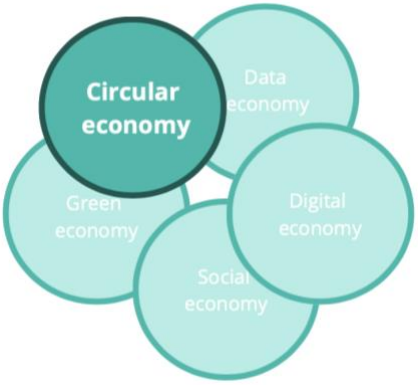
Pillar 4

The fourth and last pillar targets public affairs and legislation. Besides its direct impact on the food waste through the B2C platform, TGTG further aims at engaging with policymakers to ensure

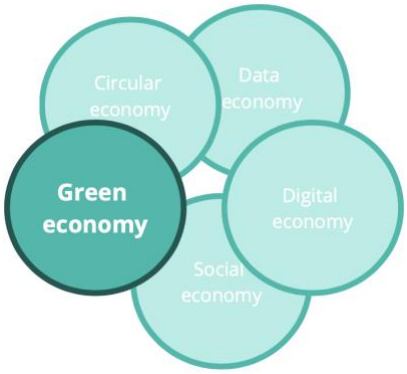
that the appropriate regulatory and legislative framework is in place to provide possibilities to reduce food waste and make the food system more circular, green, and sustainable (Condamine, 2020).

4.2. X-Economies in Too Good To Go

Too Good To Go integrates four of the five different types of X-economies, discussed above, namely the circular, green, social, and digital economy. The company actively and effectively contributes to advancing these different types of X-economies.

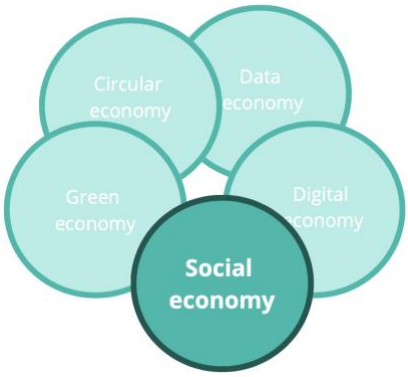


Circular economies aim to extend the life cycle of materials through the four R-framework, consisting of reducing, reusing, recycling, and restoring materials and products instead of throwing them away. TGTG, jointly with its users and business partners, aims at reducing food waste. Food that is left over at the end of the day and would be thrown away by restaurants, cafes, bakeries, and hotels is sold to consumers at a lower price, thereby extending its life cycle and contributing to circularity.



Green economies follow resource efficiency while prioritizing environmental protection in exchange for economic growth. Food waste is responsible for 10% of all global greenhouse gas emissions (Condamine, 2020). As TGTG acts against food waste, it also contributes to the reduction in greenhouse gas emissions. By 2020, TGTG has avoided the equivalent of more than 72,000 tons of greenhouse gas emissions by saving

meals and reducing food from going to waste. TGTG thereby advances the green economy (Condamine, 2020).



Social economies are driven by principles of solidarity, equality, and redistribution of profits. In a social economy profits and capital are reinvested into the community. Spreading awareness and educating the next generation on the issue of food waste is a fundamental value for TGTG. They are focused on giving back to the community. Their business partners do not work with them for monetary reasons or economic growth. Instead, while reducing food waste, they also want to give back to their customers which is reflected in the price of the TGTG bags. As a young company, TGTG also created many new jobs. At the end of 2019, the company was employing close to 500 people across Europe (Condamine, 2020).

Digital economies process real-time data through digital process systems. TGTG acts through the digital economy as it connects consumers and businesses via the world's largest digital B2C platform, in the form of a mobile app to be downloaded on any mobile device. Thereby the company makes it easy for businesses to add the food surplus they have, and consumers can view and purchase the offer available.

4.3. Multiple Value Creation by Too Good To Go

TGTG works actively to close the loop in the food sector and prevent food from going to waste, which benefits not only the businesses they work with but also the society and the environment.

TGTG business developer Alix Trébaol notes that at the core of TGTG, their mindset focuses on finding a balance between the company's social, environmental, and economic priorities (Lagercrantz, 2021). The key mission is to spread the movement to every sector and create a valuable impact everywhere, so that food resources are used effectively. *"Yes, we are for-profit"* Trébaol states, *"but primarily because it gives us the resources to make a difference*" (Lagercrantz, 2021, para. 10).

Due to the interaction of the circular, green, social, and digital economies, TGTG is able to produce both intentional and unintentional synergic outcomes that create value for the environment, society, and the economy. In the following, these outcomes are elaborated upon in line with the *X-economies procedure* that was previously defined.

The intentions behind the project are clear: to reduce food waste. With this mission, a lot of additional positive outcomes occur. One of these outcomes adds value to the environment, by reducing CO_2 emissions. As less food ends up in landfills less of the potent greenhouse gas methane is produced (WWF, n.d.). Another positive intentional outcome is the change in the consumption patterns of citizens. Through the four pillars, TGTG encourages inter alia households to consume food more sustainably by helping them gain an understanding of the value of food. Moreover, consumers get the food products they purchase via TGTG for a highly discounted price. This adds value to society, as consumers are able to buy high-quality food for a greatly reduced price. Amy, a saleswoman at a local bakery in Maastricht tells us that *"the customer pays 5€ and what they get is worth 15€"*[C3].

Various positive unintentional outcomes also create multiple values. Businesses can acquire new regular customers through TGTG. This happens when TGTG users try out a restaurant or bakery because of an offer posted on TGTG and if they like it, they might come back to that restaurant or bakery as a regular customer in the future. Moreover, businesses can make

a bit of additional profit off food surplus that they would otherwise throw away. While Tom and Max state that this is not their motive when working TGTG this could be an underlying reason for other businesses anyway.

There are no known negative intentional outcomes that occur due to the synergies of the different economic models. This is also recognized by businesses that work with TGTG. *"I don't know any downsides of it for now, no"*[C2] says hotel front desk manager Chris, a statement that small business owner Tom can also corroborate: *"they should continue what they are doing"*[C1] – he also sees no downsides to the service.

Only a few negative unintentional outcomes of TGTG can be identified. Depending on the business additional packaging waste might be created when selling something via TGTG. Many restaurants offer take-away options for regular customers anyway which are always linked to packaging waste. However, other businesses do not offer take-away regularly and thereby create additional packaging waste when selling something via TGTG. The Mabi City Center Hotel in Maastricht, for example, offers leftovers from its breakfast via TGTG. Hotel breakfast is normally not offered for takeaway. Therefore, by selling leftover breakfast over TGTG, additional packaging waste is created. To counter this extra waste, TGTG encourages its partners to allow consumers to bring their own containers to pick up food and also provides businesses with packaging made of kraft paper, which is more environmentally friendly compared to plastic (Condamine, 2020). Another negative unintentional outcome is that food could be thrown away anyway, not by the business, but by the end-consumer. Consumers could be unsatisfied with the products inside the TGTG bag as they do not know what products the bag will be filled with and might throw it away if they do not like the products that are inside.

4.4. Summary

Below you find a summary of the three most important synergic outcomes Too Good To Go creates through their application of the four different X-economies. These outcomes are divided into the different values they create for the environment, society, and the economy.

X-economies	Value creation	Outcomes	Intentional	Unintentional
Circular Green Social Digital	Environment	Reduced greenhouse gas emissions	**X**	
	Society	Sustainable consumption patterns	**X**	
	Economy	Profit off food surplus		**X**

Table 2: Synergic outcomes Too Good To Go

5.1. Case Description

De Clique is a young Dutch company that aims to fight commercial food waste by offering a resource service that transforms organic waste into new food products (De Clique, n.d.). The company was established in Utrecht, in 2019, by the two experienced entrepreneurs Anja Cheriakova and Bas van Abel. As both founders are social entrepreneurs, the company follows the mission to create impact first and profits are seen as a means to an end instead of the main goals of their activities. Together, they founded De Clique with the mission to stop wasting urban resources through recycling and thus, creating sustainable raw material chains. The idea behind the company is that *"there is no waste, you can use everything again"*[C4], according to their processing specialist Max.

Annually, 2.6 megatons of commercial waste are produced in the Netherlands (Maatschapwij, 2021). Without proper waste separation, most of the waste is burned in incinerators and thereby, valuable organic resources are destroyed. This means that the nutrition that is still included in these organic waste flows is not restored. De Clique wants to change this by collecting and separating organic waste at the source. The company has around 125 partners in Utrecht such as supermarkets, companies, restaurants, and the local university. From these clients, they collect three kinds of organic waste which are coffee grounds, orange peels, and other food leftovers for a fee. The clients collect the organic waste in plastic boxes provided by De Clique and the boxes get collected by the company using CO_2-neutral cycle couriers and

electric vehicles. Once the waste is collected, it gets further processed in De Clique's own facilities or partner facilities to produce new products like tea, bread, beer, vegan croquettes, or compost that will be sold to other B2B business partners. Moreover, some of these products are also sold back to their clients where the scraps were collected. This enables the company to close a resource cycle and establish valuable, shorter, and circular raw material chains. The chains are shorter as the resources go from the consumer directly to De Clique and its partners and then back to the consumer as a new food product.

Figure 5: How Coffee Ground becomes Oyster Mushrooms

Through its resource service, De Clique accomplishes its vision of turning organic waste flows into products that enrich the city. According to the company, they manage to reuse 15000kg of Utrecht's raw material per month as well as to save 8500kg CO_2 per month. With every additional kilogram of organic waste received by the company, these figures are rising. In addition, De Clique has an impact on the following Sustainable Development Goals (SDG) defined by the United Nations: SDG 11 sustainable cities and communities, SDG 12 responsible consumption, and SDG 15 life on land.

De Clique has an effect on SDG 11 as the company tries to reduce the environmental impact of Utrecht by reducing and recycling waste.

De Clique has an impact on SDG 12 as they aim for more efficient use and consumption of natural resources through their project.

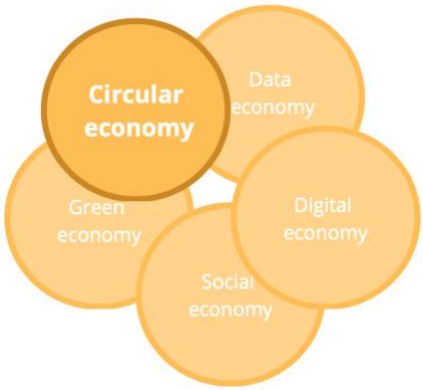
De Clique has an effect on SDG 15 as they aim for more sustainable use of the ecosystem by reusing resources, thereby contributing to the restoration of our ecosystem.

In the future, De Clique plans to expand to more cities in the Netherlands as Teun, De Clique's logistics and sales expert, claims that *"[...] a lot of cities are very enthusiastic about our idea"*[C5]. Instead of collecting waste streams from other cities and transporting them to their hub in Utrecht, De Clique plans to establish new hubs in other Dutch cities like Amsterdam or Eindhoven. The idea is to create an ecosystem of suppliers, waste streams, and local product developers in each city to create an impact. Moreover, with more waste streams and product developers, new and different food products can be offered that are made out of organic waste.

5.2. X-economies in De Clique

Following the vision of De Clique, the enterprise contributes to four of the five types of X-economies, namely, the circular, green, social, and digital economy. By laying their business model on sustainability through efficient waste reduction, De Clique integrates circularity, makes

an impact on the environment, takes social responsibility, and recognizes digitized instruments for emission tracking.

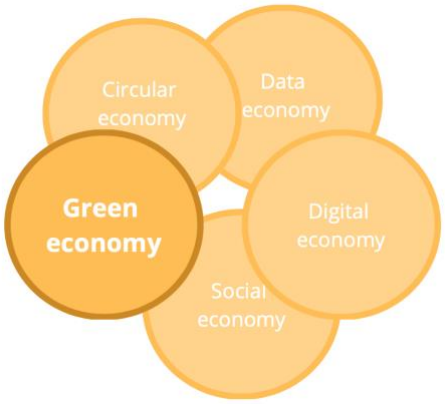


In line with De Clique's mission to fight resource waste, the company aims to collect and recycle commercial food waste, intended to create a recycled product. As Teun said: *"We try to close the circle as much as possible, so, we try to make our customers enthusiastic about the idea of collecting the coffee grounds and then* [processing] *it with local* [...] *entrepreneurs* [to create] *a new product and bring it back to them* [customers]"[C5]. Here, Teun refers to the circularity of De Clique´s operation, namely, to recycle commercial food waste to create a new product that will be sold back to the same customer eventually. This extends the life cycle of resources while contributing to the circular economy significantly. Evidently, De Clique applies the four R-strategy by reducing commercial food waste through reusing resources and thereby creating new products. Through reducing waste and maximizing re-usage of resources, De Clique creates three value chains that are indispensable for making an impact and contributing to circularity:

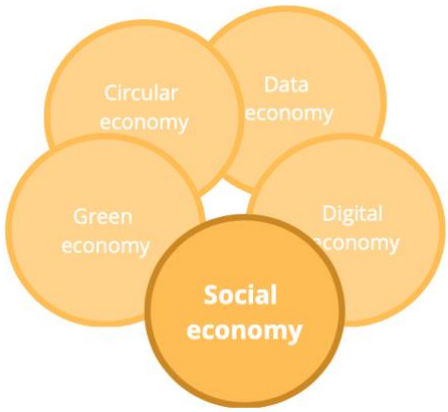
Growing soil chains: By using coffee grounds to become compost, De Clique creates soil that can either be used for agriculture or grow vegetables, a resource that is fundamental for circularity.

Ingredient Chain: As used for food products, raw materials are processed into circular products to retain the most value of ingredients. These can be lemonade, tea, or beer.

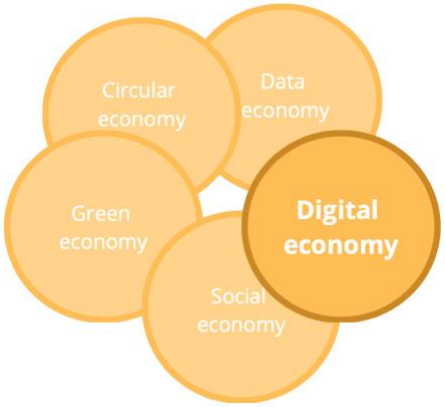
Animal feed chain: To maximize the recycling process of resources, De Clique uses bio-waste for animal feed. This will not only save further resources and its associated CO_2 emissions, but foster products like eggs, dairy, or meat to become circular.



With the aim to fight climate change, De Clique´s business model aims to reduce greenhouse gas emissions by extending the life cycle of resources. By collecting and recycling CO_2-neutral commercial food waste, the company emphasizes sustainable development instead of following the prevailing dynamics of a 'throwaway' society. Indeed, De Clique´s CO_2 footprint can be followed in their annual reports. At hand, the enterprise contributes to the green economy because it prioritizes environmental protection to go hand in hand with economic growth. As of their vision, the company pursues to adapt their business model to the needs of the earth while asking for fair premiums.



De Clique takes social responsibility by stressing the urgency of and spreading awareness about climate change and sustainability. This is reflected in Teun's statement, arguing that *"our biggest challenge is still the urgency that our clients feel about how they can also contribute to climate change and the urgency for sustainability through waste reduction"*[C5]. De facto, what Teun describes is not only a challenge for De Clique but a challenge of our time: To change the mindset of society and thus, take social responsibility to protect future generations. To tackle this, De Clique offers coaching for larger clients; first, to stimulate corporate responsibility in the field of climate change, and second, to support the implementation of circular eco-systems in clients' businesses based on employee training. At hand, De Clique participates in the social economy by making an impact on climate change collectively while urging society and enterprises to turn their mindset toward a sustainable future.



To measure its impact, De Clique uses barcodes to track the collection and recycling process of resources. Digitized methods enable the company to apply the life cycle assessment methodology to compare their resource efficiency to the emissions of other 'status quo' dynamics as such to track the amount of CO_2 emissions De Clique saved compared to others. Furthermore, these real-time data transfers enable the company to track each customer's ecological footprint by assessing what and how their waste was recycled and reused. These are indispensable assets for contributing to the digital economy.

5.3. Multiple Value Creation by De Clique

De Clique tries to close the resource cycle by implementing valuable, shorter, and circular raw material chains. This does not only bring an advantage for the company and its partners but also adds value to society and the environment. Logistics and sales expert Teun explains that the mission of De Clique is *"[…] to incentivize people and society to recycle and to become more sustainable"*[C5]. This shows that the company's mindset is to bring value to society and the environment.

Due to the interaction of the circular, green, social, and digital economies, De Clique creates both intentional and unintentional synergic outcomes that add value to the environment, society, and the economy. In the following, these outcomes are explained in line with the X-economies procedure that was previously defined.

The main intention behind De Clique is to save valuable resources. This is accomplished by saving organic waste flows from the incinerators and processing them into new food products. This

process goes in hand with further positive intentional outcomes. One of them is reducing food waste and thus, adding value to the society and environment. One-third of all food produced globally is wasted which is a threat to worldwide food security and restricts the availability of important resources (Janssen & Van de Hei, 2018). Another positive intentional outcome is reducing CO_2 emissions which adds value to the environment. Through their cycle couriers and electric vehicles, De Clique's resource service is CO_2 neutral. In addition, saving food from ending up in landfills leads to less methane being released, a greenhouse gas, which is emitted through incinerators (Danthurebandara et al., 2012). Finally, De Clique aims to change people's mindset about waste and reusing resources which adds positive value to society. Through the project, consumers become more aware of the importance of separating waste and the fact that a lot of waste can be processed into new products. Logistics and sales expert Teun describes this mindset they want to convey as *"[..] we don't call it waste. We call it resources"*[C5].

Multiple values are also created through unintentional positive outcomes. One of them is new business opportunities for De Clique's clients through the new food products produced through organic. Clients of De Clique can buy back the food products with a discount code which has a financial benefit and can lead to new potential customers. Thus, value is added to the economy. However, logistic and sales expert Teun claims that the *"biggest benefit they make is a positive impact […]"*[C5] for our environment. Another unintentional positive outcome is that clients like supermarkets can measure and adjust their waste production. De Clique provides their clients with information about the number of waste streams they collect from them. Supermarkets or other clients can then use this information to adjust their waste policies and produce less waste.

Due to the synergies of the different economic models, De Clique has no known negative intentional outcomes. However, there exist a few unintentional negative outcomes. One of them

occurs during the process of growing oyster mushrooms. The mushrooms grow in plastic bags filled with coffee grounds and after the growing process is completed, the bags are thrown away as they cannot be reused. This means that new waste is produced during the recycling process that ends up in landfills. Nonetheless, processing specialist Max claims that this is the only waste produced by the company and that the leftover coffee ground is used as compost. Another unintentional outcome is packaging waste. For example, vegan bitterballen made out of oyster mushrooms is packaged in paper and plastic packaging. Finally, another negative, and certainly unintentional, outcome is that the company is not profitable yet. Finally, their resource service and the selling of the new food products are not enough to make a positive profit. Therefore, the company is still dependent on impact investors.

5.4. Summary

Below you find a summary of the three most important synergic outcomes De Clique creates through their application of the four different X-economies. These outcomes are divided into the different values they create for the environment, society, and the economy.

X-economies	Value creation	Outcomes	Intentional	Unintentional
Circular Social Digital	Environment	Reduced greenhouse gas emissions and food waste	**X**	
	Society	Change people's mindset about waste and reusing resources	**X**	
	Economy	New business opportunities due to new food products		**X**

Table 3: Synergic outcomes De Clique

AEROFARMS®

6.1. Case Description

AeroFarms is an agriculture company founded in 2004 and headquartered in Newark, New Jersey that produces microgreens through the use of indoor vertical farming and aeroponics. For clarification, microgreen refers to the vegetable greens that are harvested right after the occurrence of their first leaves. In addition, aeroponics refers to the process of growing plants by spraying directly at the roots or the stems of the plants with nutrient-rich water solution; this process does not require the plant to absorb nutrition through conventional intermediaries such as soil or water such as in hydroponics.

The mission of AeroFarms (n.d.a) is "to grow the best plants possible for the betterment of humanity" (para. 1). Its main three visions are: (1) understand plant biology to be greater farmers and solve broader problems in agriculture; (2) serve communities by leading with the brand and providing access to high quality, consistent and safe products; and (3) protect the environment for future generations, growing more while using less.

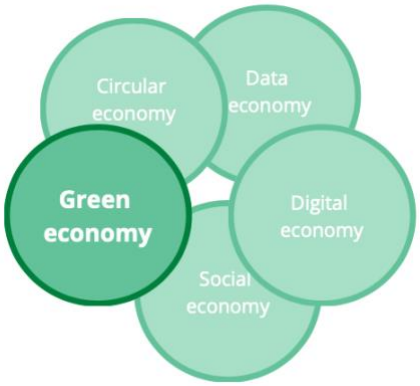
To achieve these visions, AeroFarms (n.d.b) aims to do agriculture differently. In addition to the previously-mentioned characteristics of focusing on microgreens and using aeroponics, the company also claims that there are six main features that differentiate it from its competitors. These six features are as follows:

- **Superior Flavor + Quality** because indoor agriculture allows AeroFarms to have almost complete control over environmental elements such as lights, nutrients, and temperatures through their plant-specific algorithm. This algorithm uses data collected through the development of the plants to adjust the indoor environmental elements so that the plants develop desired flavors and qualities.

- **Local Production at Scale** because their indoor farms are built "in and around major cities, and close to major distribution routes, enabling fresh food production and local distribution at scale all year round" (AeroFarms, n.d.b, para. 4).
- **Sustainably Grown Indoors** because AeroFarms claims to "have designed [their] operation to embody circular design and maximize output using less resources, allowing [them] to grow with up to 95% less water, up to 99% less land, zero pesticides and a fraction of the fertilizers compared to field farming" (AeroFarms, n.d.b, para. 5).
- **Elevated Food Stability + Traceability** because AeroFarms claims to have "over 200 robust food safety standard operating procedures and full traceability from seed to package" (AeroFarms, n.d.b, para. 6).
- **Year-Round Growing** because AeroFarms' agricultural process depends only on their internal artificial environment and not on regional climate, season, or weather.
- **No Pesticides Ever** because the indoor element of the agricultural process means that there is no need for pesticides, herbicides, or fungicides.

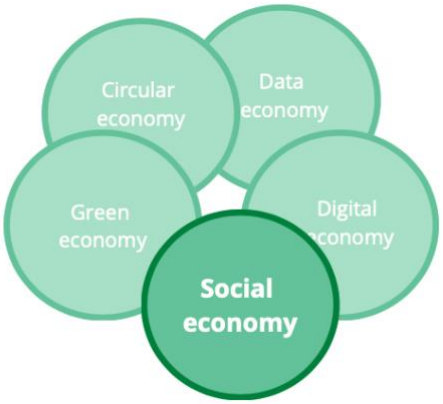
6.2. X-economies in AeroFarms

The aforementioned differentiating self-proclaimed features of AeroFarms indicate that the enterprise appears to follow four main X-economies, namely the green, social, data, and digital economies.

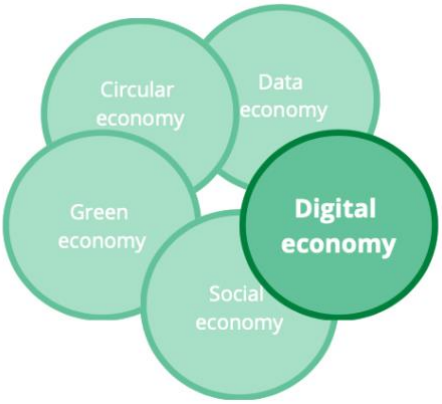


With a growing urban population, our food production relies on a fastly decreasing number of aging farmers and farmland available (American Farmland Trust, 2022). Moreover, the ancient approach to cultivation, where increasingly unpredictable extreme weather, deforestation, and inefficiency all result in the fact that agriculture represents one of the most polluting industries

today (United States Environmental Protection Agency, 2022a). These are problems we are facing today and vertical farming and therefore AeroFarms is able to provide solutions to most of these problems. AeroFarms' use of isolated growing spaces allows them the ability to eliminate (extreme) weather from the equation, resulting in a consistent and reliable yield. This yield is further elevated by efficient additions such as 3-dimensional land expansion, no needed pesticides, year around growing, and 95% less water usage. All coming together in order to provide 390x times the productivity per square meter compared to traditional outdoors farms (AeroFarms, n.d.b).

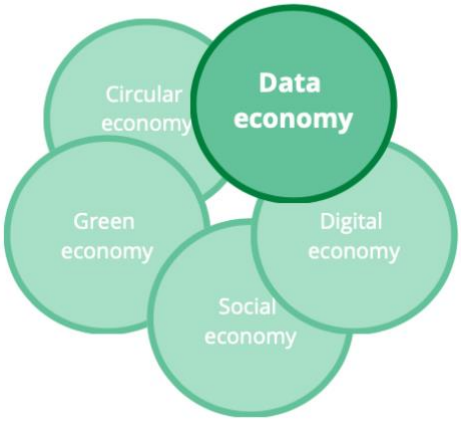


AeroFarms also participates in the social economy through two main channels. The first channel is the establishment of small-scale for-profit farms that are used to feed children from multiple 'charter schools' in their local communities. The second channel is their active employment of formerly incarcerated individuals (AeroFarms, 2021, p. 7).



The company utilizes the digital economy in order to ensure the traceability of its products. A QR code is placed on each of their products which informs consumers about the production process of their microgreen foods. AeroFarms is only a user and not an innovator of the digital economy as the idea of using QR codes for traceability has gradually become a standard practice of sustainable production enterprises (AeroFarms, n.d.b). Moreover, an extensive internet of things (IoT) network within the factory makes it possible for large parts of the cultivation process to be automated and closely monitored. From automatic seeding, watering, and harvesting the whole cultivation process has a digital twin within the cloud where

problems can be spotted early and predictions on yield are readily available. Resulting in an in-depth overview of the farms' operations (AeroFarms, n.d.b).



While AeroFarms' business is rooted in the Green-economy, its efficiency, and therefore existence would be impossible without the foundation of data science, machine learning, and AI. The efficiency is realized by the thousands of input numerical data points including temperature, humidity, light intensity, nutrients, and many more. Resulting in thousands of possible output values such as yield, taste and growth time. Because the direct connections between these data points are generally unknown, machine learning and AI are used to open the black box of data between the in- and output (AeroFarms, n.d.b). This is only possible because both in- and output are controlled by AeroFarms. In turn, making it possible to research the most efficient growth recipes for each plant in every condition. Therefore, AeroFarms is currently building the largest research center for vertical farming in the world in Abu Dhabi. Leading the way for a data-driven approach to agriculture and a sustainable way of feeding our future generations.

6.3. Multiple Value Creation by AeroFarms

The previous review of AeroFarms and its associating X-economies shows that AeroFarms has indeed involved itself in the multiple value creation process. Internally AeroFarms is able to incorporate data science and cutting-edge technology such as AI, together with automation provided by IoT systems to realize an MVC network outside of its farm's borders. These MVC applications are represented by the extreme increase in efficiency within the agricultural sphere and green economy. Providing multiple solutions to climate, efficiency, and reliability problems within the outdated sphere of today's agricultural industry.

AeroFarms is one of the first companies in agriculture to start using machine learning and artificial intelligence in order to slowly open that black box of cultivation that existed since the beginning of contemporary agriculture more than 7000 years ago (Cortois & De Deyn, 2012) Because so little innovation has taken place within the agricultural industry compared to other industries, especially within the efficiency of cultivation, AeroFarms creates multiple positive outcomes, both intentional and unintentional.

One of the main reasons these positive outcomes are realized is because of AeroFarms' continuous growth cycle analysis. This growth cycle analysis improves the inputs in order to get better outputs. It does this by setting a target (chosen by AeroFarms), which can be a higher yield for example. Then, multiple different growth cycle recipes simultaneously and in parallel to each other in order to find the inputs that result in the highest yield (output) by using cloud computing. When it finds the best-performing inputs, that recipe is stored within the database and the model uses that recipe as a starting point in the next growth cycle (AeroFarms, n.d.b). Together with a largely automated cultivation process, its extreme efficiency is the main reason for AeroFarms' application in MVC in the food and agricultural industry.

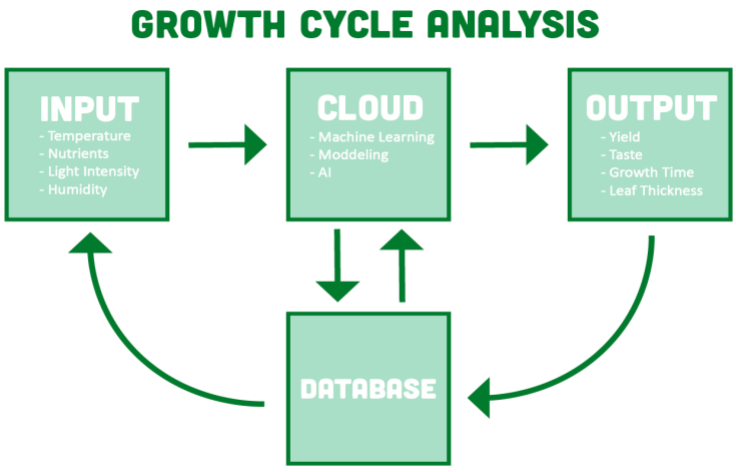


Figure 6: Growth Cycle Analysis

This efficiency is much needed in the agricultural industry. While the global total factor productivity (TFP) within agriculture has increased in recent years, it is well below the annual target of 1,73% per year set by the Global Agricultural Productivity Report in order to feed the world's growing population by 2050 (Steensland & Thompson, 2020). Especially because the current sources of agricultural output growth are based upon the TFP and land expansion. Here, AeroFarms is able to improve the TFP while at the same time decreasing the dependency on land expansion by cultivating within a 3-dimensional space. This is impossible without vertical farming.

Within the cross-section of these X-economies, AeroFarms is able to make large increases in efficiency while being better and more reliable for the environment than traditional agriculture. However, it does not stop there, it uses every high- and low-tech innovation to its advantage by finding an application within the company. It uses QR-codes in order to provide the customer with the possibility to scan and see when their product was planted, harvested, and packed - down to the second. Moreover, because all of this is very innovative, there are multiple programs created for school children and former prison inmates in order to feed and help communities that need it. Therefore, AeroFarms makes use of its innovative platform not only by providing products but by actually participating in the social economy of their plant factories.

Due to the extreme focus on innovation and using every possible outcome of its product and way of producing it to its advantage, it is hard to find any unintentional positive outcomes. However, while testing different grow cycle analyses they found that it was possible to alter the taste, looks, and feels of the plant by providing different inputs. Creating the opportunity to diversify their offerings within the same plant species with different tastes in the future.

Despite the aforementioned efforts, AeroFarms suffer from multiple unintentional outcomes in the economic, agricultural, and energy spheres. Regarding the economic sphere, Zimberoof (2021) reports that the sustainability efforts of AeroFarms do not bring about economic rewards for the company in terms of profits.

Regarding agricultural matters, AeroFarms cannot grow more crops than leafy greens. Globally important commodities such as corn and wheat are unable to be grown using the company's aeroponic technology due to the fact that these crops require a large amount of sunlight which is too expensive to imitate indoors. A lot of innovation in solar and LED technology is needed in order to make the cultivation of heavier crops possible.

Regarding energy, AeroFarms' agricultural model requires a lot of electricity and energy. If the company does not use renewable energy sources, its sustainable efforts can hurt the environment instead of saving it.

6.4. Summary

Below you find a summary of the three most important synergic outcomes AeroFarms creates through their application of the four different X-economies. These outcomes are divided into the different values they create for the environment, society, and the economy.

X-economies	Value creation	Outcomes	Intentional	Unintentional
Green Data Digital Social	Environment	Extreme efficiency in crop cultivation due to innovation in agricultural practices.	**x**	
	Technology	Using big data, machine learning, and AI in order to push agricultural efficiency forward.	**x**	
	Economy	Negative profits for consecutive years		**x**

Table 4: Synergic outcomes AeroFarms

UNU-MERIT | Maastricht University

Part IV:

Comparative Discussion

7. Comparative Discussion

Based on the previous case studies of Too Good To Go, De Clique, and AeroFarms, especially their summary tables, figure 7 showcases the composition of X-economies in each investigated case study.

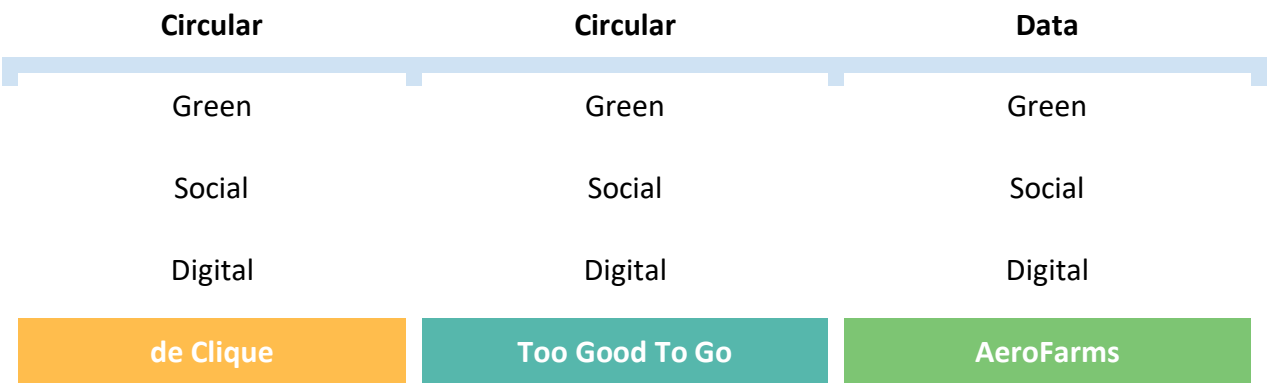


Figure 7: Comparative Composition of X-economies

Comparing De Clique and Too Good To Go, we recognize that they integrate the same four X-economies, namely the circular, green, social, and digital economy. Despite their similar components of X-economies, they have different economic outcomes. While the economic outcome of TGTG is surplus profit generated from unconsumed food, the economic outcome of De Clique is the occurrence of new business opportunities for their partners due to new products. In other words, while TGTG has already been able to capitalize on their operations, De Clique has not been able to capitalize on these business opportunities. This comparison shows that similar X-economies components do not necessarily translate into similar outcomes. This conclusion is also made stronger due to the fact that the two companies work in the same market of urban food waste circularity.

Comparing TGTG and AeroFarms, we recognize that their difference is not in the additional inclusion of another element but in their X-economies compositions themselves: both companies integrate the three X-economies green, social, and digital economy but while TGTG additionally employs the circular economy, AeroFarms employs the data economy. Different

from the previous comparison, this comparison between TGTG and AeroFarms can be difficult due to the companies' different objectives — while TGTG focuses on the waste end of foods, AeroFarms focuses on the production end of foods. However, one can still compare the two companies in terms of their outcomes. Regarding environmental and societal outcomes, both companies are able to generate positive outcomes. Their difference lies in the sphere of economic outcomes where TGTG is shown to be able to make profits out of their operations while AeroFarms is not yet.

The two comparisons above show that the way TGTG integrates the circular, green, social, and digital economies appear to be optimal as the business is the only one among the three discussed companies to generate positive outcomes in all three; social, economic, and environmental, spheres. However, it must be clarified that this analysis looks closely at X-economies and has not fully addressed the variety of complications coming from the companies themselves or the specific markets that these companies engage in. Despite this limitation, this comparison affirms the findings of previous reports, which are the usual associations of Circular Economy x Social Economy and Digital Economy x Collaborative (Social) Economy (Türkeli et al., 2021).

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Part V:

Conclusion and Limitations

8. Conclusion

This report has revealed that the synergies of different alternative economic models can produce successful outcomes that outweigh the negative outcomes. Hence, the research question is answered in the following way: *The interactions of the circular, green, social, digital, and data X-economies produce predominantly positive intentional and unintentional outcomes within the three case studies and simultaneously create value for society, the environment, and the economy.* It is evident that our current food system must change immediately and rapidly. The results of the MVC analysis showcase that the synergies of alternative economic models can produce the necessary outcomes to transform our food system into a more sustainable, resilient, and responsible one. It is thus important that X-economies are adopted in more and more businesses, corporations, and organizations within the food sector and beyond, across different sectors and industries.

This report may act as a steppingstone for future research to commence and also overcome certain limitations faced in this research. Broadening the pool of research on X-economy interactions may include researching more case studies within the food business or other industries. This can help to gain a bigger picture of how other X-economies are implemented in different industries. Additionally, researching the diverse applications of alternative economic models in a cross-industry comparison may give more in-depth and valuable insights. For this report, we limited ourselves to 5 X-economies, however, there are many other alternative economic models that may apply to our, and other, case studies. Including other models and case studies might lead to a more nuanced analysis and comparison.

It is evident that the research on X-economy interactions is just getting started and it is important that it is continued. The presence of alternative economic models, as well as their synergies, provide promising outcomes to move towards a more sustainable future. It is therefore important that the interactions of other X-economies are further researched to establish an overview of successful X-economy interactions.

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Interviewees

C1 Tom - Co-Founder of Restaurant SoupBros

C2 Chris - Front Desk Manager at Mabi City Center Hotel Maastricht

C3 Amy - Saleswoman at Bakkerij Voncken

C4 Max - Processing Specialist at De Clique

C5 Teun - Logistics and Sales Expert of De Clique

C1-C4 are anonymized. Pseudonyms are used. C5 is not anonymized (consented).

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Appendix A

Interview transcript: SoupBros: Tom

I: Interviewer: Alexandra & Paula

R: Respondent: Tom

I: Ok so first, can you state your name and position if we want to like quote you or something?

R: Yes, yes, so, my name is Tom uh and I started this business together with my uh best friend…

I: Ah nice!

R: … two and a half years ago after the Hotel Management school.

I: So you are like the boss here?

R: Yes!

I: Great that we can talk to you!

I: Uhm ok so, how long have you been working with Too Good to Go?

R: Now for already over a year.

I: Ok nice. Uhm and is it successful? Like how much do you sell via TGTG?

R: Yeah, so actually uh well first of all we are happy that we don't have uh that we don't have that much uh that much waste, uh since now uh we we base everything on uh on our data. So, we now say that okay today we sell so many and so on and so on. But uh, definitely everyday we have something left. Yeah. Exactly.

I: And can you say how much that is approximately?

R: Uh, approximately yeah two per day. Two soups per day.

I: And do you feel like the consumers are happy with it?

R: Yes, exactly.

I: Do these portions always get sold?

R: Yes for sure, because they always get a uh they get good value uh for money.

I: Mhm, how much does it cost?

R: Uh 4,29€ uh and then they receive two big, large yeah soups.

I: Oh wow, okay.
Paula: Uh and why are you working with TGTG? Like what do you think are its benefits?

R: Yeah, so first of all the philosophy behind it uh because they don't want uh yeah they want to help uh the no waste policy which is good. Uh it suits to our DNA as well uh and other than that yeah I think it's also nice that uh of course we don't have any waste and the customer uh pays just a little amount. It's win win win.

I: Do you use it mostly for the sustainability aspects or also to reduce costs?

R: Yeah exactly, it's not for the money uh but exactly because we don't make that much money uh but for sure exactly, sustainable purposes.

I: Ok great!

I: Uhm and are there other ways that you implement sustainability into your business besides TGTG?

R: Of course, so first of all we are 100% vegan. We don't add any animal products uh also all of our materials are made of 100% sugar cane so nowhere plastic, no stuff like that and uhm yeah actually those are the things I can think of now. Yes.

I: So it really contributes to the way you are doing business

R: Yeah, yeah exactly. And actually oh yeah as you can see in the video [displayed in the shop] we also have our own garden so everything comes from our own land.

I: Oh nice!

I: Is that here in Maastricht?

R: No that's in uh, uh Weert. Yeah uh upper part of Limburg. Yes.

I: Yes, so still local.

R: Yeah, right, exactly.

I: That's really cool!

R: Thank you!

I: Uhm and do you believe there are any like downsides to TGTG or not really?

R: No, actually no. There aren't. The philosophy is good, the DNA is good so uh yeah they should continue what they are doing.

I: So you personally like the concept?

R: For sure, yes for sure.

I: Ok thank you so much for participating!

I: Yes, thank you!

R: You're welcome! Come back any time.

Appendix B

Mabi City Centre Hotel: Chris

I: Interviewer: Alexandra & Paula

R: Respondent: Chris

I: Hey, so maybe first, can you state your name and what your position is here?

R: Yeah, my name is Chris and I'm the front desk manager from Hotel Mabi.

I: And how long have you been working with Too Good To Go?

R: Ehm, I'm not sure, but I think for more than two years now. Or one and a half years, two years, yeah.

I: And would you say it's successful? Like, do you sell a lot, and what exactly do you sell with Too Good To Go?

R: Yeah, we don't have a lot of fnb [food and beverages], we only do the breakfast here in our hotel and we sell to Too Good To Go everything left from the breakfast. We sell each day normally one Too Good To Go, we have only one Too Good To Go open for each day, ehm, normally we sell one Too Good To Go per day. So for today, I sold one. And that's everything that is left over from the breakfast, so this is scrambled eggs, bread, bacon, and that kind of things.

I: Nice. And why are you working with Too Good To Go? What do you think are its benefits?

R: Yeah, because we have to throw, sometimes we have to throw away a lot of stuff because it's difficult to see how many people are coming to breakfast and how much they eat, so that's the first thing. And it's really easy to work with Too Good To Go because I think also online, people can make reservation and then we can just give them the bag with everything what is left over, so we have to throw away much less than we did before.

I: So, would you say you also do it for the sustainability aspect?

R: Yeah, sure, yeah yeah yeah.

I: Okay, and do you believe there are any downsides to Too Good To Go?

R: No, I don't think so. It's really easy to work with for us because we don't have to do a lot of, with it. And if we are close sometimes, we can just close the ticket on Too Good To Go and don't sell any Too Good To Go and that is really easy for us. And the people just have to swipe a code, so that's also really simple. And then we can just go on with the, with the order from the guests. So, it's really simple for working. So, I don't know any downsides of it for now, no.

I: Okay, great. Yeah, that was it.

R: Yeah, okay.

I: Thank you so much, super helpful.

Appendix C

Bakkerij Voncken: Amy

I: Interviewer: Alexandra & Paula

R: Respondent: Amy: Sales girld

I: So, do you know how long have you been working with Too Good To Go?

R: Ehm, in August it's my first year here, so that is also a year that I'm working with Too Good To Go.

I: Ah okay. And is it successful? Like how much do you sell via Too Good To Go? Is it a lot?

R: We have a lot, but our boss reduced it to four Too Good To Go each day.

I: Okay, is that always picked up then?

R: Yes.

I: And why did you reduce it?

R: Because it was too much. So we have 23 other shops and then we spread in those shops.

I: And do you feel like the consumers are happy with it? Like do they…

R: I think… You have different people. One says it's not enough and the other one says it's too much. So…

I: And how much do you, like how much does it cost and how much is in the bag?

R: The customer pays 5€ and what they get is for 15€.

I: Oh okay, that's great, yeah.

I: And why are you working with Too Good To Go? Like what do you think are its benefits?

R: Ehm, we throw away less. So, it's a waste if you throw everything away.

I: So, you do it for the sustainability aspect?

R: Yes, yes.

I: Okay.

I: That's nice. And are there other ways that you implement like sustainability into your business or do you just use, eh, do you just use Too Good To Go?

R: I don't know what the boss is doing. But I think other things, we have to, eh, it's going back to the, to the head, eh, station, I will say. And they, eh, we have, eh these houses for elderly, and they, they give it to them.

I: Okay, so it's not the only thing you're doing.

R: No, no.

I: Okay, that's really nice.

I: Ehm, we also just want to ask you what you personally think of the concept of Too Good To Go, if you like it or…?

R: Sorry, say that again.

I: Eh sorry, what do you personally think of the concept of Too Good To Go?

R: I think it's a very good one, yeah, yeah.

I: Okay, and then, just if we want to quote you, can you maybe state your name and your position here?

R: Ehh, my name is Amy and eh I'm a sales girl, to say it like that.

I: Okay, thank you so much.

Appendix D

Interview Transcript 1: DeClique

I: Interviewer: Julius & Lilly

R: Respondent: Teun: Logistics and Sales

I: How does Declique measure sustainability? How does Declique measure its impact?

R: Yeah. Well it's pretty straightforward. We use the lifecycle assessment methodology so all the crates that we collect from our customers there are pinned to that customer by barcode. From each customer, we can see which resource and how much in weight we collect from. By using the LCA, we can then see their environmental impact which is compared to the status quo. So, we compare our resource efficiency to the emissions of big diesel trucks for instance, and much we can save compared to them. Yeah.

I: Yeah, I think this is awesome. We already experienced a lot of how you develop products, but how do you sell them and where do you sell your products?

R: We are completely focused on a B2B approach, so we do not sell to customers, or, like particular customers but only to other businesses. And how do we sell them? Yeah, we try to sell the complete package. So, this includes the collection process of resources and selling the products after, for example, if we select the coffee grounds we also try to sell the snacks, the vegan bitterballen from the collected waste and the crockets. So, actually, how we sell it is…, it's like a package form to our customers, so, mainly restaurants, cafes, and the bigger catering companies, yeah, so where these resources like coffee and food is actually consumed.

I: So, to clarify, this is kind of how you close the circle then, right? Because you sell your recycled products back to where the resources got collected from?

R: Yes. So, we try to close the circle as much as possible so and we try to make their customer enthusiastic about the idea of collecting the coffee grounds and then process it with local and other local entrepreneurs through a new product and bring it back to them. So, we can collect all the resources, so, go into the city with our vehicles, collect the streams and then drive back here to the hub with again a full vehicle of resources. Yeah. So that is the main idea.

I: Is there a benefit for the small coffee and food store to give you all their waste?

R: Like maybe a financial benefit you mean? I mean the biggest benefits that you make is a positive impact really, like a positive impact of lower CO2 emissions by using electric vehicles and by simply making a new product out of the resources instead of burning them. So, the quickest benefit is that you literally have a lower CO2 impact. And there is also a financial benefit as well. They can buy our products with discount back.

I: So, the circle closes again. Yeah, so their benefit for us is, again to close the circle by collecting their waste and sell it back to them. Cool. On your website, we read that you also have a coaching program. What is specifically?

R: Yeah, well, that is for bigger clients, like for example “hogthreeun” the one that is right at the central train station here in Utrecht, at the mall. The big mall is also a client of us and so there, we give a more consultancy focused approach to them about also the other types of streams. But with the smaller clients like cafes and restaurants, our services mainly consists of collecting the streams and giving them back the information about the amount of streams we collect and its efficiency. For example, we collect the streams also from supermarkets and they really want to know how much they threw away every week because they can adjust their waste policies accordingly then.

I: What challenges did you have lately? What challenges will you have in the future still?

R: Yeah, like, for us, we are still reliant on impact investors and, uhm, our biggest challenge is still the urgency that our clients feel about how they can also contribute to climate change and the urgency sustainability with their waste. Uhm, so, we don't call it waste. We call it resources. But so, that is currently not their main priority about what to do with their rescoures and where is it going through and what type of products do they buy that produce what kind of waste. Another issue is that people just don´t care that much about local food. They just go to a big supermarket and buy everything they want instead of the benefits of buying local food and separating their different waste streams so that it can still be used. So, it's not a priority still. Another big challenge is that now, a lot of restaurants and bars do not have the employees they need. So, for a lot of them, their main priority is not to implement a new system like ours, to recycle waste streams, like there are no employees. So, yeah, a big challenge for us is to incentivize people and society for the urgency to recycle and to become more sustainable.

I: So, how does society perceive Declique generally?

R: Very enthusiastic. Everyone I speak to is really enthusiastic about it but at the end, whenever it comes to finalizing a partnership or they have to sign a contract and pay a small amount each month for getting their waste collected, it is still their main priority, like they think they can still do it in the future and that it Is nothing for them at the moment. Like often, they say, yeah, call me back in a couple of month or so. Like they say it´s not very convenient for them at the moment. So, people are very enthusiastic about it, also because it is a really simple plan that we have, like, you put your streams in a bin that we collect which is not really difficult and quite easy to implement into their business model but still, it's a different mindset they still have. Like a different mindset in terms of seeing their waste as a resource and not just useless waste.

I: Do you think this will have an impact on Declique´s future?

R: Yeah, as I said, the main challenges is the mindset of people. The mindset of the people needs to change because otherwise our surface is really down to earth. It is really simple. It's just that you need your motivation of also change your way of working. But also that is not difficult. But apparently, changes are really scary… But besides that, I don't really see any other challenges despite the change of mindset.

I: Do you have any other projects planned for the future? What other projects do you have next in your pipeline?

R: We want to expand in the Netherlands because a lot of cities are really enthusiastic about our idea and want come to our city to get more information about it to build another hub. And so, a lot of people came to us and asked if we could also collect their streams in another city but we don't want the same way of work in every city, like, in our case the normal I've seen the normal treatment of waste. We don't want to transport all these streams from all different cities in the Netherlands to Utrecht. Instead, we want to build a hub in Amsterdam, and in the Hague, and Eindhoven to create their own ecosystem over there. An ecosystem of the suppliers, the streams, local product developers, and build an ecosystem. And of course with more streams, we want to offer more different kinds of products. So, we are always looking for new opportunities, new products, and new streams that we can get collect and make new products out of it.

I: Thank you very much

Coding:

Impact Measuring

Business model	**Future projects**
Circularity	**Challenges**
Bio-Waste Collection	**External Impression about DeClique**

Appendix E

Interview Transcript 2: DeClique:

I: Interviewer: Julius & Lilly

R: Respondent: Max: Processing Specialist

I: Can you tell us something about the process of using coffee ground to grow oyster mushrooms?

R: It is the only product we are doing ourselves and you can almost taste it, from coffee to mushroom in 6 weeks.

I: What do you mean by that?

R: You have waste, and you can make something from it. And you can see it if someone walks in with a coffee. The waste from this coffee, the coffee ground, this is what you can do with it. You can use it to grow the mushrooms which then can be used for new food products.

I: That is very interesting!

R: Yes and this is for everything. There is no waste, you can use it again