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Sustainable Agri-Food Startups:
a Study on Business Models and Creation of Value From Waste

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Abstract: English Version

In the last years, the need of a radical change in the human consumption patterns represents an urgent challenge for governments, firms and consumers. The objective is to meet "the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). This is the most acknowledged definition of "Sustainable Development". The following study is going to investigate the implementation of sustainable development in the agri-food industry, where its effect on the society and on the environment are immediately visible, through the radical change of companies' business models towards a sustainability orientation. Because of the radicality of this change, the achievement of a sustainability orientation is easier for new ventures, rather than for incumbents. Therefore, the unit of analysis chosen for the study are startups.

The findings of the study showed a significant prevalence of technological oriented innovations that are leading the startups' business models towards sustainability orientation. In particular, it has been possible to describe the business model of 173 startups as "Maximize energy and material efficiency" through technological innovations, highlighting the research of efficiency as a key driver for the implementation of sustainability. Furthermore, the analysis of the study focused on a specific technological and environmental innovation, the "Creation of value from waste". Through four case studies it has been possible to identify the main typologies of this business model applied to the supply chain stage "Service Providers", and the main drivers that lead companies to its implementation. Moreover, through the Business Model Canvas tool, the drivers of the specific decision of the interviewed companies for each block of the Canvas have been analysed. For example, the main drivers for the decisions in the block "Key activities" have been identified in the research of scalability and reliability. The former is leading the companies towards a hub-less business model, while the latter is constraining some startups from relying on volunteers for the delivery services. Concerning the different layers of the Food Waste Hierarchy in which the startups are positioning, the type of product managed by the startup has been evaluated as the main decision driver, along with the role of policy makers, that can both, incentivize or constrain the implementation of the "Create value from waste" business model.

Abstract: Italian Version

Negli ultimi anni, la consapevolezza della necessità di un cambiamento radicale nelle abitudini di consumo è cresciuta esponenzialmente, sia tra istituzioni ed imprese che tra i consumatori. L'obbiettivo è di "Soddisfare le necessità attuali senza compromettere la capacità delle future generazioni di soddisfare le proprie necessità" (WCED, 1987). Questa è la definizione più riconosciuta di "Sviluppo sostenibile", la cui implementazione nell'industria alimentare verrà analizzata durante lo sviluppo della tesi.

In questo contesto, i risvolti sociali ed ambientali dell'implementazione di un modello di business sostenibile sono immediatamente percepibili. A causa della radicalità del cambiamento, si è deciso di usare come unità di analisi le startups operanti nel settore, in quanto più propense ad implementare questa trasformazione rispetto ad aziende già consolidate. Lo studio ha mostrato la prevalenza di business model focalizzati sull'innovazione tecnologica come mezzo per creare sostenibilità. Nel dettaglio, il modello di business di 173 startups è stato descritto come "Massimizzare l'efficienza energetica e dei materiali" attraverso innovazione tecnologica. Ciò mette in luce l'importanza della ricerca di efficienza come motivazione per l'implementazione dello sviluppo sostenibile. Successivamente, l'analisi si è concentrata su una particolare tipologia di innovazione tecnologica, volta a creare valore dagli sprechi. Quattro studi di caso hanno permesso l'identificazione delle principali tipologie di questo modello di business nello stadio della filiera "Service providers", delle principali motivazioni che hanno portato i fondatori intervistati ad intraprendere un simile modello di business e la specifica struttura analizzata dal caso studio. Inoltre, attraverso l'uso del Business Model Canvas, i fattori che hanno influenzato le decisioni delle startups intervistate per ogni blocco del Canvas sono state analizzate. Per esempio, per quanto riguarda le attività performate dalle aziende, la ricerca di scalabilità e affidabilità hanno guidato le decisioni delle startups. La prima ha portato allo sviluppo di modelli senza supporti fisici, la seconda ha invece impossibilitato alcune startups del campione ad affidarsi a dei volontari per il servizio di ritiro e consegna. La tipologia di prodotto trattato è invece risultata influenzare il posizionamento nella Food Waste Hierarchy. Anche le azioni dei policymakers risultano influenzare, sia in positivo che in negativo, l'implementazione del modello di business "Create value from waste".

Executive summary

I. Introduction

"Sustainable development" has been defined as meeting "the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

In defining sustainable development, the World Commission on Environment and Development (WCED) recognized the "threats" that the actual consumption pattern is for human survival. Thankfully, governments' actions and the increasing awareness of consumers are changing this disruptive consumption pattern. However, despite the increased attention on the topic, the implementation of sustainable development is not standard practice for every company.

The agri-food industry is one of the environments in which the importance of a change in the consumption patterns is most evident, due to its direct reflection into the human wealth. In the light of the above, several NGOs are dedicating their mission to the implementation of sustainability into the agri-food industry. The existence of hungry people is one of the main issues to be tackled in the industry.

"*Hunger is still one of the most urgent development challenges, yet the world is producing more than enough food*."

Food and Agriculture Organization of the United States (2017b)

The above-mentioned sentence explicit the "Paradox of food insecurity and food waste", meaning the coexistence of two facts: on the one hand, one-third of food produced for human consumption is lost or wasted every year; on the other hand, in 2016 815 million of undernourished people has been recognized (Food and Agriculture Organization of the United Nations).

The logical approach that follows to tackle the problem is the management of surplus food and reduction of wasted food (Garrone et al., 2016). Concerning the control of

surplus food, one option is to pursue the creation of value from what would otherwise be wasted. This particular implementation of sustainability moved the focus of the research on the business models aimed at the production of value from waste.

The application of this business model in the agri-food industry is a breakthrough that is affecting the downstream stages of the food value chain.

The strong relation between the topics of sustainability and innovation highlighted by several studies (Behnam and Cagliano, 2017; Ludeke-Freud, 2009; Upward and Jones, 2016; Schaltegger et al. 2012; Caliceti, 2017) drove the decision of focusing on the startups operating in the agri-food sector as a chosen unit of analysis, due to the intrinsic relation these businesses have with innovation.

The significance of the impact the mentioned topic has on society, and the interests expressed by the authors of the thesis are leading the focus of the research on sustainable oriented business models implemented by startups operating in the agri-food industry.

The objective of the thesis: the aim of the thesis is the identification of the most adopted business models by startups operating in the agri-food industry and their contribution to the industry's sustainable development. Moreover, the focus of the thesis will subsequently shift towards a specific business model, the one described by Bocken et al. (2014) as "Create value from waste." The drivers and barriers faced by this business model will be the scope of analysis, as well as the different shades the business model may assume and the definition of the drivers and barriers that can impact on each analysed nuance.

The two research questions will be explored in the chapter "Literature review and research questions," where the literature gaps from which the research questions arose are explicated.

II. Literature review and research questions

The history of the global awareness concerning the sustainability topic has been drafted from the point of view of both, governments and firms. Its birth has been identified in the Club of Rome's publication "The Limit of Growth" (1972) and it experienced a growing trend, highlighted by several key events. The United Nation Conference on the Human Environment (1972), the World Commission on Environment and Development (1983-1987) and the United Nations Content on Environment and Development (1992) are the most representative milestones of the governments' increasing awareness. A similar path has been followed by firms' sustainability awareness: sustainability was not even considered as an issue until the first '80s (Samant and Sangle, 2016), while nowadays firms are starting to look at sustainable development as leverage which can create competitive advantage (Porter and Kramer, 2011).

Consequently, the concept of sustainable development has been applied to the agri-food industry. The implementation of sustainability in the industry may be used as a mean to tackle the several emerging trends that the sector must face, such as climate change, rapid technological innovation, new demands for food, as well as biofuel, and an increasing need of access to information fostered by governments and customers' requirements. However, one of the main challenges faced by the agri-food sector is the stated battle against the "Paradox of food insecurity and food waste."

To have a better understanding of the topic, it is critical to define the difference between surplus food and food waste. The definition proposed by Garrone et al. (2014) has been used as a reference. Surplus food has been described as "the edible food that is produced, manufactured, retailed or served but for various reasons is not sold to or consumed by the intended customers". Consequently, food waste has been recognized as "the surplus food that is not recovered to feed people, to feed animals, to produce new products (e.g., jams or juices), new materials (e.g., fertilizers) or energy". Concerning the difference between avoidable and unavoidable food waste, the definition provided by Papagyropolou et al. (2014) has been used as a reference: avoidable food waste considers all the food waste that during its lifecycle has been potentially edible. Consequently, unavoidable food waste refers to food waste that is not, and has never been edible.

In order to classify the possible actions that have been, or might be used to tackle the paradox of food insecurity and food waste, Papagyropolou et al. (2014)'s application of the waste hierarchy to the agri-food industry has been adopted. It classifies all the actions into five stages, from the most to the least favourable regarding social and environmental impact: Prevention, Re-use, Recycle, Recovery and Disposal.

The incorporation of sustainability into the company's business model has been discovered to be a key element in gaining competitiveness (Lüdeke-Freund, 2013). "The design of truly sustainable businesses requires the innovation of the company business model" is a representative sentence about the mentioned topic stated by Professor Cagliano as an opening talking about the sustainable oriented business model (Leadership & Innovation course, 2017 – Politecnico di Milano). The sentence also enhances a strong relationship between sustainability and innovation, making it a key reason why the analysed sample is composed of startups. The strong relation with change is intrinsic in their business model.

For the purpose of the thesis, it has been necessary to identify a classification of sustainable business models. After a literature review process, it has been decided to adopt the framework developed by Bocken et al. (2014). The frame considers three main clusters and eight archetypes. In particular:

- T) Technological oriented innovation
    - T1: "Maximize material and energy efficiency"
    - T2: "Create value from waste"
    - T3: "Substitute with renewables and natural processes"
- (S) Social oriented innovation
    - S1: "Deliver functionality rather than ownership"
    - S2: "Adopt a stewardship role"
    - S3: "Encourage sufficiency"
- (O) Organizational oriented innovation
    - O1: "Repurpose for society/environment"
    - O2: "Develop scale up solutions"

However, the chosen framework is not agri-food centric. Nevertheless, it can be considered suitable for any type of industry. Eventually, a gap in the literature has been

individuated: the absence of a specific framework able to classify the business models adopted by agri-food Sustainable Oriented startups. The individuation of this gap rises the first research question:

RQ1: What are the most implemented business models by the agri-food Sustainability Oriented startups?

- **RQ1a:** What are their characteristics regarding supply chain stage in which they operate, geographical distribution, ability to collect funds, and typology of sustainability orientation pursued?

- **RQ1b:** What are the differences and similarities that emerge from a comparison with the analysis performed by Caliceti (2017)?

After the identification of a framework for the classification of sustainable business models, the focus of the research has shifted towards the archetype T2: "create value from waste." The decision has been the result of several studies concerning the topic emerged from the literature review that stimulated the interests of the authors. Moreover, no application of the archetype has been identified in the literature concerning the scope of the thesis: the agri-food startups.

The definitions provided in the literature for the terms “create value from waste” and “circular economy” has been analysed, resulting in the decision of considering them as synonymous for the purpose of the thesis.

The logic behind this business model is trying to replicate the natural processes, in which the waste of one entity becomes input for another one (Gibbs and Deutz, 2007). The revolution is to rethink the value chain beyond the traditional linear concept, creating circular patterns. Recent trends, such as the increase of resources prices and their unpredictability have been identified as significant initial drivers that led towards the implementation of this archetype.

In order to describe the power and the potential of this radical thinking innovation, Ellen MacArthur Foundation (2013a), which gave an essential scientific contribution to this topic, highlighted four pillars of value creation: “Power of the Inner circle”, “Power of circling longer, “Power of cascaded use and Inbound material/product substitution” and

“Power of pure, non-toxic, or at least easier-to-separate inputs and designs”. Moreover, a categorization of the waste which is possible to avoid through the implementation of a closed loop model has been individuated. The macro-categories defined by Ellen MacArthur Foundation (2013a) are: "Waste in the production chain," "End-of-life waste," "Energy use," "Erosion of ecosystem services."

The literature review also identified some drivers and barriers of the firms' implementation of the circular model.

The implementation of a circular business model, can overcome some limitations intrinsic in the linear value chain model, such as price risk, supply risk, and natural system degradation (Ellen MacArthur Foundation, 2015; Ellen MacArthur Foundation, 2013b; Kazancoglu Y. et al., 2018), and the possibility of increasing profits and market shares through the achievement of competitive advantage (Kazancoglu Y. et al., 2018). Opportunities for improvements in both, efficiency (Ellen MacArthur Foundation, 2013b; Ellen MacArthur Foundation, 2015; Merli et al., 2018) and effectiveness (Ellen MacArthur Foundation, 2013b; Kazancoglu Y. et al., 2018) are driving an increasing number of firms towards the implementation of a circular business model. Additional drivers to the application of a circular business model are a consequence of changes in the consumer's behaviour and governments actions (Ellen MacArthur Foundation, 2013b; Ellen MacArthur Foundation, 2015; Sauvé S. et al., 2016).

On the other hand, some concerns would increase the barriers to the implementation of a circular business model. Including the previously stated government activities which could also negatively affect the implementation of circular business models (Sauvé S. et al., 2016). Some authors claimed that the economic aspect could act as a barrier to the circular model implementation (Sauvé S. et al., 2016; Andersen, 2007). Ellen MacArthur Foundation (2015) provided a structured classification of the barriers a company might face in the pursuit of a circular business model. It distinguishes between fifteen categories, grouped into four macro-categories:

- Economics
    - “Not profitable for businesses even if other barriers are overcome”;
    - "Capital intensive and/or uncertain payback times";
    - "Technology not yet available at a scale that is at a cost-effective level";

- Market failures
    - “Externalities (true costs) not fully reflected in market prices”;
    - “Insufficient public goods/infrastructure provided by the market or the state”;
    - “Insufficient competition/markets leading to lower quantity and higher prices than is socially desirable”;
    - "Imperfect information, for example, asymmetric or high-cost information, which negatively affects market decision";
    - “Split incentives (agency problem) when two parties to a transaction have different goals and levels of information”;
    - “Transaction costs such as the costs of finding and bargaining with customers or suppliers”;
- Regulatory Failures
    - “Inadequately defined legal frameworks that govern areas such as the use of new technologies”;
    - “Poorly defined targets and objectives which provide either insufficient or skewed direction to industry”;
    - “Implementation and enforcement failures leading to the effects of regulations being diluted or altered”;
    - “Unintended consequences of existing regulations that hamper circular practices”;
- Social factors
    - “Capabilities and skills lacking either in-house or in the market at reasonable cost”;
    - "Custom and habit: ingrained patterns of behavior by consumers and businesses."

The final part of the literature review will focus on delineating the topic of “Create value from waste” in the agri-food industry.

Implementations of circular business models in the agri-food industry are usually identifiable in the downstream levels of the value chain, at the consumption stage (including retailers). The changes in consumers habits and the introduction of smart technologies are the biggest drivers of this movement. Concerning the barriers faced by

this industry, Ellen MacArthur Foundation (2015) applied the classification mentioned above, identifying economic barriers, market failures, regulatory failures and social factors that are working against the implementation of circular business models.

In this respect, the second research question is going to investigate the archetype "create value from waste," the drivers and barriers that the business model may encounter, the different nuances the archetype may assume and how drivers and barriers affect them. The unit of analysis will be the startups, in order to be coherent with the classification previously performed and due to their innovative and experimental nature.

RQ2: What are the characteristics of the business model "Create value from waste" implemented by startups operating within the agri-food industry?

- **RQ2a**: What are the drivers and barriers that may affect the startup implementation of a "Create value from waste" business model within the agri-food industry?
- **RQ2b**: What are the different nuances assumed by the implementation of the business model "Create value from waste" in the agri-food industry?
- **RQ2c**: What are the drivers and barriers that may affect the implementation of the different nuances of the "Create value from waste" business model?

III. Methodology

This paragraph will illustrate the methodologies used in order to identify the answers to the two research questions of the dissertation.

The starting point of the work has been the creation of a database filled by agri-food startups and relative information, from which it will be possible to answer the first research question and to start the construction of the case studies for the second one.

The source used in order to generate the database has been the online database Crunchbase. From this collection of data, it has been possible to extract information regarding 7966 startups. The filters used for the extraction have been: date of foundation,

category groups and specific keywords related to the agri-food industry (the list of keywords are reported in Annex B).

The extraction method assures that all the startups belonging to the agri-food industry have been retrieved but it does not assure that other startups belonging to different industries do not fall into the retrieval, due to the vague description of the startups present in Crunchbase. In order to evaluate if a startup would be part or not of the agri-food supply chain, the NACE classification (Nomenclature generale des Activités économiques dans les Communauté Européenne) has been used, which provides a list of activities performed within the agri-food industry, defined by the European Union. Consequently, for each agri-food startup, the core activity and the stage of the value chain in which the startup operates in have been defined. The remaining startups of the database have been considered as not operating in this industry and consequently erased from the database since they do not concern the topic of this dissertation. However, startups which inputs derive from agri-food waste and are reprocessed into other industries output have been highlighted and further analysed, even if it has not been possible to associate any NACE agri-food activity to them.

Moreover, once the list of startups belonging to the agri-food supply chain has been completed a framework was necessary to define a structure to describe the characteristics of a sustainable business model, in order to be able to address if a startup would result or not as sustainable oriented. The chosen framework is the Sustainable Development Goals proposed by the United Nations in the "2030 Agenda of Sustainable Development"; a list of goals and targets that present a guide for governments and firms aimed at the elimination of poverty and hunger, the fight against inequalities and the achievement of universal freedom by 2030.

The identification of Sustainable Oriented startups (SOs) and Non-SOs have been performed through the identification of the startups' mission. Therefore, for each SOs, a further analysis has been completed, in order to outline which Sustainable Development Goal and targets (2030 Agenda of Sustainable Development) the startup is trying to pursue through its operations.

Eventually, a further level of analysis has been necessary to address the typology of the sustainable business model implemented by the startup.

The framework recognized by Bocken et al. (2014) has been used to classify the typology of each business model's sustainability orientation, according to its mission and activities. This recent research identifies eight business model archetypes, divided into three main macro-groups, organizational, social, technological, depending on their innovation orientation.

The final database, which has been drafted by applying the methodology just mentioned, has been merged with the database elaborated by Caliceti (2017) in order to have a comprehensive perspective of the last five years, from 2013 to 2017 included. The resulting database is composed of 2295 agri-food startups, 412 of which have been classified as Sustainable Oriented. The final database is the source of information for the further analysis, aimed at the individuation of the answer to the research question #1 and the extraction of complementary information.

The results of the analysis performed in order to answer the first research question have been the starting point for the second part of the thesis project. The focus has centred on the archetype T2: "Create value from waste". The sample given by the database is composed of 27 startups in which the implementation of the closed loop archetype has been recognized. Papagyropoulou et al. (2014) definition of the waste hierarchy has been used to map the startups according to two dimensions: the stage of the value chain in which they are operating, and the layer of the hierarchy which they fit in.

The first step of the investigation has been to draft a specific profile for each one of the 27 startups by analysing their websites. Consequently, it has been possible to classify the startups according to the food waste hierarchy framework. From this classification, it has been decided to focus on the supply chain stage "service providers", since it is the only stage present in different layers of the hierarchy and the most represented one. It is the only stage that allows the presence of heterogeneity in the case studies. Therefore, the sample has been limited to the 16 startups operating in the agri-food industry as service providers. In order to deepen the analysis of these startups, the business model canvas, which has been chosen as the best representation for a business model, has been draft for each service provider startup and reported in Annex D.

The analysis of the canvases led to the identification of 9 decision trees, one for each block of the business canvas. The so-called "decisions" are the different characteristics of

the block implemented by each startup. From these trees, it has been possible to choose the sample of startups for the case studies. The final sample, resulting from the decision trees and the willingness of startups to contribute to the research, is composed of four out of sixteen startups. The four startups are divided into two groups, according to the level of the food waste hierarchy in which their food waste management strategy has been recognized. The firms JustNow and BigZpoon belong to the prevention level, the other two, Olio and Replate, are part of the reuse level.

As already mentioned, the tool that has been used to answer the second research question is the case study. This structure allows to qualitatively answer the research question, whose purpose is to describe the specific archetype taken into consideration through the support of the literature review previously analysed. The case study analyses multiple descriptive cases, in detail the four startups have been interviewed through a video call with their founders, CEO or COO.

The interview has been conducted following the blocks of the business model canvas. Firstly, the interview aims at evaluating the history of the startup, the reasons why the founder decided to move towards the agri-food industry and especially toward the implementation of a sustainable business model.

Then, it has been fundamental to address the different areas of the business models:

1. Customer Segment
2. Key activities and Resources
3. Costs and Revenues

Eventually, the third part of the interview is focused on the evaluation of the drivers and barriers identified through the literature review:

Drivers:

1. Increase in demand
2. The rise of new markets
3. Customer awareness
4. Change in customer preferences

Barriers:

1. Regulations and laws can result as a constraint for the development of this archetype
2. Geographic dispersion
3. Customer habits and cultural heritage

The analysis performed on the case studies has been divided into two main sections: firstly, a single case study analysis has been conducted for each startup; secondly, three cross-study analysis have been conducted to highlight the main differences and similarities among the various businesses. Two cross-studies have been performed between the two startups belonging to the same level of the hierarchy; the last cross-study has been conducted between the two different levels of the pyramid.

IV. Results

RQ1

From the database analysis, the archetype T1-"Maximize energy and materials efficiency" resulted the most implemented by the agri-food SOs, 173 startups out of 412 (42% of the sample). In detail, the popularity of the archetype has been driven by businesses selling data analysis tools and startups selling technologies for aquaponics and aeroponics models. The macro-category in which the most pursued archetype is included resulted as well the most common between the startups of the sample: more than half of the SOs (245 startups) are implementing a business model which is recognised in the classification provided by Bocken et al. (2014) as "Technological oriented innovation."

The second most implemented archetype resulted O1-"Repurpose for the society/environment." The diffusion of this archetype is very significative since it reflects the growing trend of people's awareness of social and environmental issues.

On the other hand, the macro-category "Social oriented innovation" resulted in being the least implemented one. In particular, the archetypes S3-“Encourage sufficiency” and S1-“Promote functionality rather than ownership” have been reported as implemented respectively by only four and three startups.

The geographical location has been considered as a driver of the choice of the archetype. The analysis has been performed at the macro-category level and pointed out that startups based in developed countries are more focused on technological oriented innovations,

while startups focused in developing countries are more focused on organizational oriented innovations. The dispersion of funding has also been investigated as a driver for the implementation of a specific archetype. The most funded archetype resulted to be the archetype "O2-"Develop scale up solutions." However, this last result is biased by the presence in this archetype of the startup Sundrop Farms, which collected an extraordinary value of funding amount: 100,000,000 $.

Concerning the Sustainable Development Targets, the targets 2.3 and 2.4 resulted as the most implemented. They are described in the 2030 Agenda of Sustainable Development (2015) respectively as "By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment" and "By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality". As a consequence, the Sustainable Development Goal 2 "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" (2030 Agenda of Sustainable Development, 2015) resulted the most pursued by Sustainable Oriented startups.

Furthermore, it has been noted that the Sustainable Development Goal 2 resulted the most pursued by every archetype apart from T2-"Create value from waste." The mentioned case is the only one in which the Sustainable Development Goal most pursued by startups is 12 "Ensure sustainable consumption and production patterns". In particular, the target 12.3 "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses" resulted from the analysis as the main target for 16 T2 startups out of 27.

RQ2

This section of the dissertation aims at describing in detail the archetype T2, "Create Value from Waste," as well as identifying the drivers and barriers that lead a business towards the implementation of this type of sustainable business model.

The chapter firstly identifies the nine decision trees and the procedure applied in order to limit the sample of the case study to 16 startups. Eventually, it presents the four cases which together constitute the case studies research:

1. BigZpoon (USA, 2015, Prevention)
2. JustNow (Romania, 2013, Prevention)
3. Replate (USA, 2016, Reuse)
4. Olio (UK, 2014, Reuse)

The four startups are initially shortly described by their business model canvases; then, every single interview is reported, highlighting the important aspects and features of each business. Consequently, the three mentioned cross-study analysis were conducted, in order to better evaluate the similarities and differences among the startups.

The core activity of each startup is the management of an online platform which enhances the connection between the different actors within a marketplace. Each firm develops the platform in different areas and stages of the supply chain and involves different players.

BigZpoon aims at filling the communication gap present between food services and final customers, through the creation of a platform with the aim of reducing food waste and creating a win-win-win solution for customers, businesses, and environment.

JustNow aims at reducing food waste through the promotion of surplus food produced by retailers. The platform connects buyers and retailers and creates ad hoc notifications for the end-users.

Replate aims at the reduction of food waste through the donation of surplus food produced by canteens and catering services to charities and people in need. The business also supplies logistics activities to pick up and delivery the surplus food.

Olio bases its business on the concept of community. The startups want to reduce surplus food produced by retailers and private citizens by sharing it with the community. A network of volunteers allows the communication between the retailers and the end users.

From the cross analysis between BigZpoon and JustNow it results that the activities performed are very similar, even if the players of the marketplace are different, indeed, both startups are interested in enlarging their customer base in the future. Since the activities performed are the same. Also the cost structure of the firms is quite similar: the cost of management of the platform, marketing efforts, engineering and operations costs. Both startups believe that their hub-less and physical-free model allows them to be more scalable.

Eventually, for what concerns regulations, they both believe that European laws are nowadays more in favour of this type of businesses; on the other hand, since JustNow is operating as well in South Africa, it believes that in Africa laws are not incentivizing firms to implement this sustainability orientation.

Both startups do not recognize customer habits as a potential barrier, in fact, the food they offer is not leftover foods, but only surplus food which could not be sold.

The second cross-study has been conducted between Replate and Olio, both operating at the reuse level of the hierarchy. Their operations result differently since they offer different activities for different customers using different types of resources. Olio bases its model on volunteers, who can pick up surplus food from retailers and share it on the platform. Olio's main objective is to build a strong sense of community within the actors. This factor can overcome the risk of the unreliability of volunteers.

On the other hand, Replate uses employees as the main resource for the logistics activities. The startup believes that employees are more reliable and can create a relationship with the final customers. Therefore, the cost item which is added in Replate cost structure is the employee's cost, which is not present in Olio's structure.

Both firms agree on the fact that a hub-less model increases the factor of scalability.

Regarding regulations, both startups believe that they can represent a barrier for the development of these business models. Moreover, the barrier created by customer habits could be broken down only through a long-term process.

Eventually, the analysis between the two stages shows that a firm could be incentivized to use a reuse or prevention model due to the type of surplus food the startup is dealing with and the regulation constraints present in the operating country.

Moreover, all startups aim at connecting the actors of the marketplace and at increasing their customer base over time. At the reuse level, it is more common to offer also logistics services to pick up and deliver surplus food.

The important factor that allows the scalability of these businesses is their hub-less, physical-free model.

Concerning current regulations, there are different opinions between the startups, and they affirm that laws can concurrently incentivize and limit the growth of these businesses, but in any case, there are margins of improvements for regulations to incentivize these models more.

Concerning the barrier presented by customer habits, at the reuse level it is recognized as a big issue which could be broken overtime by the assessment of a long-term mission. At the prevention level instead, the barrier is recognized but does not represent a big issue, since it will break down itself due to the presence of new social trends.

Lastly, a brief description of the six business models which use as input agri-food wastes, in order to reprocess them and create output channelled into other industries, has been performed. However, no case study has been dedicated to this sub-sample since they are out of the research scope.

V. Conclusions

To conclude, the topic of sustainability has been analysed through its historical evolution and its adaptation and impact in the agri-food industry. Once the link between sustainability and innovation has been highlighted, it was clear that startups would have been the most suitable unit of analysis for the purpose of the thesis.

The two literature gaps at the basis of the research questions have been identified in the absence of a framework able to exhaustively and compressively classify agri-food sustainable startup business models, and the absence of studies in the literature to the application of the business model "Create value from waste" by the startups operating in the agri-food industry. The thesis contributed to filling this literature gaps with a quantitative analysis of the sustainable business models implemented by startups, and

qualitative analysis on the implementation of the circular economy within the agri-food startups.

The business model T1-"Maximize energy and material efficiency" resulted in the most spread within the sample, coherently with the results observed by Caliceti (2017). In contributing to the numerosity of this archetype are mainly startups selling data analysis tools with the aim of increasing efficiency and startups selling technologies and structure for the implementation of aqua/hydroponics solutions. Within the archetype, coherently, the most popular supply chain stages are Service providers (76 SOs) and Technology suppliers (72 SOs). Therefore, it has been possible to conclude that the main objective of sustainable startups is to achieve higher efficiency through the implementation of a sustainable business model. The importance of the geographical location in the implementation of sustainability has been reported, in fact, the distribution of the archetype is different if startups are based in developed countries or startups are based in developing countries.

Concerning the study for the answer to the second research question, the performed interviews have been the key element to highlight the motivations that led founders in developing a business model focused on this kind of sustainability and to understand the drivers and barriers that most affect its implementation. The research of flexibility and scalability have driven all the major decisions of the interviewed founders, such as the absence of a physical hub.

JustNow’s interview has been useful also in understanding the importance of policymakers. The startups are operating in both, Europe and South Africa, and are experiencing different levels of difficulties according to the level of involvement of policymakers.

The main limitation of the research has been identified in the choice of the sample for the interviews, limited by the startup's collaborations.

Moreover, interesting insights could arise from the analysis of the startups operating within different industries, using as input material wastes produced in the agri-food

industry. However, these startups were out of the scope of the research. Further research on the topic might lead to interesting insights.

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1. Introduction

"*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*"

World Commission on Environment and Development (1987)

This is the most recognized definition of sustainable development. Since 1987, the World Commission on Environment and Development (WCED) recognized the need of a change in the human consumption patterns. In the report "Our common future", the WCED described the former consumption pattern and methodology as "threats for human survival".

Mercifully, the attitude and the awareness of the mentioned need of a change has been recognized by governments, firms and consumers. Governments have been the first in recognizing this need and they started fostering the development of firms' sustainable orientation. Until the first '80s firms were not considering sustainable development in their processes. Only in the 80's firms started to approach sustainability, firstly with the sole objective of achieving legal compliance with governments and stakeholders' requirements (Samant and Sangle, 2016). In a second phase, in the 90's, sustainability has been driven by the risk of reputational damage (Samant and Sangle, 2016) and by the objective of gaining competitive advantage (Kramer, 2011).

Moreover, thanks to the knowledge spread by governments and NGOs, even consumers' interest and awareness about the topic started to increase.

However, despite the momentum sustainability has gained in the last 40 years, its implementation in business processes is not a standard practice for every company. Moreover, different trends such as the increase in the world population, the climate change and the shortening of the product lifecycles are worsening the actual situation and increasing the threats for human survival.

One of the industries in which the need of further actions is clearly visible is the agri-food one.

Given the importance of sustainability in this sector and its immediate reflection into the human wealth, different NGOs are devoting their mission in implementing and fostering sustainability into the industry.

The Food and Agriculture Organization of the United Nations (FAO) is the most involved NGO in the global fight for the implementation of sustainability in the sector. In one of its last report, "The future of food and agriculture: Trends and challenges", after the study of the major trends that are going to affect the industry, FAO summarized in 10 major topics the possible challenges that the industry is expected to face in the next years, driven by the evolution of the implementation of sustainable oriented initiatives:

- "Sustainability improving agricultural productivity to meet increasing demand"
  This challenge is caused by the expected increase in demand and the increase of competition for natural resources. While demand is rising, natural resources are becoming increasingly stressed. An improvement in agricultural productivity is needed.
- "Ensuring a sustainable natural resource base"
  This challenge is very linked with the concept of sustainable extraction of natural resources. Its successful implementation will result in the access to resources "without compromising the ability of future generations to meet their own needs" (WCED, 1987).
- "Addressing climate change and intensification of natural hazards"
  The key actions to tackle this challenge aim at maintaining the current agricultural capacity while reducing the environmental and climate disruption towards which unsustainable practices are leading to.
- "Eradicating extreme poverty and reducing inequality"
  Poverty is the main driver of hungry, and the major part of the poor and hungry population is working in agriculture, fisheries and forestry. The main action in order to successfully face this challenge is to sustainable empower these people.
- "Ending hunger and all forms of malnutrition"
  With the expected increase in population (9.7 billion people are expected in 2050, from around 7.2 billion people today (FAO 2017b)), the urbanization trend and the rise of the middle classes (KPMG, 2013), the demand of food is going to grow.

This is a strong call for actions in order to face the problem that is already present and is expected to worsen.

- "Making food systems more efficient, inclusive and resilient"
  This challenge highlights the problem of efficiency in the food value chain. The amount of wasted food per year is incredible. Moreover, the stages of the value chain in which this waste is created is different according to the country. In developing countries, the main causes are the absence or the inadequacy of infrastructures, while in developed countries the 90% of the waste is created at the consumption stage. Different actions must be considered according to the specific context.
- "Improving income earning opportunities in rural areas and addressing the root causes of migration"
  The mentioned challenge highlights the need of addressing inequalities that are affecting the conditions of rural areas. Empowerment of people working in these areas and a reshape of the used infrastructure is needed in order to successfully face this challenge.
- "Building resilience to protracted crises, disaster and conflicts"
  The countries which are affected by protracted crises, disaster and conflicts are the most critical to be addressed. The fight against hunger, malnutrition and poverty is even a bigger challenge.
- "Preventing transboundary and emerging agriculture and food system threats"
  The increased internationalization, together with the climate change are increasing the risks arising from food safety issues. An increase in the food value chain visibility is needed to tackle this challenge.
- "Addressing the need of coherent and effective national and international governance"
  To successfully fight hunger, is clear the need of collaboration between different governments, sector-specific and local policies are not enough to fully implement a sustainable orientation.

The 2030 Agenda is the common plan of action published by the United Nations. It summarises in 17 Sustainable Development Goals (SDGs), divided into 169 targets all the sustainable objectives that the United Nations are planning to achieve by 2030. They

"seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls". All the mentioned challenges are encompassed in the SDGs. Since The 2030 Agenda is not specifically developed for the agri-food industry, some of the SDGs are addressing different sectors.

However, the main issue to be tackle in the agri-food industry remains the existence of hungry people. The most significative SDG in this prospective is the second: "End hunger, achieve food security and improved nutrition and promote sustainable agriculture". The problem of hunger is one of the main issues the world is facing, despite the agricultural sector is producing more than enough food for the current population.

"*Hunger is still one of the most urgent development challenges, yet the world is producing more than enough food*."

Food and Agriculture Organization of the United States (2017b)

The quoted sentence perfectly summarizes what is the paradox of food insecurity and food waste. The current world population is about 7.2 billion people and it has been estimated that agriculture produces enough food for 12 to 14 billion people. Despite the agricultural production rate, 850 million people are still living within a situation of chronic hunger. Concurrently, 1.3 billion tonnes of food are estimated to be wasted every year (FAO 2017b).

In the practice, several approaches have been adopted in order to tackle food insecurity. Some examples aim at the increase in production and distribution of food. However, the above mentioned paradox and figures drive towards approaches whose aim is to reduce the amount of wasted food (Garrone et al., 2016).

The implementation of sustainability in the agri-food industry has been driven by the prevention of creation of food waste. The actions and initiatives towards this direction can be classified into the "Food Waste Hierarchy", an adaptation of the waste hierarchy proposed by Papagyropolou et al. (2014). Two main lines of action are possible to avoid the creation of food waste: the prevention of surplus food creation and the management of the produced surplus food.

Concerning the management of surplus food, several initiatives are spreading, aimed at the consumption stage (including retailers). The objective of these initiatives is to create value from what would otherwise become waste.

The principle at the base of this concept is the circular economy. It is gaining momentum in the last years. mainly thanks to Ellen MacArthur Foundation. The foundation is spreading knowledge and devoting its mission to help companies in the implementation of circular business models.

The main concept of the circular economy is to overcome the classical linear pattern of the traditional processes and to emulate the natural ecosystems, making the production of one entity as the input resources for another (Gibbs and Deutz, 2007). In other words, the goal of a circular business model is to extract further value from a product that is the waste of a process.

The implementation of this business model into the agri-food industry is a major breakthrough. Its application in the downstream part of the food value chain are gaining momentum, mainly thanks to the introduction of smart technologies and to a radical change in the consumers' behaviour. It is a powerful tool that is helping communities in fighting the existence of the paradox of food insecurity and food waste.

However, a radical change in the business model is needed to implement this kind of revolutionary value chain and, generally, to implement sustainability into a business model. The relation between innovation and the implementation of sustainability has been analysed and confirmed by several studies (Behnam and Cagliano, 2017; Ludeke-Freud, 2009; Upward and Jones, 2016; Schaltegger et al. 2012; Caliceti, 2017). According to this perspective, the most suitable sample for studying the implementation of sustainability in the agri-food industry is the one composed by the startups operating in the sector.

Because of the remarkable impact of the mentioned topics on the society and the interest expressed by the author of this work, the thesis will focus on the sustainable oriented business models implemented by the startups operating in the agri-food industry. In detail, the research aims at identifying which are the typologies of sustainability most implemented. In order to define the different typologies of sustainability implemented, a

classification of the startup's business models will be performed, concurrently with the identification of the main SDGs and targets pursued by each analysed startup.

Moreover, the focus of the thesis will further shift on the specific business model described by Bocken et al. (2014) as "Create value from waste" and its application in the agri-food industry. The objective of this second part of the research is the analysis of all the nuances the business model can assume, and the drivers and barriers of the implementation of this business model, according to the theory and the startups experience.

The thesis will be structured as follow. Chapter 2 will be dedicated to the literature review of the sustainability topic, its application to the agri-food industry and a deepening on the circular economy topic, its drivers and barriers and its application within the food value chain. From the literature review, the two research questions of the thesis are expected to be drafted, aimed at the follow up of the above mentioned topics. Chapter 3 will describe the methodologies and the frameworks adopted in order to conduct the research of answers for the two research questions. In particular, two different investigation methods will be described, a quantitative and a qualitative one. Chapter 4 will deploy the first investigation method, looking for a quantitative answer to the first research question. On the other hand, Chapter 5 will be dedicated to the qualitative research of an answer to the second research question, through case studies analysis. Finally, Chapter 6 will conclude the thesis, summarizing the main findings and insights that will emerge from the research performed. Furthermore, limitations and identification of scopes for future research will be discussed as well in the conclusive chapter.

2. Literature review and research questions

The literature research has been performed in Scopus database, Google Scolar database and Google using keywords related to sustainability and business model innovation topics, both alone and linked through Boolean operators with the words "food", "agriculture" and "agri-food" in order to align the research with the subject of the thesis. Both academic and non-academic literature (NGOs' reports) has been used as source of information.

2.1 Sustainable development

The sustainable development topic has gained momentum in the last years. The origin of the topic has to be looked for in the Club of Rome's publication "The Limit to Growth" (1972). It is the first acknowledgment that the economic growth cannot proceed non-stop in the long term; at least without a deep thought at the other two pillars on which the concept of long term sustainability is based: social and environmental impacts. Despite the relevance of the acknowledgment, the message was coming from an organization of individuals, without the involvement of any government.

The first step of governments' involvement toward this direction has been the United Nations Conference on the Human Environment (Stockholm Conference) in 1972. For the first time, the topic described by the Club of Rome's publication reached an official congress of nations.

After the Stockholm Conference, the subsequent pillar in the consolidation of the sustainable development topic took place in December 1983: The Secretary General of the United Nations appointed the Prime Minister of Norway, Gro Harlem Brundtland, as chair of the World Commission on Environment and Development (WCED), with the aim of leading countries into the process of pursuing long-term sustainable development. Despite several definitions have been adopted during the following years to describe the

meaning of sustainable development, the most employed remained the definition provided by the WCED (1987) in the report "Our Common Future":

"*it meets the needs of the present without compromising the ability of future generations to meet their own needs*".

The WCED report and the commitment of the United Nations have been able to successfully set the right example on the topic. Countries all over the world started to consider and promote sustainable development in their programs and policies.

The second remarkable meeting on the topic has been held in Rio de Janeiro, June 3rd - 14th 1992. It is known as the United Nations Content on Environment and Development (UNCED), delegations from 170 nations took part to the meeting. The most relevant outcome of the meeting is the Agenda 21. It is a general action plan to spread awareness of sustainable development and actions aimed at its implementation. One of the objective of the document is the local development on the part of each country of its specific sustainability agenda.

Following this increasing trend towards sustainable development, other remarkable results have been met in the subsequent years, from the drafting of the Kyoto Climate Agreement and its adoption by more than 150 nations, until the last plan of action published by the United Nations in 25th September 2015: the "2030 Agenda of Sustainable Development". The new agenda is leading the world's action plans in achieving social, environmental and economic sustainability. It is divided into 17 Sustainable Development Goals (SDG), which are broken up into 169 targets that "seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls".

It is possible to notice a similar evolution path towards sustainable development looking at the firms' level.

Until the first '80s, sustainability was not even considered as an issue by most of the operating firms (Samant and Sangle, 2016). Iconic of this approach is the essay from Friedman "The Social Responsibility of Business is to Increase its Profits" (1970).

Concomitantly with the WCED work, it is possible to notice a change in the firm's approach to sustainable development. Firms in the 1980's started to look beyond the mere short-term profit and started focusing on three complementary pillars of the value creation: economic, social and environmental. However, in this period the company's approach to sustainable development was still limited to the achievement of legal compliance of their obligation with governments and stakeholders (Samant and Sangle, 2016).

Only in the late '90s firms moved towards a more proactive approach, often driven by fear of reputational value losses (Samant and Sangle, 2016). Some representative examples of the damage that an unsustainable behaviour could lead are Nike's case of supplier child labour in Vietnam (Locke, 2003) and the more recent Nestlé palm oil scandal, well described by the article "Lessons from the palm oil showdown", published by The Guardian in 27th October 2010.

The awareness of governments, firms, and public opinion about the topic has increased. Nowadays, sustainable development can no longer be neglected. Moreover, firms are starting to see sustainable development as a possible competitive advantage (Porter and Kramer, 2011). This is the main driver of the firms' change in the approach to sustainability, from a legal compliance orientation towards a more strategic one.

In parallel with the concept of sustainable development, a similar notion has emerged: The Triple Bottom Line (TBL), developed by Elkington (1997). Basically, TBL splits the two-pillars perspective of sustainable development in a three-pillars one: Social sustainability, Environmental sustainability and Economic sustainability (Pope et al., 2004). The economic sustainability is therefore added to the two-pillars perspective. It is very important, since, it has been proved that financial reasons can sometimes result as a constraint to sustainability (Kantor et al. 1997). This is coherent with the definitions of the pillars, that are described as "recognized to be interconnected and interdependent" (Gibson, 2001). However, different researches (Behnam and Cagliano, 2017) describe sustainable development as encompassing the TBL. The thesis will refer to the latter definition each time the topic of sustainable development is mentioned.

To summarise what has been explained above, the attitude towards sustainable development has changed for both companies and governments. With an increasing awareness on the environmental and social challenges, both firms and governments are developing a more proactive approach in order to face these aspects and to leverage sustainable development with the final aim of gaining competitive advantage.

2.2 Sustainability in the agri-food industry

Despite the global economy's ups and downs, the agri-food industry is constantly experiencing a growth trend. The root cause of this peculiar situation has to be looked for in the continuous growth and expansion of the drivers that are leading the sector's demand, such as the world population, urbanization and the rise of the middle classes (KPMG, 2013).

However, despite the bright economic condition described above, the sector is facing some major challenges that can become the drivers of future tragedies. Climate change, rapid technological innovation, new demands for biofuel and need of access to information are reshaping the industry, leading to increased volatility, complexity and scrutiny along the whole value chain. Collaboration and cooperation among all the stages of the value chain are required to ensure the successful future of the sector (KPMG, 2013).

"*Opportunities abound for players at all stages of the value chain, but improvements to business intelligence, agility, and risk management strategies must first be realized.*"

(Chris Stirling – Global Head of Life Sciences – KPMG International)

Nonetheless, it remains to be mentioned the most important challenge the sector is facing, the "Paradox of food insecurity and food waste". The expression is used to indicate the contradictory and simultaneous existence of food waste and hungry people. The numbers to quantify the dimension of the Paradox have been collected by the Food and Agriculture organization of the United Nations (FAO) and show food insecurity rising. From 2015 to 2016 the number of undernourished people has increased by 38 million, up to the figure of 815 million of undernourished people. The prevalence of undernourishment is mostly concentrated in the least developed countries, and this gap increased constantly in the last years (Table 2.1).

Year	Geographical region	Prevalence of undernourishment (%)	Delta
2012-2014	World	10.8	12.7
	Least Developed Countries	23.5	
2013-2015	World	10.7	12.9
	Least Developed Countries	23.6	
2014-2016	World	10.7	13.7
	Least Developed Countries	24.4	

Table 2.1 Comparison of the undernourishment distribution between the world statistics and developing countries. The index has been computed through a moving average on the last 3 years data available.
Source: FAOSTAT, 2018.

At the same time, FAO estimated that one-third of food produced for human consumption is lost or wasted every year, to the extent of 1.3 billion tons per year (FAO, 2011).

The logic inconsistency between these data highlights the entity of the mentioned paradox.

The root cause of the latter side of the paradox, the existence of food waste, could be looked for into the production and subsequent bad management of surplus food. Indeed, food waste is the output of a bad surplus food management.

Several definitions have been given to identify food waste. FAO defined it as edible material that has been prevented from being consumed by people, because of changes in the availability, edibility, wholesomeness or quality (FAO, 1981). As pointed out by Papagyropolou et al. (2014), a broader definition of food waste has been outlined by Stuart (2009). Stuart's definition includes also edible material that is fed to animals or is a by-product of food processing that is not going to be eaten by people. Food waste is produced along the whole food value chain. It can be the result of losses in the field or during agricultural production because of inefficiencies, during transportation, storage or at the retailer level because of bad management and/or because the food reaches its sell-by date, or waste created by the consumer at the consumption stage (Ellen MacArthur Foundation, 2013a).

To define the boundaries between food waste and surplus food, the thesis will refer to the definitions provided in the article "Opening the black box of food waste reduction" (Garrone et. al, 2014). Surplus food has been defined as "the edible food that is produced, manufactured, retailed or served but for various reasons is not sold to or consumed by the intended customers". Consequently, food waste has been described as "the surplus food that is not recovered to feed people, to feed animals, to produce new products (e.g. jams or juices), new materials (e.g. fertilizers) or energy".

It is important to introduce another distinction, the difference between avoidable and unavoidable food waste. Food waste is classified as avoidable if, during its lifecycle, it has been potentially edible. On the other hand, unavoidable food waste refers to food waste that is not, and has never been edible, like fish or meat bones, or fruits' skin (Papagyropolou et al., 2014).

Concerning the possible actions to tackle this phenomenon, the best option is to act at the source of the problem, preventing the generation of surplus food. The reduction of food production will be translated in a reduction of costs for producers and consumers, surplus food is a product without demand. As pointed out by the United States Environmental Protection Agency (EPA), the improvement in the cost structure will be the outcome not only of an increase in productivity, but also of the reduction in the disposal fees needed to manage food waste (EPA, 2012).

However, the prevention of surplus food generation is not always technically and economically feasible. Kantor et al. (1997) highlighted that food waste prevention is constrained by logistics and financial limitations. In these cases, the management of surplus food becomes the best alternative, i.e. reselling the surplus food at discounted prices or through different channels in order to reach secondary markets. Also redistributing the food for free to feed insecure people is an option preferable than disposal, even for economic reasons: the savings on disposal fees towards which redistribution of surplus food can lead have been mentioned already; moreover, an additional benefit is tax reduction that is possible to achieve thanks to food donations (EPA, 2012; Kantor et al., 1997).

Given the definition of surplus food mentioned above, the activities of processing surplus food in order to transform it for the purpose of feeding animals, production of new products, new materials or energy have to be considered when mentioning surplus food management.

The least desirable option is the disposal of food waste. It should be pursued only when the previously discussed alternatives are not feasible.

A more structured classification of the described option is provided by the waste hierarchy. It has been introduced into the European policy in the 1970s, and it has been adopted and recognised worldwide as the refence framework for waste management (Papagyropolou et al., 2014).

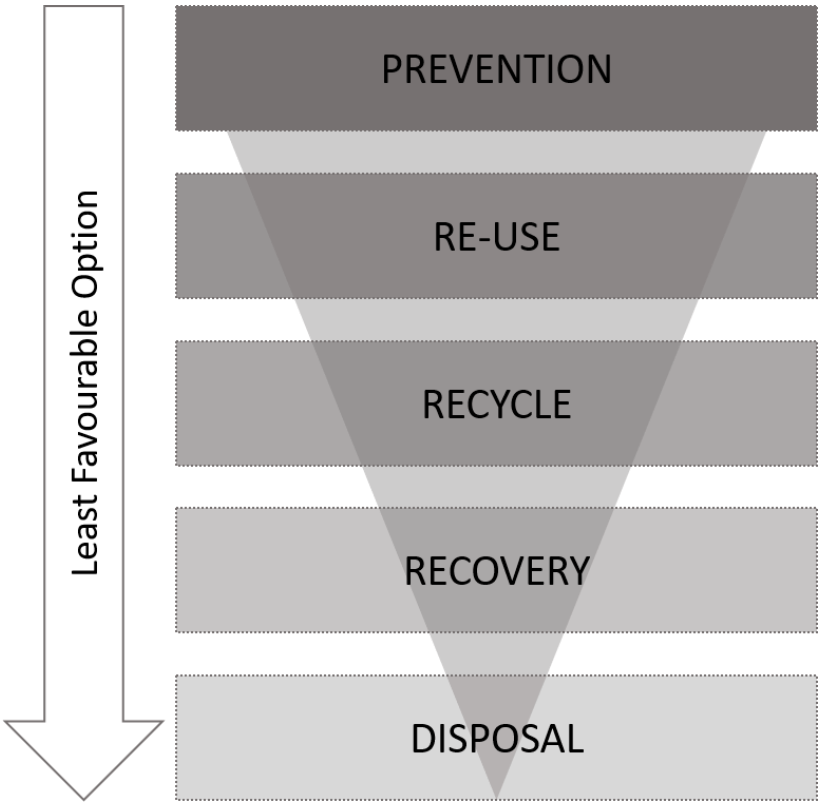


Figure 2.1 The waste hierarchy.
Source: Adapted from Papagyropolou et al., 2014.

Furthermore, Papagyropolou et al. (2014) provides an application of the waste hierarchy to the agri-food industry, detailing all the heads of the hierarchy:

- Prevention

  It takes into consideration all the actions aimed at preventing the generation of surplus food and food waste in the processes of both production and consumption, along the whole supply chain (Papagyropolou et al., 2014).

- Re-use

  It considers all the alternatives which contemplate the redistribution of surplus food for human consumption through secondary markets or donations (Papagyropolou et al., 2014).

- Recycle

  This category includes all the actions devoted to the transformation of surplus food into animal feed or composts (Papagyropolou et al., 2014). Surplus food in this category is referred as food waste from Papagyropolou et al. (2014), since it refers to Stuart (2009)'s definition of surplus food and food waste. All the food that is not going to be eaten by human being has been classified as food waste, including in the definition also products reprocessed with the purpose of transformation into animal feed or composts.

- Recovery

  It includes the activities that aim at treating food waste in order to recover energy (Papagyropolou et al., 2014).

- Disposal

  The least favourable category of options, it includes the disposal of food waste into landfill. It is explicitly described as the last options to be pursued (Papagyropolou et al., 2014).

It is important to notice that the Food Waste Hierarchy described by Papagyropolou et al. (2014) does not consider the recycling activities which, starting from agri-food wastes, are able to create value in different industries. Any use of food wastes that is not intended as an input for further agri-food processes or to recover energy is defined as "Disposal". However, the reuse of agri-food waste as input for other processes, even if their outputs are not part of the food value chain, should be considered as a favourable option with respect to the disposal of food waste into landfill. Some examples of the mentioned opportunity will be discussed in the following chapters of the thesis.

The next section will provide an overview of the business models presented in the literature with the aim of leading firms towards a sustainable approach.

2.3 Overview on business model innovation towards sustainability

It has already been drafted the importance of sustainability, with particular attention to the agri-food industry. However, it is important to make a step further in the implementation of sustainability in the company's business and to identify its incorporation into the company's business model.

"A business model describes the rationale of how an organization creates, delivers, and capture value" (A. Osterwalder and Y. Pigneur, 2010).

One of the most used tools to analyse a company's business model is the Business Model Canvas (BMC). It has been firstly developed by Osterwalder and Pigneur. It is able to describe a business model, its elements, their interconnections and their impacts on the creation of value (Joyce and Paquin 2016), through a visual representation. The representation is composed by nine blocks that aims at describing the whole company's business model. The Business Model Canvas is useful to support and explore insights on business model innovations. The nine blocks are: Customer segment, Value proposition, Channels, Customer relationships, Revenue streams, Key resources, Key activities, Key partnership, Cost structure. Through these elements it is possible to define all the characteristics of a business model. However, some limitations have been proved to constrain the use of the Business Model Canvas. In particular, the environmental and social aspects of value creation of the triple-bottom line are not explicitly specified, only the economic layer is highly emphasized (Joyce and Paquin 2016).

For this reason, the Business Model Canvas cannot be used to identify a company's approach towards sustainability. It will be used in the following of the thesis in order to highlight differences and to further describe the business models, but only after the identification of the company's sustainable approach. Eventually, a different framework has to be used in order to tackle the sustainability aspect of the agri-food startups.

Several researchers focused on the relations between the company's approach towards sustainability and its business model. In particular, Boons and Lüdeke-Freund (2013)

stated that a company's sustainability orientation must be linked and incorporated in its business model in order to be able to gain competitiveness.

Professor Cagliano at Politecnico di Milano opened the topic of sustainable oriented business models with the following sentence:

"*The design of truly sustainable businesses requires the innovation of the company business model*"

(Raffaella Cagliano – Leadership & Innovation course, 2017 – Politecnico di Milano)

The sentence tries to link the concept of sustainability with innovation. The link between sustainability and innovation is strong. Actually, sustainable innovation could lead to even better results than innovation without considering sustainability, such as risk reduction (technical, political, societal and market), increased reputation and brand value, increased attractiveness as an employer and the achievement of non-economic goals. Accordingly, sustainability can be seen as a further trigger of innovation (Behnam and Cagliano, 2017). Moreover, Behnam and Cagliano (2017) have been able to statistically prove the implication "The pursuit of sustainability priority leads to the pursuit of innovation priority". On the light of the above statement, it is not possible to identify business models that are centred on sustainability and concurrently overlooking at innovation. Nevertheless, the two concepts are strictly related.

Even in the definition provided in the theory about sustainable business models (Ludeke-Freud, 2009; Upward and Jones, 2016; Schaltegger et al. 2012) it is possible to see a link with innovation. They are related and characterized by the idea of overcoming a trade-off, one of the main triggers of innovations. More in detail, the fil rouge that is linking the different definitions of sustainable business models is the idea of aiming at overcoming the trade off, present in traditional businesses, among the three pillars of the triple bottom line.

For this reason, the unit of the analysis of the thesis will be startups. Innovation is intrinsic in the concept of startup, and the implementation of sustainability in this dynamic environment will be addressed in the following of the thesis.

Caliceti (2017) used the fil rouge linking the three mentioned definitions to outline a more comprehensive definition of sustainable business model: "a mean of value creation which through the active involvement of stakeholders in the firms' business practices can manage appropriately resources in order to create long term social, environmental and economic benefits for the planet and the company itself".

The next step is to identify a definition of sustainable business models that can suit the subjects of the research, the agri-food sustainable start-ups. In the literature it is possible to identify different perspective when trying to look for a classification. Some researches (Reim et al., 2015) present peculiar cases, too specific to develop a general framework to classify sustainable business models. On the contrary, other authors such as Grassl (2012) classifies business models according to broader terms, i.e. Grassl (2012)'s classification has been created according to the governance structure (non-profit, for profit, hybrid). The latter classification results too general to apply. A more specific and comprehensive classification is required for the objective of this research. Other authors focused their researches on this gap, trying to define comprehensive and exhaustive framework to classify sustainable business models.

In this direction, Schaltagger and Wagner (2011) proposed a framework in order to relate sustainable innovation business strategies with sustainable entrepreneurship. They classified the different kinds of sustainability-oriented entrepreneurship in four clusters:

- Ecopreneurship – mainly focused on improving environmental impact;
- Social entrepreneurship – mainly focused on improving social impact;
- Institutional entrepreneurship – mainly focused on improving legislations and institutions;
- Sustainable entrepreneurship – it encompasses all the previous goals.

The drivers used in the definition of this classification are "Core motivation", "Main goal", "Role of economic goals", "Role of non-market goals" and "Organizational development challenge". The authors described firms led by sustainable entrepreneurship as "innovative startup selling innovative socially and environmentally friendly products to conquer a larger market". This definition is very interesting and, even if not completely encompassing all the start-ups analysed by this thesis, it can be suitable for a big portion

of them. However, the two authors never mentioned the concept of business model in their work, a further step in this direction is still needed before going on with the analysis.

A deeper focus on business models while talking about sustainable innovation has been introduced by Boons and Lüdeke-Freund (2013). Their work firstly defined the key concepts that should characterize a generic business model (Value proposition, Supply chain, Customer interface and Financial model) and then, they mentioned Wirtz (2011)'s work. It was able to identify three main clusters of sustainable business models (named streams), according to the focus of the business:

- Technology-focused stream includes businesses that are leveraging technologies in order to improve sustainability performances;
- Organizational-focused stream includes business that are leveraging planning and the structure of the business in order to improve sustainability performances through organizational efficiency;
- Strategy-oriented stream includes businesses that are devoting their strategy to improve sustainability and performances.

Boons and Lüdeke-Freund (2013) introduced their own classifications, with a stronger focus on the relation between sustainability and innovation, and therefore it is even more suitable for the purpose of the thesis, since, part of the dissertation objective is to catalogue sustainable start-ups. They identified three clusters:

- Technological innovation

  "Sustainable business models with a focus on technological innovation are market devices that overcome internal and external barriers of marketing clean technologies; of significance is the business model's ability to create a fit between technology characteristics and (new) commercialization approaches that both can succeed on given and new markets".
- Organizational innovation

  "Implementation of alternative paradigms other than the neoclassical economic worldview that shape the culture, structure and routines of organizations and thus change the way of doing business towards sustainable development; a sustainable business model is the aggregate of these diverse organizational aspects".

- Social innovation

  "Enables social entrepreneurs to create social value and maximize social profit; of significance is the business models' ability to act as market device that helps in creating and further developing markets for innovations with a social purpose".

The three clusters of sustainable business models defined by Boons and Lüdeke-Freund (2013) are comprehensive enough to be addressed to the agri-food start-ups that will be analysed in the following chapters. However, those clusters are still very broad, a more precise sub-classification is needed.

A more precise framework has been provided by Bocken et al. (2014). The new framework increases the granularity of Boons and Lüdeke-Freund (2013)'s classification by dividing the three main clusters in 8 sustainable business model archetypes. Despite the similarities, the definitions of the three main clusters is slightly different. Firstly because Bocken et al. (2014) individuated three different key elements to describe a business model: "value proposition", "value creation and delivery" and "value capture". Secondly, Bocken et al., (2014) used the classification Technological, Social, and Organizational oriented innovation only as a high-level representation of the topic on which a business model is focused on and not for identifying the business model itself. The final classification proposed by Bocken et al. (2014) is the following:

- (T) Technological oriented innovation
  - T1: "Maximize material and energy efficiency"
  - T2: "Create value from waste"
  - T3: "Substitute with renewables and natural processes"
- (S) Social oriented innovation
  - S1: "Deliver functionality rather than ownership"
  - S2: "Adopt a stewardship role"
  - S3: "Encourage sufficiency"
- (O) Organizational oriented innovation
  - O1: "Repurpose for society/environment"
  - O2: "Develop scale up solutions".

The main limitation for the application of Bocken et al. (2014)'s framework for the purpose of the thesis is the absence of focus on the agri-food industry. However, since the framework is not industry specific, it can be combined with industry specific knowledge in order to increase its suitability for the analysed agri-food start-ups. Eventually, the literature review showed a lack of framework industry-specific and comprehensive for the agri-food industry. In fact, all the observed studies are case specific, excessively specific to be adopted as a classification framework.

In view of the above, Bocken et al., (2014)'s framework is the chosen one for the development of the studies and for an initial classification of the analysed sustainable oriented agri-food start-ups, according to the adopted business model. The archetypes constituting the model will be described in detail in chapter 3:"Methodology" and 4:"Database analysis".

To summarize, the paragraph pointed out the existence of the relation between sustainability and innovation, and the need of this relation to be included in the firm's business model in order to develop a sustainable innovative business. The definition of sustainable business model has been outlined and several classification of sustainable business models have been analysed. In conclusion, Bocken et al. (2014)'s framework has been selected as the most suitable for the purpose of the thesis, even if it has been said that the framework is not agri-food specific.

In this respect the thesis is going to further investigate the sustainable business models adopted by the agri-food sustainable oriented start-ups (SOs) of the considered database. Therefore, the first research question will be devoted at the identification of the most implemented business models by the sustainable oriented start-ups, their characteristics, and the difference with a similar analysis performed by Caliceti (2017) (Research question #1), without neglecting which are the sustainable development targets and goals pursued by those start-ups. The first research question is explicated at the end of the chapter.

2.4 Overview on the archetype T2: "Create Value from Waste"

Following the investigation for answering the Research question #1, the scope of the dissertation will focus on a precise sustainable business model archetype: the one previously referred as T2: "Create Value from Waste". The decision of focusing on this particular archetype has been led by the increasing importance of the business model, reflected by the huge number of researches on the subject emerged from the literature review, and the absence of any specific work on the agri-food startups. Therefore, a general introduction of the topic will be provided in this chapter, then the business model will be analysed within the boundaries of the agri-food industry.

Bocken et al. (2014) described the archetype as based on a radical thinking innovation, by eliminating the traditional concept of waste. This rethink of waste is implemented through its use as input for different processes. The logic behind this archetype is similar to natural processes, in the natural ecosystems "the energy and/or matter produced by one species is consumed by another" (Gibbs and Deutz, 2007).

The objective of this business model is to overcome the classical linear pattern of the traditional processes with a closed loop one (Figure 2.2). Several names have been used to describe a concept that goes beyond the traditional idea of production and consumption, reshaping it in a circular loop. Bocken et al. (2014), providing examples of the business model applications, mentioned "Circular economy, closed loop", "Cradle-2-Cradle",

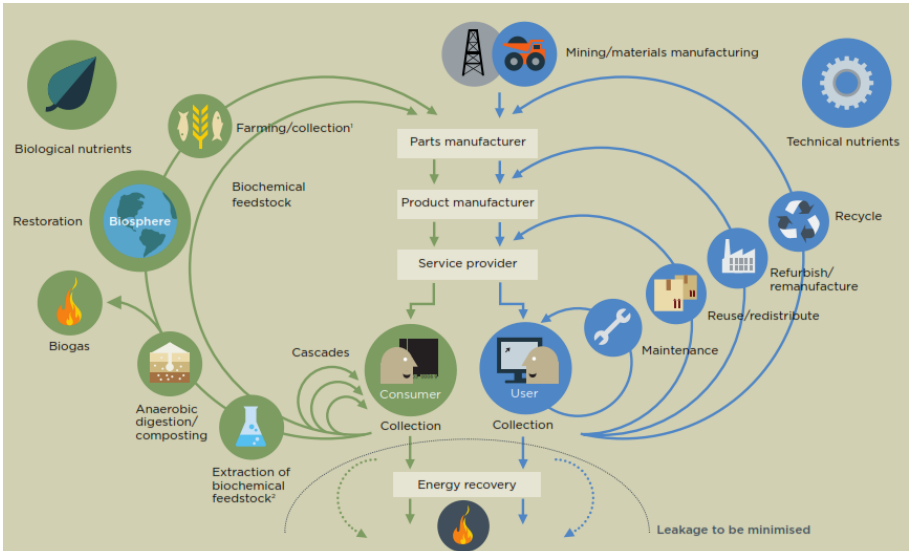


Figure 2.2 The Closed Loops.
Source: Ellen MacArthur Foundation (2013a).

"Industrial symbiosis", "Reuse, recycle, remanufacturing", "Take back management", "Use excess capacity", "Sharing assets", and "Extended producer responsibility".

It is not feasible to exhaustively discuss about the business model idea of creating value from waste without mentioning Ellen MacArthur Foundation. Several authors in literature (Ten Wolde, 2016; Michelini et al., 2017; Grace, 2017; Linder, 2017; Saidani et al., 2017; Ghambari et al., 2017) recognize the key role the foundation has covered, and still is experiencing, in the development and diffusion of this business model.

A key fact that is important to highlight is that Ellen MacArthur Foundation refers to the closed loop business model as "Circular economy" in his reports, mentioning the creation of "value from what are otherwise wasted resources" (Ellen MacArthur Foundation, 2013b) as a specific example of its implementation. On the other hand, Bocken et al. (2014) adopt a different point of view. They consider, as already mentioned, "Circular economy" as an example of the business model "Create value from waste". In the thesis the two terms will be referred as synonymous to indicate the business model that goes beyond the traditional linear pattern, reshaping the company's processes into a circular loop.

Concerning its diffusion, the major cause of the recent years propagation is traceable to the rising of the resource prices and their increasing unpredictability.

The consumption trend sustained until few years ago has been driven by the low level of resource prices, if compared with labour costs. Given that, the reuse of materials has never been considered an option.

As a consequence, the classical linear pattern is becoming no more sustainable even from a mere economic point of view. The mentioned increases of both, prices and prices volatility are not going to slow down. Indeed, several factors are suggesting a future worsening of the actual situation: The demographical growth trend, the infrastructure needs to sustain this demographical trend, the increasing impact of political risk, the globalization of the market which is going to expand the local price volatility to a global level, and the variation in regional climates which is disrupting some resource industries (Ellen MacArthur Foundation, 2013a).

In this context, the concept of create value from waste is spreading among different realities, such as Michelin, Caterpillar, Renault, Desso and several others.

As already mentioned, the key concept behind this business model is to design value chains under the example of the natural ecosystems' processes, where waste produced from an entity is going to become nutrition for other entities.

To describe the power of such a radical thinking innovation, Ellen MacArthur Foundation (2013a) highlighted the existence of four pillars of value creation:

- "Power of the Inner circle"
  The tighter the circle pursued by the business model, the higher the impact in terms of savings. For small circles, not many activities are needed to reintroduce the waste in the market, bringing cost savings due to less use of "material, labour, energy, capital and the associated rucksack of externalities".
- "Power of circling longer"
  Some products and materials can lie in the circle for several iteration, multiplying the available resources and reshaping its concept.
- "Power of cascaded use and Inbound material/product substitution"
  The process of transforming a waste into an input can adapt to cross-industries scenarios. Instead of reusing a product or material several times within the same circle, the "cascade" refers to the use of a process waste as input (value) for a completely independent process.
- "Power of pure, non-toxic, or at least easier-to-separate inputs and designs"
  Through a specific and dedicated product design, it could be possible to achieve economies of scale and further spread this business model even in processes and situations in which it would currently be not profitable.

In addition, thanks to the closed loop structure of the value chain, there is the possibility to avoid several types of waste, more difficult to avoid in the classical linear structure (Ellen MacArthur Foundation, 2013a):

- "Waste in the production chain"

  It is a direct consequence of the closed loop, by skipping part of the production chain in the second iteration of the product or material within the cycle, some of the stages in which waste would have been experienced are eliminated from the process.

- "End-of-life waste"

  The avoidance of this kind of waste is clearly visible, since the output of the process will not reach a "end of the life", but rather the begin of a new life. In this sense, it is representative the terminology "Cradle-to-cradle".

- "Energy use"

  The reduction of the use of energy is a direct consequence of the closed loop. Usually, the upstream processes of the value chain are the most energy-consuming. Therefore, skipping these processes through a closed loop makes the savings in energy remarkable.

- "Erosion of ecosystem services"

  The causes of this waste avoidance are two, the first one is the reduction of emissions due to the fact that part of the upstream processes will be avoided thanks to the closed loop nature. The second cause is the use of recycled/reused materials instead of virgin one. These savings in terms of waste are strictly linked with the definition of sustainable development given above: avoiding the erosion of ecosystem services, it is allowing the world to "meet the needs of the present without compromising the ability of future generations to meet their own needs". This last category of waste avoidance is strictly related with other two major environmental advantages that Ellen MacArthur Foundation (2013a) quotes along with the mentioned economic and risk balancing advantages: "Need for virgin material extraction would decrease substantially" and "Growth of landfill and total material stock would decrease".

2.4.1. Drivers of the circular model implementation

Regarding drivers and opportunities that are leading the success of the "create value from waste" business model, the first to mention is the possibility to overcome some of the linear model limitations, such as price risk, supply risk and natural system degradation

(Ellen MacArthur Foundation, 2015). Moreover, the expectation of an increase in demand for goods and services by 2030 is acting as an accelerator in increasing the mentioned risks (Ellen MacArthur Foundation, 2013c). Price risk is mainly described by Ellen MacArthur Foundation (2013c) as price volatility, it stated "if we remain in our 'business as usual' mode, price volatility will continue to surge alongside the probable inflation of key commodities". For what concerns supply risk, it is both a consequence of the globalization process of the last years and of the last limitation of the linear model: natural system degradation. The increased scarcity of resources, caused by their unsustainable use, is also a cause of both, supply and price risk. Kazancoglu Y. et al. (2018) focused the attention on the positive effect the circular business model could achieve in reducing the environmental risk.

However, the opportunities achievable through the implementation of a circular model are not limited at the overcome of the linear model barriers. It has been argued that it may allow an increase of profit and market share through the achievement of competitive advantage (Kazancoglu Y. et al., 2018). This competitive advantage is created by improvements in both, efficiency and effectiveness. Drivers of the improvement in efficiency are savings in costs coming from the materials savings (Ellen MacArthur Foundation (2013c) estimated over a trillion US $ of possible savings worldwide), increased utility level and value of materials and products (Merli et al., 2018), increased shelf life (Ellen MacArthur Foundation, 2015), reduction of resource competition and consequent reduction in prices, and material productivity improvements (Ellen MacArthur Foundation, 2013c). Moreover, through collaborative use models it will be possible to achieve higher asset productivity, availability and quality (Ellen MacArthur Foundation, 2013c). Concerning effectiveness, drivers that are leading towards improvement in the field are the opportunity of reaching non-traditional markets (secondary markets), improvement in innovation and a higher rate of technological development (Ellen MacArthur Foundation, 2013c), and an increase of the product range which will lead to higher responsiveness to customer demand (Kazancoglu Y. et al., 2018).

Additional drivers leading towards the direction of the implementation of a circular business model are a consequence of changes in the customers behaviours: customers are

changing their preference form an ownership-based economy towards an access-based one (Ellen MacArthur Foundation, 2013c). Moreover, the evolution of the socio-economic trends, and the consequent urbanization, are going to ease the capture of the circular economy benefits, lowering transportation costs and issues, and consequently enabling reverse logistics and integrated systems (Ellen MacArthur Foundation, 2013c; Ellen MacArthur Foundation, 2015).

At the same time, governments are acting in order to ease the implementation of circular business models, moved by the mentioned benefits it is going to create for the environment and for the society. Ellen MacArthur Foundation (2013c) argued that "Circular Economy fosters wealth and employment generation". Governments are creating incentives for its implementation (Sauvé S. et al., 2016) and barriers for linear models which require an excessive utilization of virgin resources, making more difficult to renew licences (Ellen MacArthur Foundation, 2013c).

However, despite the opportunities that the implementation of a circular business model could lead into a company, it is not possible to neglect the presence of some barriers which could limit its implementation.

2.4.2. Barriers of the circular model implementation

It has been stated above that government activities could enhance the implementation of circular business models; however, hey can be seen also as barriers to its application, since it depends on some authorities (Sauvé S. et al., 2016).

Moreover, the economic issue can become a constraint, it is not always profitable to rely on a circular model instead of a linear one. Andersen (2007) argued that a circular model must be pursued only when economic and social conditions will be improved. Sauvé S. et al. (2016) stated "as long as the benefit is greater than or equal to the cost".

Ellen MacArthur Foundation (2015) provided a structured classification of the barriers a company might face in implementing a circular business model. These barriers are classified under 15 categories and grouped into 4 macro-categories: economics, market failures, regulatory failures and social factors. The classification is illustrated below:

- Economics
    - “Not profitable for businesses even if other barriers are overcome”;
    - “Capital intensive and/or uncertain payback times”;
    - “Technology not yet available at scale at a cost-effective level”;
- Market failures
    - “Externalities (true costs) not fully reflected in market prices”;
    - “Insufficient public goods/infrastructure provided by the market or the state”;
    - “Insufficient competition/markets leading to lower quantity and higher prices than is socially desirable”;
    - “Imperfect information, for example asymmetric or high cost information, that negatively affect market decision”;
    - “Split incentives (agency problem) when two parties to a transaction have different goals and levels of information”;
    - “Transaction costs such as the costs of finding and bargaining with customers or suppliers”;
- Regulatory failures
    - “Inadequately defined legal frameworks that govern areas such as the use of new technologies”;
    - “Poorly defined targets and objectives which provide either insufficient or skewed direction to industry”;
    - “Implementation and enforcement failures leading to the effects of regulations being diluted or altered”;
    - “Unintended consequences of existing regulations that hamper circular practices”;
- Social factors
    - “Capabilities and skills lacking either in-house or in the market at reasonable cost”;
    - “Custom and habit: ingrained patterns of behaviour by consumers and businesses”.

The framework is applicable to any industry, it is however important to decline the framework on the specific case by identifying which are the most impacting barriers.

Moreover, the focus of the thesis is on agri-food startups. It has not been possible to find in the literature any general reference to startups implementation of circular business models. The works pointed out from the literature research about the startups implementation of a circular economy are focused on the clothing and fashion industry (Weissbrod and Bocken, 2017; Bocken et al., 2017; Todeschini et al., 2017). Therefore, all the drivers and barriers will be further investigated in order to understand their impact on agri-food startups.

To summarize, the above section discussed about Bocken et al. (2014)'s archetype "create value from waste". Moreover, mainly thanks to the wide knowledge spread by Ellen MacArthur Foundation, it has been possible to highlight the main limitations of the traditional linear structure of the value chain, the advantages of the implementation of a circular model and its implication in the reduction of waste produced. In conclusion, the main drivers and barriers the theory mentions about the implementation of a circular model have been reported. The mentioned drivers and barriers have been recognized as affecting companies' businesses. No example of the drivers and barriers impact on startups in general or on agri-food startups has been identified.

The following section will apply the description of the "crate value from waste" archetype to the agri-food industry.

2.5 Create value from waste in the agri-food industry

The agri-food industry is one of the most interesting industries for the implementation of the circular economy approach. The thesis already discussed the problem of surplus food and food losses, but it has not been mentioned yet that the implementation of circular business models might help in the reduction of this phenomenon. Moreover, it has been argued that the social objective is usually missing in the implementation of circular economy (Sauvé et al., 2016). This is completely false in the agri-food industry, where the creation of value from waste, or food that is going to become waste, has undeniable social implications.

On the environmental point of view, the implementation of a circular business model has two main advantages. One is the preservation of resources with a decrease in the

consumption of virgin materials and a consequent increase of the land productivity, while the other is a reduction of the food disposed and the consequent emission of methane (Ellen MacArthur Foundation, 2013a).

From the economic point of view, the biggest opportunity comes from the "power of cascaded use", the reuse of waste created through the agri-food value chain in other independent processes, or even in different industries (Ellen MacArthur Foundation, 2013a). However, this implementation is not very common since it requires a very high level of cross-firm or cross-industry collaboration that is not always met. Some examples of this collaboration will be provided in the following of the thesis, showing the value creation of the cascaded use of food waste.

Much more spread in the industry are actions in the downstream part of the process, aiming at preventing/reusing surplus food and food waste at the consumption stage (including retailers). Most of the actions implemented in this direction aim at increasing the consumers knowledge, from right-sizing the basket case to increase the knowledge about food preservation.

The changes of the consumers behaviour, of their attitude towards waste management and the introduction of smart technologies in the society are the biggest drivers (Ellen MacArthur Foundation, 2015). Smart technologies allowed customized inventory management for the single unit/product, customized offer and a direct channel with the final consumers to propose those offers.

Talking about the barriers in the introduction of a circular business model in the downstream stages of the agri-food industry, Ellen MacArthur Foundation (2015) performed an analysis of the Denmark case study, applying the above mentioned classification:

- Economics
    - No economic barriers have been identified in the study. However, logistic costs such as transportation and inventory management can become a barrier to the profitability of the circular business model implementation.
- Market failures
    - Imperfect information

It is widely spread among customers. In particular, knowledge about the difference between "best before" and "use by" is not common and the tolerance that producers and retailers use to identify these dates is underestimated.

- Split incentives

  Retailers have the incentive to sell as much as they can (e.g. "3 for 2" offers on fresh products), increasing the surplus food on the consumers side. Moreover, producers have the incentive to shorten the "best before" dates in order to accelerate the consumption or disposal of their products and consequently increase their sales.

- Externalities

  Since food prices do not reflect the environmental cost, incentive to reduce waste is still low from the consumers side.

- Regulatory failures
  - Poorly defined targets and objectives.
- Social factors
  - Lack of capabilities and skills

    This barrier is strictly related with imperfect information. The absence of knowledge about "how to buy, store, evaluate the freshness of and prepare food in such a way that minimize waste and left-overs" is limiting the potential of actions in the sector.
  - Custom and habit

    It has been described as "the largest barrier limiting the reduction of food waste in Denmark". Evidences of the impact of this barrier even in different geographic location (Italy) have been provided by Marco Lei, Co-founder and CEO of ReBOX, during the conference "Innovazione, collaborazione e circolarità: i tre ingredienti per la sostenibilità del sistema agroalimentare" hosted by Politecnico di Milano (June 2018).

Ellen MacArthur Foundations (2015) provides also some example of initiatives to overcome these barriers. They are directed to consumers ("informing and educating consumers"), retailers ("creating the tight framing conditions to avoid food waste in

retail" and "stimulating the capability to build through training programmes") and governments ("Introducing fiscal incentives", "setting national or EU-level quantitative food waste targets" and "influencing other levels of policy making").

This section depicted the implementation of the archetype "create value from waste" in the agri-food industry, highlighting opportunities, drivers and barriers.

Concerning the opportunities of the implementation of a circular business model into the agri-food industry, the drivers and barriers to its implementation, no reference to the agri-food startups has been individuated. Given the growing awareness about the closed loop business model and the innovative approach that distinguishes startups, it is possible to individuate several example of agri-food startups whose aim is the creation of value from wastes.

In this respect the thesis is going to further investigate the spreading of this archetype in the agri-food startups. The second research question will be devoted to the identification of the different variants of the archetype T2 and the drivers which lead the start-ups towards the implementation of one variant with respect to the others (Research question #2). The second research question is explicated at the end of the chapter.

2.6 Conclusions and research questions

To conclude, the literature review analysed the history of the sustainable development topic. Its origin has been acknowledged to the Club of Rome's publication "The Limit of Growth". Its diffusion in the private and public sectors has been analysed through the history of companies and governments' approach towards sustainability. The most recent evidence has been identified in the "2030 Agenda of Sustainable Development" (2015), the last plan of action published by the United Nations.

The importance of the topic within the agri-food industry has been investigated as well, due to the relevance recognized to the industry in the "2030 Agenda of Sustainable Development". In particular, the "Paradox of food insecurity and food waste" has been deepened. The Food Waste Hierarchy proposed by Papagyropolou et al. (2014) has been used to identify the possible actions aimed at tackling the paradox. A limitation of the Food Waste Hierarchy has been pointed out, i.e. the activities that aim at creating value

outside the food value chain, starting from agri-food waste are considered at the same level as "Disposal" activities, even if their social and environmental positive impact is not negligible. Some examples of these activities will be discussed in the following of the thesis, in order to highlight their social and environmental impact.

The next step has been the acknowledgment of the strong relation between the implementation of sustainability from a company, its business models, and the concept of innovation. Several frameworks have been analysed in order to identify the most suitable for the agri-food sustainable startups. Some of them, such as the Business Model Canvas, has been discarded because of their focus on the economic side of businesses, neglecting the social and environmental impacts. Others have been discarded because too general (Grassl, 2012) or too specifically focused on other industries (Reim er al, 2015) in order to fulfil the objective of the thesis. The framework proposed by Bocken et al. (2014) has been chosen to classify agri-food startups, due to its strong consideration of the relation between sustainability and innovation. The fact that it has not been developed specifically for the agri-food industry is the main limitation for the adoption of the framework. However, its integration with industry-based knowledge allowed the use of the framework for the purpose of the thesis.

The absence of a framework dedicated to the classification of the agri-food Sustainable Oriented startups will be the starting point of the research. Adapting the general framework developed by Bocken et al. (2014), the thesis will study the typologies and the characteristics of the business model implemented within the startups sample. A similar classification has been performed by Caliceti (2017); it will be used to analyse any changes or trends that emerged in the last year.

Therefore, the **first research question of the thesis (RQ1)** will be devoted to the identification of the analysis of agri-food startups approach towards sustainability through the identification of the implemented business models and the typologies of sustainability pursued (through the assignment of one or more than one sustainability target). Moreover, the startup distribution along the supply chain, their geographical dispersion and their ability to collect funds will be analysed and a dynamic approach will be adopted, which will allow to compare the results with Caliceti (2017)'s findings.

The first research question is summarized as follow:

RQ1: What are the most implemented business models by the agri-food Sustainability Oriented startups?

- **RQ1a:** What are their characteristics in terms of supply chain stage in which they operate, geographical distribution, ability to collect funds, and typology of sustainability orientation pursued?

- **RQ1b:** What are differences and similarities that emerge from a comparison with the analysis performed by Caliceti (2017)?

The second part of the literature review focused on the business model described by Bocken et al. (2014) as "Create value from waste". In the first part of the literature review, several papers dedicated to this peculiar business model have been observed, but nothing has been individuated with a precise scope on the agri-food startups.

The interaction of the terms "create value from waste" and "circular economy" has been analysed, resulting in the decision of using them as synonymous in the following of the thesis. The open knowledge dispensed by Ellen MacArthur Foundation has been fundamental for the analysis of the topic. It summarized in four main pillars the value creation opportunity that may arise from the business model (Ellen MacArthur Foundation, 2013a): "Power of the Inner circle", "Power of circling longer", "Power of cascaded use and Inbound material/product substitution" and "Power of pure, non-toxic, or at least easier-to-separate inputs and designs". In addition, the typologies of waste which is possible to avoid through the implementation of a circular loop business model have been grouped into four categories: "Waste in the production chain", "End-of-life waste", "Energy use", "Erosion of ecosystem services".

After an overview on the circular economy topic, the research focus shifted on the drivers that may lead its implementation into a company and the barriers that may constrain it.

The most important drivers identified are the limitation of the traditional linear business models, such as price risk, supply risk and natural system degradation (Ellen MacArthur Foundation, 2015), and a possible creation of competitive advantage (Kazancoglu Y. et

al., 2018) through improvements in both, efficiency (Ellen MacArthur Foundation, 2013c; Ellen MacArthur Foundation, 2015; Merli et al., 2018;) and effectiveness (Ellen MacArthur Foundation, 2013c; Kazancoglu Y. et al., 2018). Governments actions, the evolution of the socio-economic trends and a change in the customers' behaviour have been identified as further opportunities towards the implementation of a closed loop business model (Ellen MacArthur Foundation, 2013c; Ellen MacArthur Foundation, 2015; Sauvé S. et al., 2016).

For what concerns the barriers that a company may face in the implementation of a "create value from waste" business model, the main reference is the classification provided by Ellen MacArthur Foundation (2015). The classification includes 15 categories of barriers, grouped into 4 macro-categories: "Economics", "Market failures", "Regulatory failures" and "Social factors".

Finally, the circular business model has been depicted within the boundaries of the agri-food industry. The drivers and barriers previously mentioned have been adapted to the industry and their impact will be further analysed through case studies.

In the literature, it is missing a precise classification of the nuances this business model may assume when implemented by agri-food startups. The analysis and barriers that these companies might face in the creation of value from waste have not been analysed as well in the investigated literature. The only application to specific context identified refers to the clothing and fashion industry (Weissbrod and Bocken, 2017; Bocken et al., 2017; Todeschini et al., 2017).

Therefore, the **second research question of the thesis (RQ2)** will be devoted to the analysis of the business model "create value from waste" implemented by startups operating in the agri-food industry and the identification of drivers and barriers which are affecting the companies' implementation of this business model. Moreover, the search will focus on the identification of all the different nuances the business model may assume in the industry, and the drivers and barriers faced by each nuance in the implementation of the chosen waste management strategy. This qualitative research will be conducted through a case study methodology, which will be described in the following chapters.

The second research question is summarized as follow:

RQ2: What are the characteristics of the business model "Create value from waste" implemented by startups operating within the agri-food industry?

- **RQ2a**: What are the drivers and barriers that may affect the startup implementation of a "Create value from waste" business model within the agri-food industry?
- **RQ2b**: What are the different nuances assumed by the implementation of the business model "Create value from waste" in the agri-food industry?
- **RQ2c**: What are the drivers and barriers that may affect the implementation of the different nuances of the "Create value from waste" business model?

3. Methodology

This chapter will introduce the frameworks used to answer to the two research questions, their specific application in the dissertation and their linkage with the literature review.

Here, with aim of facilitating the illustration in the following paragraph of the structures and methodologies used to build the answers to the questions of this dissertation, are reported the two research questions.

RQ1: What are the most implemented business models by the agri-food Sustainability Oriented startups?

- **RQ1a** What are their characteristics in terms of supply chain stage in which they operate, geographical distribution, ability to collect funds, and typology of sustainability orientation pursued?

- **RQ1b** What are differences and similarities that emerge from a comparison with the analysis performed by Caliceti (2017)?

RQ2: What are the characteristics of the business model "Create value from waste" implemented by startups operating within the agri-food industry?

- **RQ2a**: What are the drivers and barriers that may affect the startup implementation of a "Create value from waste" business model within the agri-food industry?
- **RQ2b**: What are the different nuances assumed by the implementation of the business model "Create value from waste" in the agri-food industry?
- **RQ2c**: What are the drivers and barriers that may affect the implementation of the different nuances of the "Create value from waste" business model?

3.1 Methodology database definition

The first part of the paragraph will be dedicated to the description of how the database has been developed and updated; the database structue is based on an already defined framework which is precisely described in the thesis "Agri-food Startups and Sustainability: A Study on Business Models and Internalization" (Caliceti, 2017), which will be reported in the following paragraphs in order to better understand the background of this research.

As a consequence, this section will summarize the definitions and frameworks used to build and classify the startups into the database, and eventually, the methodologies exploited to analyse the database, and to be able to find an answer to the research questions described above.

The second part of the chapter will illustrate the frameworks and their related literature reviews, used to analyse the case studies selected for the second research question:

1. Business Model Canvas
2. Decision Tree and Sample Definition
3. Case Studies
4. T2 Non-Agri-Food Startups

3.1.2 Framework used for database development and update (RQ1)

In order for the analysis to be robust with the work performed and the results achieved by the former dissertation, the frameworks utilised to answer to the first research question are the ones described and used by Caliceti (2017). Therefore, in the following paragraphs a summary of these methodologies will be presented.

First of all, in order to continue the empirical analysis performed during the year 2016/2017 it has been necessary to update the previous database with new data available from the online platform www.crunchbase.com. The choice of this tool has been driven by the willingness to maintain a strong coherence with the previous analysis. The platform provides information about innovative businesses, and therefore, its usage is suitable for the aims of this thesis. Furthermore, also the previous database has been used as a source of data since the updated database would result as a merger between the 2017 one and the new data extracted.

3.1.3 Agri-food industry

This framework has been built in order to be able to correctly define those start-ups that are part of the agri-food industry from the ones that are not. In fact, through this scheme, it is possible to evaluate the players acting within this industry and their role and activities throughout the overall agri-food supply chain.

The activity range performed in this industry is wide and numerous. Therefore, a structured classification has been adopted. The activity classification taken into account for the analysis is the one provided by NACE (Nomenclature generale des Activités économiques dans les Communauté Européenne), defined by the European Union. The overall list of activities performed in this industry is presented in appendix A, divided into the main stages of the agri-food supply chain. The detailed description of each activity can be consulted in the thesis "Agri-food Sturtups and Sustainability: A Study on Business Models and Internalization" (Caliceti, 2017).

The rules and the methodology used to allocate an activity to a business are the ones determined by the previous dissertation. It is important to highlight that, to each startup can be assigned a maximum of three activities, and, moreover, these can be part only of one supply chain stage. Therefore, to each startup it can be assigned only one stage of the supply chain. Eventually, through the allocation of the core activities to each start-up, it is possible to obtain the stage of the supply chain in which the start-up is operating.

The agri-food supply chain structure can be summarized as follow:

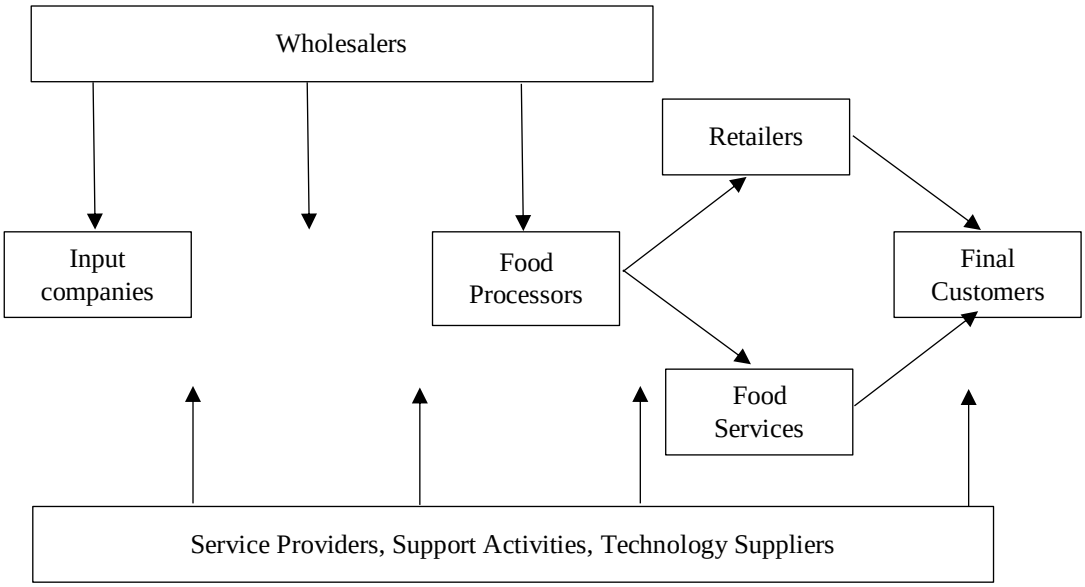


Figure 3.1 Food Value Chain.
Source: Adapted from Caliceti (2017).

3.1.4 Sustainability

Once that the rules to identify an agri-food business have been set, it is necessary to define and evaluate its orientation towards sustainability. Therefore, it must be identified a framework which is able to classify the sustainable oriented start-ups in the agri-food industry. The most appropriate framework among the ones considered is the Sustainable Development Goals proposed by the United Nations in the "2030 Agenda of Sustainable Development". The Agenda aims at defining a plan of action and guidelines for all the countries, stakeholders and firms in order to eliminate poverty and hunger, fight inequalities and achieve universal freedom by 2030. As mentioned in the "Literature review" chapter, the document provides 17 Sustainable Development Goals (SDG) divided into 169 targets aiming at realizing human rights acting on different critical dimensions: People, Planet, Prosperity, Peace and Partnership (2030 Agenda of Sustainable Development).

Therefore, the targets described in the Agenda consider a vast range of topics. Since some of the targets are not directly applicable to the agri-food industry, for the purpose of the research, only the SDGs and targets referring to the agri-food industry have been taken into consideration. The entire list of targets used for the assessment of the database is reported in the following table (Table 3.1), composed by 23 targets and 10 SDGs.

SDG	Target	Description	Triple Bottom Line Component
Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture			
2	2.1	By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round	Social
2	2.2	By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons	Social
2	2.3	By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	Social
2	2.4	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Environmental
2	2.5	By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	Social & Environmental

SDG	Target	Description	Triple Bottom Line Component
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all			
4	4.4	By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	Social
Goal 6. Ensure availability and sustainable management of water and sanitation for all			
6	6.3	By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Environmental
6	6.4	By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	Social & Environmental
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all			
8	8.5	By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	Social
8	8.8	Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	Social
8	8.9	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	Social

SDG	Target	Description	Triple Bottom Line Component
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation			
9	9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	Environmental
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable			
11	11.4	Strengthen efforts to protect and safeguard the world's cultural and natural heritage	Social
Goal 12. Ensure sustainable consumption and production patterns			
12	12.2	By 2030, achieve the sustainable management and efficient use of natural resources	Environmental
12	12.3	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	Environmental
12	12.4	By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	Environmental
12	12.6	Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	Environmental
12	12.8	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	Environmental

SDG	Target	Description	Triple Bottom Line Component
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development			
14	14.4	By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	Environmental
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably			
15	15.1	By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	Environmental
15	15.6	Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed	Social
15	15.8	By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	Environmental
Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development			
17	17.7	Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	Social & Environmental

Table 3.1 Sustainable Development Goals and Targets directly affected by the agri-food industry.
Source: Adapted from "2030 Agenda of Sustainable Development".

3.1.5 Sustainable business models

This step is necessary to define the sustainable business model frameworks, in order to be able to classify each startup according to the sustainability orientation of its business model. Therefore, once this framework has been determined, it will be possible to collect the results obtained by the analysis of the database (RQ1); moreover, from the characterization of the sustainable business models it will be possible to focus on one specific archetype (T2, "Create Value from Waste") and define those drivers that lead a startup to choose this specific model (RQ2).

For what concerns the definition of the business models, it has been used the framework Business Model Canvas (Osterwalder and Pigneur, 2013), already illustrated. On the other hand, since sustainability covers a wide range of topics, the most appropriate source to define this concept and classify the sustainable orientation of a business model has been "A literature and practice review to develop sustainable business model archetypes" by Bocken et al. (2014).

This latter research is focused on the classification of sustainable business models which is applicable to every industry and to every type of business. Consequently, due to the versatility of the model, it has been possible to centre the framework on the agri-food industry.

The document describes a business model through three main aspects:

- Value proposition: product/service, customers service and relationships; in a sustainable business the definition would be: "the value proposition would provide measurable ecological and/or social value in concert with economic value." Bocken et al. (2014);
- Value creation and delivery: key activities, resources, channels, partners, technology;
- Value capture: costs structure and revenue stream; therefore, it describes how to earn revenues.

Bocken et al. (2014) categorizes eight business models archetypes, divided into three macro-groups, each one with a main technical innovation characteristic: Organizational (two archetypes), Social (three archetypes) and Technological (three archetypes) oriented innovations.

The definition of each archetype is recorded in the following paragraphs, together with the lists of some examples of agri-food start-ups that can fit each model. The examples of start-ups are reported from Caliceti (2017), according to the scholars' definitions.

1st Organizational Archetype (O1, hereafter): "Repurpose the business for society/environment"

> **Bocken et al. (2014) definition: "**Prioritizing delivery of social and environmental benefits rather than economic profit (i.e. shareholder value) maximization, through close integration between the firm and local communities and other stakeholder groups. The traditional business model where the customer is the primary beneficiary may shift."
>
> **Agri-food startups that can fit the O1 archetype:**
>
> - Local food producers, distributors and all those firms which enable the promotion of local food products;
> - Direct distribution such as marketplaces which allow the farmers or producers to directly reach consumers assuring fresher and traceable products and producer a higher share of profit (i.e. from farm to customer marketplace);
> - Collaborative consumption i.e. farms which share their products in the local community;
> - Agricultural consulting for sustainability to increase environmental safety reducing the exploitation of resources and generate social benefits enabling farmers to increase income through innovative agricultural techniques;
> - Partnerships to create socially desirable results.

2nd Organizational Archetype (O2, hereafter): "Develop scale up solutions"

> **Bocken et al. (2014) definition: "**Delivering sustainable solutions at a large scale to maximise benefits for society and the environment."
>
> **Agri-food startups that can fit the O2 archetype:**
>
> - Organisations fostering technological alliances with other market agents;
> - Firms enhancing open innovation for the creation of growth opportunities such as research consortia (Giarratana, 2004);

- Enterprises such as incubators, accelerators or venture capital and similar who give access to capital and other assets for small firms to win incumbents;
- Organizations that encourage the investment in co-specialized assets by two or more firms;
- Economic agents developing sourcing collaborative approaches for other organizations.

1st Social Archetype (S1, hereafter): "Deliver functionality rather than ownership"

Bocken et al. (2014) definition: "Provide services that satisfy users' needs without having to own physical products."

Agri-food startups that can fit the S1 archetype:

- Firms that exploit a pay per use business model;
- Firms enabling product sharing, product renting and product pooling;
- Organisations that engage in selling a product and providing for its maintenance.

2nd Social Archetype (S2, hereafter): "Adopt a stewardship role"

Bocken et al. (2014) definition: "Proactively engaging with all stakeholders to ensure their long-term health and well-being."

Agri-food startups that can fit the S2 archetype:

- Firms that purchase only and exclusively from certified suppliers or collaborate with suppliers in order for them to meet standards and or/gain certifications;
- Enterprises that promote the development of sustainable business practices by their suppliers both environmental (use of less chemical products etc.) and social (wellbeing of employees, development of know-how and community);
- Business models that aim at offering products or services which increases consumers' health and well-being;
- Startups that increase the level of food traceability and security;
- Organizations that allow the delivery of food products to the hungry or people in difficult economical situations.

3rd Social Archetype (S3, hereafter): "Encourage sufficiency"

Bocken et al. (2014) definition: "Solutions that actively seek to reduce consumption and production."

Agri-food startups that can fit the S3 archetype:

- Firms that increase awareness of the consumer on the impact of the goods and services on environment and society and act accordingly;
- Organizations monitoring demand in order to produce only when needed;
- Enterprises aiming at reducing advertising schemes to increase the ability of the consumers to engage in sustainable consumption.

1st Technological Archetype (T1, hereafter): "Maximize material and energy efficiency"

Bocken et al. (2014) definition: "Do more with fewer resources, generating less waste, emissions and pollution."

Agri-food startups that can fit the T1 archetype:

- Firms that promote hydroponics, aquaponics, naturaponics and other farming techniques which allow agricultural production without the conversion of non-agricultural land as defined by sustainable agriculture practices;
- Organizations that sell as products or services sensors, software and hardware that enable farm management through the provision of scheduling and organisational tools, harvesting management, climate and weather forecast, crops growth controls, pests, fertilizer and irrigation management, monitoring of livestock parameters;
- Organizations that use or offer biodegradable packaging for pursuing zero wastes goal;
- Companies that prefer efficiency oriented processes and transportation in order to reduce emissions.

2nd Technological Archetype (T2, hereafter): "Create value from wastes"

Bocken et al. (2014) definition: The concept of 'waste' is eliminated by turning waste streams into useful and valuable input to other production and making better use of under-utilised capacity.

Agri-food startups that can fit the T2 archetype:

- Companies who use recycled or recyclable materials to create new products/services but not packaging as this is included in T1 archetype;
- Firms which resell food or crops which otherwise would have been wasted either contacting directly the farmers, the restaurants or the consumer;
- Organizations which transform wastes for the creation of agricultural input/other food.

3rd Technological Archetype (T3, hereafter): "Substitute with renewables and natural processes"

Bocken et al. (2014) definition: "Reduce environmental impacts and increase business resilience by addressing resource constraints 'limits to growth' associated with non- renewable resources and current production systems".

Agri-food startups that can fit the T3 archetype:

- Firms exploiting natural and renewable i.e. both energy and alternative production systems (insect based food production);
- Organisation that replicate natural processes: delivering functionality and avoiding over-processing just for standardization purposes;
- Firms that prefer the use of local resources and the collaboration with supply chain actors in seek of major efficiency;
- White biotechnology firms or firms providing green chemicals products.

This classification has been a fundamental tool for the development of the thesis and an important milestone for answering the research questions.

Eventually, after the definition of the agri-food industry, activities and roles played within the supply chain and the identification of sustainability and sustainable oriented business models, it is possible to continue the discussion describing the database construction and analysis.

3.2 Database construction

The frameworks described above have been the basis for the database construction. In fact, once these have been clarified, it has been possible to proceed with the data extraction, identification of the agri-food start-ups, definition of the sustainability

approach, and, eventually, assignment of the sustainable archetype to each sustainable oriented start-up.

3.2.1. Data extractions

As it has been illustrated in the paragraph 3.1.2. "Framework used for database development and update (RQ1)", the information needed to build the starting database have been collected from two sources. The first source of information has been the database built in 2016/2017, since it has been the starting point of the analysis of this thesis. The second reference has been the online platform Crunchbase, from which start-ups information have been retrieved in order to update the old database and merge it with new information.

Since the tool collects a wide range of data concerning different types of firms within different industries, it has been necessary to outline some filters in order to retrieve only start-ups belonging to the agri-food supply chain as well as the selection of only those information for each start-up useful for further analysis on the database.

The filters set for the extraction are:

1. According to the definition provided by Puri and Zarutskie (2012), a start-up can have a maximum of 5 years, therefore, the foundation date has been set "between 31/12/2012 and 31/12/2017". Compared with the filter used in the previous research, the foundation date shifter of one year ahead;
2. The second filter aims at collecting only those startups that are not closed: "status include any Operating, IPO, Acquired".

The data retrieved for each start-up are here reported, according to Caliceti (2017):

- General information: Company name, Founded Date, Headquarters location (city, region, state), Email contact, Phone Number, Website, Status, Number of Employees, Number of Founders.
- Financial information: Number of funding rounds, Number of lead investors, Last funding date, Last funding amount, Last funding type, Last equity funding amount, Total equity funding amount, Total funding amount.
- Other data assigned by Crunchbase: Company name URL, Category groups, Categories, Description.

Once the filters and the required information have been decided, it has been fundamental to evaluate how to retrieve data concerning only the agri-food industry.

Two procedures have been followed, the first one is an extraction based on the filter category group. In Crunchbase each startup is assigned to a specific category. The intelligence tool is able to classify the main activity or output of the firm and to allocate the startup to a specific category group, which consists of a set of categories related to the same industry. From this classification it has been possible to select two category groups, among the 46 present in Crunchbase, which refer to the agri-food industry: "Agriculture and Farming" and "Food and Beverage".

Therefore, the filters set for the first two extractions are:

- Foundation date: between 31/12/2012 and 31/12/2017
- Status include any: Operating, IPO Acquires

Followed by:

- Category group include any: Agriculture and Farming. For the first extraction

or

- Category group include any: Food and Beverage. For the second extraction

The extraction activity has been entirely made at Politecnico di Milano on March 27th, 2018; the number of start-ups obtained by this procedure is: 3.555. This number includes some duplicates, since some start-ups could have been classified online within both category groups, therefore, through this method they would have been retrieved twice. Moreover, it is necessary to consider also the fact that there can be some duplicates between the start-ups retrieved and the ones already present in the elder database. The elimination of the duplicates has been done only once the information regarding all the considered start-ups have been downloaded.

The second method pursued to retrieve start-ups belonging to the agri-food supply chain has been based on key words, in order to be able to select also those firms that do not directly fall into the two above mentioned category groups. The key words have been set as a filter which must be contained within the data field "Description" assigned to each firm in the intelligence tool. The key words used have been the same as the ones selected in the older research (Caliceti, 2017), in order to be coherent with the work previously

performed. The entire list of key words is illustrated in appendix B, they all refer to activities, inputs or output related to the agri-food industry.

An example of these extractions is here reported:

- Foundation date: between 31/12/2012 and 31/12/2017
- Status include any: Operating, IPO Acquires
- Category group does not include: Agriculture and Farming
- Category group does not include: Food and Beverage
- Description include any: Key word_1 (i.e. Key word_1: Agricultural)

This procedure has been performed for all the key words.

With this method the number of startups retrieved has highly increased, moreover, since the description of a startup can be broad and not industry centered, also some firms not belonging to the industry under analysis could have been selected. Furthermore, even this procedure could report some duplicates between the elder database and the new retrieved information.

The overall number of startups retrieved through both methods is: 15.964.

In order to reduce this large number, firstly, all the duplicates have been removed. Further on, since the filters in the key words' extraction have been set on the description and not on the category group, the startups retrieved can belong to any category group. From this statement, it has been possible to evaluate the different category groups, and to eliminate those startups belonging only to groups not related at all with the agri-food industry; the list of the category groups considered, for the purpose of the thesis, as completely unrelated with the agri-food industry has been created during the previous research (Caliceti, 2017), and it is reported in annex C. After these initial steps, the database counted 7.966 startups.

3.2.2. Database elaboration

The final assessment of the database had to be done through the collection of additional information on each startup, by the analysis of all the startups' website. In fact, not all 7.966 startups obtained by the extraction activity were part of the agri-food industry. Therefore, the further website analysis aimed at the restriction of the database, by

identifying only agri-food firms and assessing the sustainability orientation of each one. A meticulous analysis and a manual one-by-one startup assessment have been necessary.

The single startup analysis has been carried out through its website, from which it has been possible to classify, for every startup, the core activity performed and the output supplied according to the activity framework described in the paragraph 3.1.3 "Agri-food industry". All the startups whose activity or output were not concerning any agri-food related performance have been classified as non-agri-food startups. Moreover, a certain number of retrieved startups were classified with the label "No information available", since the website was expired, or the startup was not operating anymore (despite they were catalogued as "operating" from the intelligence tool Crunchbase).

Moreover, also the sustainability aspect has been analyzed throughout this investigation. As explained in the paragraphs 3.1.4 and 3.1.5, the evaluation of each sustainable startup was conducted through the allocation of the Sustainable Development Goals (SDG) defined by the 2030 Agenda, which identify the sustainable mission of the startup, and the corresponding sustainable objectives. A maximum of three sustainable targets have been assigned to each startup, as well as the identification of a main target, from which it has been possible to define the main SDG pursued by the firm.

Eventually, based on the targets and SDG allocated to each business, it has been possible to assign to each startup the archetype, among the 8 recognized by Bocken, that would better suit the sustainability of the business.

Once this process has been performed, the last step to build the final database is the combination of the information elaborated on these startups with the ones present in the previous database. However, before performing this merger, it has been necessary to check the robustness of the analysis. In fact, the startup review has been performed by two students, each student had to evaluate about 4.000 startup each. All sustainable startups have been checked by both students, for the agri-food non-sustainable startups, a random sample has been verified by each student. The internal check has been conducted to control the coherence and the validity of results achieved.

3.2.3. Database merger and analysis definition

At this point of the assessment, the source of information for further analysis is a new temporary database which contains the information retrieved by the new extractions, cleaned by any non-industry related startups and duplicates from the old database.

It has been possible from here to merge the elder database with the new information obtained by mean of the process explained in the previous paragraphs. Nevertheless, it is important to remember the definition of startup stated in the paragraph 2.3.1, which identifies a startup a business with less than 5 years. As a consequence, from the elder database were eliminated all the startups with foundation date between 31/12/2011 and 30/12/2012, in order to be coherent with the definitions given above.

Eventually, the merger has been concluded, and the results from the set of these operations are summarized in the following table (Table 3.2):

Startup classification	Number
Agri-food Startups	2.295
Sustainable Oriented Startups (SOs)	412

Table 3.2 Agri-food startup and Sustainable Oriented startup samples size.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The database construction has been the starting point to answer to the first research question of this dissertation. In Chapter 4 all the evaluation and analysis concerning the data obtained will be explained and the results will be presented.

The research conducted regards different areas of interests, in the following list will be summarized the type of analysis done on the startups:

1) Distribution of all the startups along the agri-food supply chain, followed by the same analysis taking into consideration Sustainable Oriented startups;
2) Geographical distribution of startups and of Sustainability Oriented startups;
3) Financial analysis
4) Sustainable Development Goals and Targets pursued by the Sustainable Oriented Startups.
5) Analysis of the implemented sustainable business model

3.3 Framework used for case studies analysis (RQ2)

The previous paragraphs explained the frameworks necessary to answer to the first research question, which will be analysed in the next chapter. For what concerns the second research question, the methodologies applied will be described in the following paragraphs.

RQ2 focuses on the archetype described by Bocken net al. (2014) as T2: "Create Value from Waste". It aims at identifying which are the characteristics of this sustainable business model and what are the drivers and barriers that lead a firm towards the choice of this model through different case studies. Therefore, here it will be described the frameworks able to catch the different nuances of a business model, i.e. the business model canvas, the tools used to analyse the canvas, as well as the methodology for the development of this specific qualitative research.

First of all, from the database evaluation, it has been possible to obtain the total number of T2 agri-food start-ups founded between the years 2013 and 2017 and uploaded in Crunchbase, which corresponds to 27 start-ups. In order to have an overview of the firms, a short analysis of each one has been made. Through the evaluation of the start-up websites it has been drawn a description of the activities and outputs performed and it has been identified the food waste hierarchy level in which the start-up would operate in, following the definition given by Papagyropoulou et al. (2014).

It is important to highlight that, due to the low number of startups available within the T2 archetype and across the different levels of the food waste hierarchy and due to the fact that interviews have been the best mean to retrieve information, the best methodology applicable for this qualitative research has been the case study method.

Once that a profile for each one of the 27 start-ups has been drawn, it has been possible to evaluate the direction of the analysis to develop on these start-ups. In fact, starting from the profile sheets, the businesses have been classified along two dimensions: the stage of the supply chain and the level of the food waste hierarchy they are operating in. The result is illustrated in figure 3.2.

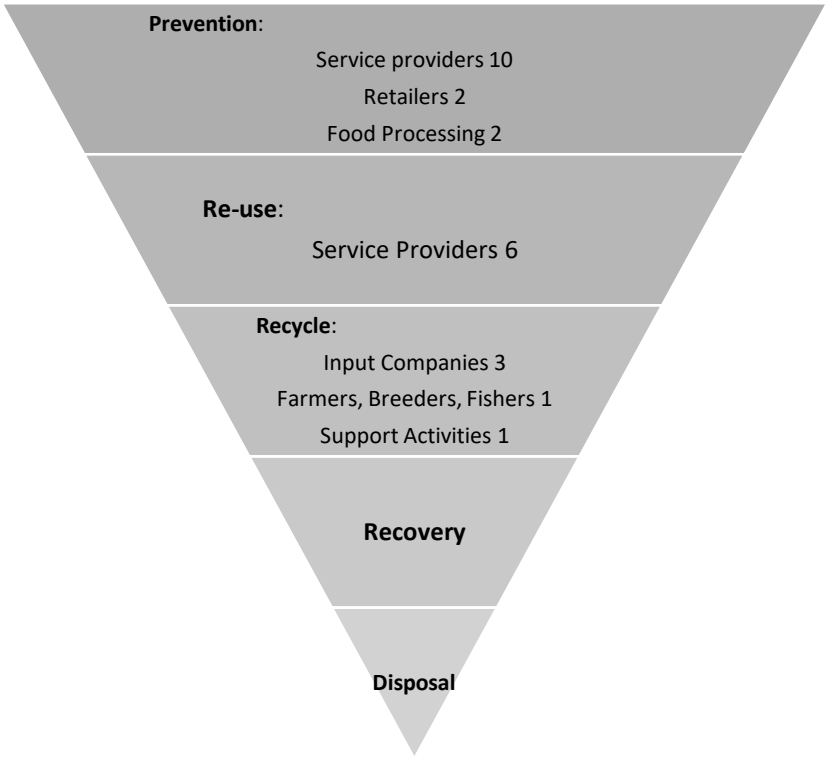


Figure 3.2 Distribution fo the T2-"Create value from waste" startups supply chain stages along the Food Waste Hierarchy.

In figure 3.2 there are only 25 startups. One of the T2 businesses (Epic Cleantec), classified as an input company, is not operating within the Food Waste Hierarchy, since, the input of the activity is not belonging to the category food waste; moreover, from Crunchbase it is possible to verify that the last startup (Pan Biyoteknoloji, input company) is still operating but no information are available on its website; this is the reason why in the pyramid a total of 25 startups is represented.

Moreover, given the definition of startups operating in the agri-food industry, and the identification of the stages of the food waste hierarchy, it is obvious that firms classified as "agri-food startups" could not enter in the last two levels of the hierarchy, since, the outputs of Recovery and Disposal cannot be described as an inputs of the agri-food industry, according with the NACE activities previously taken into consideration. The value chains of these startups are an example of the "Power of cascaded use and Inbound material/product substitution" (Ellen MacArthur Foundation, 2013a) mentioned in the "Literature review". All the cases individuated in the database of these startups will be presented in chapter 5 "T2 Archetype, Create Value from Waste".

3.3.1 Business model canvas

The pyramid illustrated in figure 3.2 is the starting point for the case studies evaluation. In fact, the RQ2 aims at identifying the drivers and barriers that occur in the development of a T2 business archetype, as well as studying the differences in the food waste management along the food waste hierarchy.

In order to define which start-ups would have been more suitable for the further research, it has been necessary to filter the range of T2 start-ups in order to reduce the number of options from which to choose the sample to study. This first process of filtering has been performed looking at figure 3.2. In fact, in the pyramid, it is possible to observe that the majority of the actors of the supply chain recognized with this archetype are classified as "service providers". Moreover, "service providers" is the only supply chain stage that is present in different layers of the food waste hierarchy. All the other stages are confined within the boundaries of one layer. In fact, the service providers start-ups are 16 in total, 10 of which performing at the prevention level, and the other 6 at the re-use level of the hierarchy. For this reason, in order to have the possibility to study heterogeneous cases, the category "service providers" resulted as the more suitable for the purpose of the thesis. With the selection of the "service providers" as main character of the analysis, it has been possible to define its role and the different business model characteristics along the food waste hierarchy stages.

On the other hand, the analysis of other actors would have not been helpful in answering the second research question, since the decision of implementing a different closed loop model could have been motivated by the mere positioning in different stages of the value chain.

Eventually, from hereafter, the range of start-ups in which the case studies will be sampled has been reduced to 16 firms. However, in order to choose the correct sample for the business cases, two further steps are required:

1) Draw for each one of the 16 start-ups the corresponding business model canvas;
2) Build a decision tree, which allows to define the most relevant sample for the case studies.

The concept of business model canvas has been introduced in the literature review chapter. The tool is able to represent a business model, its elements and their

interconnections and, therefore, is the right mean to represent the 16 startups from which to implement the case studies analysis.

Therefore, 16 BMC have been built, starting from the information available online. The canvases helped at identifying all the fundamental elements and components of the businesses, and in highlighting common features and diversities.

All the 16 canvases are reported in annex D.

3.3.2 Decision trees and sample definition

A series of supporting trees have been built in order to increase the detail of the evaluation of the business models' characteristics and coherently choose the cases to analyse and the characteristics of the business model to be highlighted for each case.

Starting from the canvases, for each block, a decision tree has been built. The objective is to individuate and evaluate the ramifications of the decisions taken by the start-ups in the definition of their specific approach to the canvas block.

This tool has been helpful to clarify the common characteristics and the different ones among the service providers. These elements will be explained further on, in chapter 5: "T2 Archetype, Create Value from Waste".

Eventually, from these trees, it has been possible to evaluate which start-ups, among the group, would have been more accurate for the case study definition. A ranking of the 16 cases has been made.

The first main distinction regards the difference between startups operating at the prevention or reuse level of the food waste hierarchy. As mentioned above, the choice of a service provider to operate within one or the other level of the hierarchy could be a valid starting point in the identification of the drivers leading the T2 archetype. For this reason, the first decision node to analyse has been the choice of the type of food waste management applied. Within the 16 service providers, 10 are performing at the prevention stage, the remaining 6 at the reuse one. In order to be able to evaluate both groups, the sample of startups to analyse has been taken from both categories.

The choice of the more interesting and coherent business models to analyse has been done by looking at the further decision nodes reported in the trees.

The first sample identified consisted in 3 reuse-startups and 5 prevention-startups, which cover all the different and common characteristics implemented by the 16 startups.

However, only two startups from the first sample have shown to be willing to participate at the project. Due to the absence of participation from the other startups and the need to have at least four startups in the sample in order to increase the robustness of the results, also the other 8 service providers have been contacted in order to cover as much as possible all the nuances of the business model.

Eventually, other two startups have agreed to collaborate, therefore, the final sample of startups for the case studies is four.

3.3.3 Case studies

In the previous section, it has been explained how the sample of case studies has been chosen. In the following paragraph, it will be illustrated how the case studies have been elaborated.

Firstly, the list of startups which have been interviewed is the following:

5. BigZpoon (USA, 2015, Prevention)
6. JustNow (Romania, 2013, Prevention)
7. Replate (USA, 2016, Reuse)
8. Olio (UK, 2014, Reuse)

As previously explained, it has been fundamental to analyse both levels of the food waste hierarchy in which the stage "service providers" was present, in order to be able to fully answer to the second research question. Consequently, two startups operating at the prevention stage and two at the reuse stage have been interviewed.

There can be many types of case studies to implement (Yin, 2009):

1. Descriptive: describes accurately processes, situations, people, through the usage of variables identified by the analysis of previous theories.
2. Explanatory: checks how previous theories are implemented in the cases.
3. Exploratory: tries to clarify theories that are not well defined yet through the case studies.

Since, the aim of the second research question is to identify which are the drivers that can lead a startup to choose a specific archetype, the type of case study used has been the

descriptive one. Moreover, the type of case study conducted is a multiple case study, since, as already stated, the firms to be interviewed are more than one. In fact, the plurality of the case studies will allow to answer properly to the research question.

In the following paragraph it is explained how the process of data collection has been performed and what have been the steps followed for this procedure.

Firstly, the startups have been contacted via e-mail, through which it has been possible to ask them to collaborate to this project. If the startup showed interest in the project, then a proposal of the interview has been sent through e-email to the startup.

The interviews have been conducted through videocall directly to the founder, except for Replate who was performed to its COO; all the interviews have been recorded.

For each case study a customised interview has been written, based on a general interview protocol. A more general draft has been drawn in order to have the basis to develop each specific interview. The four interviews are reported in annex E.

The interview protocol to build the interview has been created based on the 9 blocks of the business model canvas and on the information collected from literature review reported in the previous chapter:

1. *History and Value Proposition*

   This part of the interview aims at explaining the history of the startup from its foundation and the reasons that led the founder to create a business operating in the agri-food industry.

   Moreover, this section wants to address why the business is based on sustainability, especially on the reduction of food waste through the creation of value from it.

   Eventually, the final purpose of these questions is to evaluate the different elements and factors that drive the decision towards the development of a prevention or reuse activity, therefore, the reasons that can explain why to choose to resell the surplus food or donate it.

2. *Customer Segment*

   The first objective of this block is to define accurately the categories of customers of the startup. Since the service providers offers are represented mostly by marketplaces

and online platforms these businesses can have many different customers, each one with different functions and purposes.

The interview aims at evaluating why the business is oriented towards one/few actors of the agri-food supply chain or many of them, and what are the impacts of the specialisation of the business on scalability and long-term purposes.

It is also important to identify how the business was able to build a network with such different players and what are the difficulties in managing such a reactive marketplace, where demand and supply are always evolving.

3. *Key Activities and Resources*

   The main activities that can be performed by a service provider which supplies a marketplace as its core service are: the management of the platform and mobile application, the management of the logistics activities and related resources, the physical stock of the good. These are the macro activities executed by the actors of the case studies taken into consideration. The purpose is to understand why a business would decide to perform one or all the activities mentioned above and what are the advantages and disadvantages to be more vertically integrated or rely on third party providers. Eventually this section address which are the main resources the startup relies on.

4. *Costs and Revenues*

   This block wants to define the cost structure of the startup and classify its main cost items. Moreover, it aims at evaluating the revenue stream of the startup, therefore, how the business can be at the same time sustainable and profitable. As well it aims at evaluating its long-term mission for what concerns the scalability of the startup.

5. *Drivers and Barriers*

   This last part of the interview wants to address more in detail the main drivers and barriers discovered through the literature research explained in the previous chapter. The main trends previously recognized are shortly reported here.

   The drivers that could foster these types of businesses are:

   1. Increase in demand
   2. Rise of new markets
   3. Customer awareness
   4. Change in customer preferences

Concurrently, there can be some barriers which could limit the growth of these sustainable models, such as:

1. Regulations and laws can result as a constraint for the development of this archetype
2. Geographic dispersion
3. Customer habits and cultural heritage

Eventually, through the recognition of these factors, it is possible to address all the relevant topics which can identify the answer to the second research question.

Starting from this general form, each interview has been customised following the specifics of each startup. Once all the interviews have been done, it has been possible to analyse them through two different methods.

Firstly, each interview has been transcribed and analysed; the analysis is reported in the paragraph 5.4 of chapter 5. This within case analysis is fundamental to clearly understand the business model development of each startup and the decisions taken to build the specific type of business.

Secondly, a cross-case analysis has been performed in order to compare the different startups and understand the different factors which can lead to different decisions in the business models.

Eventually, through this analysis it has been possible to identify the answer to the second research question.

3.3.4 Note on T2 startups non-operating in the agri-food industry

The last analysis to be addressed concerns a peculiar type of startup which is somehow involved in the agri-food industry but, due to its operations, does not take any part in the supply chain of this industry. Moreover, it cannot be reconnected to any of the NACE activities mentioned above.

The inputs of these startups are, in fact, the outputs of some agri-food processes, which are reprocessed by these businesses. Due to this rework, the output of this startups is not considered anymore as a possible input of the agri-food industry, meaning that the firms cannot be located inside any stage of the agri-food supply chain.

Nevertheless, even if these businesses are not part of the industry taken into consideration, due to their performances, they can still be related to the lower levels of the food waste hierarchy and as well, their model can be recognized as a T2 archetype.

For this reason, an analysis has been carried for these startups recognized in the database as non-agri-food businesses but developing a "Create value from waste" business model.

In chapter 5 these startups will be listed and described, in order to expand the different aspect concerning the creation of value from waste across different industries as well.

3.4 Conclusions

This chapter introduced the two research questions of this dissertation. Moreover, the means and tools necessary to address the answers to the questions have been explicitly illustrated and explained.

This section reported all the steps performed to build the database which is the starting point of the analysis for the first research question, and the basis for the qualitative research performed in order to answer to the second question.

This chapter explained in detail how to recognize a startup operating in the agri-food industry, the characteristics needed to be sustainable and the means to evaluate the type of archetype developed by a business.

Eventually it has been described how the qualitative research through case studies have been performed and the analysis performed to identify a correct answer to the question taken into consideration.

4. Database analysis

The following chapter will provide an analysis and some insights on the information that have been extracted from the database. However, the main purpose of the chapter is the identification of the answer to the first research question (RQ1). Therefore, its main objective is the definition of the most adopted sustainable business models and the main Sustainable Development Goals (SDGs) pursued by the sustainable startups of the agri-food industry collected in the sample.

4.1 Database assessment

The startups database has been built according to the methodology described in the chapter "Methodology".

The first step in order to tailor the database to the thesis purpose has been the identification of every startup present in the database and operating within the agri-food industry. Moreover, the process of each startup allocation to the agri-food industry has been performed concurrently with the identification of the agri-food value chain stage in which the startup operates in, which activity it is performing, the Sustainable Development Goals the startup is pursuing (if any), and the identification of the adopted sustainable business model (if any).

Subsequently, the information collected has been merged with the database created by Caliceti (2017)'s research, in order to create a single, updated and comprehensive database.

At the end of these first two steps, the elimination from the database of all the rows containing information on startups not operating in the agri-food industry has been performed, since they are not part of the scope of this research.

The result of these preliminary phases, is a database composed by 2295 rows, containing information on startups operating in the agri-food industry. 412 of these startups have been classified as "Sustainable Oriented startups" (SOs). Whenever it will be possible, the following analysis will provide insights on the whole sample and more precise data on the SOs (i.e. it is not possible to show any insight on the SDG pursued by a startups

considered as "Non-sustainable"). The following sections will describe the results of the data collection, showing the startups distribution according to the considered variable for both, the agri-food population and the SOs one.

4.2 Distribution of startups per supply chain stage

This section will report the distribution of the startups taken into consideration along the agri-food value chain. Once a NACE activity has been assigned to a startup, the allocation in a specific stage of the supply chain will be a direct consequence of the first decision.

As already mentioned, the sample is composed by 2295 startups operating in the agri-food industry. The data collected are grouped in Table 4.1, which shows the data of both, SOs and non-sustainable ones. The most populated stage of the value chain results to be the "Service providers" one, in fact, 34.20% of the startups present in the sample is operating in this stage. "Food service" (18.43%) and "Food processing industry" (17.04%) are respectively the second and the third stage of the supply chain per numerousness of operating startups.

The supply chain stage "Other activities" includes startups whose business is strictly related to the agri-food supply chain but is not belonging to any of the activities and stages recognized in the chapter "Methodology". Some examples are dedicated financial services and fraud prevention services.

Supply Chain Stage	# Startups per stage	$\frac{\#Startups\ per\ stage}{\#Agri-food\ startups\ in\ the\ database}$
Input companies	42	1.83%
Farmers, breeders and fishers	51	2.22%
Food processing industry	391	17.04%
Retailers	321	13.99%
Food service	423	18.43%
Wholesalers	28	1.22%
Service providers	785	34.20%
Support activities	92	4.01%
Technology suppliers	159	6.93%
Other activities	3	0.13%
Total	2295	100%

Table 4.1 Startups distribution along the agri-food supply chain.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The results are coherent with the findings of Caliceti (2017)'s dissertation, shown in table 4.2. The three most representative stages in terms of startups numerousness remain stable, but the gap between "Service providers" and the other stages is growing: Caliceti (2017) catalogued the 29.34% of the total population in this stage. Its numerosity increased by almost 5% of the sample size.

Supply Chain Stage	# Startups per stage	$\frac{\#Startups\ per\ stage}{\#Agri-food\ startups\ in\ the\ database}$
Input companies	33	1.81%
Farmers, breeders and fishers	39	2.14%
Food processing industry	347	19.07%
Retailers	275	15.11%
Food service	384	21.10%
Wholesalers	26	1.43%
Service providers	534	29.34%
Support activities	72	3.96%
Technology suppliers	110	6.04%
Total	1820	100%

Table 4.2 Startups distribution along the agri-food supply chain – 2017.
Source: Caliceti, 2017.

Focusing on the 412 SOs, the filtered data are presented in table 4.3. The most present supply chain stage is still "Service providers" (46,86%). On the other hand, the second most represented stage in the population changes, in fact, if only SOs are considered, the second position is assigned to "Technology suppliers". "Food processing industry" remains the third most represented stage in the population.

Supply Chain Stage	# SOs per stage	$\frac{\#SOs\ per\ stage}{\#Agri-food\ SOs\ startups\ in\ the\ database}$
Input companies	22	5.34%
Farmers, breeders and fishers	21	5.10%
Food processing industry	46	11.17%
Retailers	24	5.83%
Food service	14	3.40%
Wholesalers	3	0.73%
Service providers	193	46.84%
Support activities	9	2.18%
Technology suppliers	80	19.42%
Total	412	100%

Table 4.3 SOs distribution along the agri-food supply chain.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Once again, the results are coherent with Caliceti (2017)'s findings, summarized in table 4.4.

Supply Chain Stage	# SOs per stage	$\frac{\#SOs\ per\ stage}{\#Agri-food\ SOs\ startups\ in\ the\ database}$
Input companies	23	6.02%
Farmers, breeders and fishers	19	4.97%
Food processing industry	50	13.09%
Retailers	32	8.38%
Food service	11	2.88%
Wholesalers	3	0.79%
Service providers	180	46.86%
Support activities	4	1.05%
Technology suppliers	59	15.95%
Total	381	100%

Table 4.4 SOs distribution along the agri-food supply chain.
Source: Caliceti, 2017.

It appears that is not very common for startups operating in the "Food service" stage, to implement a sustainable business model. However, before reaching any conclusion, it is interesting to analyse the data computed in table 4.5. They show, for each stage, the percentage of the SOs on the overall stage population.

Supply Chain Stage	# SOs per stage	# Startups per stage	$\frac{\#SOs\ per\ stage}{\#Startup\ per\ stage}$
Input companies	22	42	52.38%
Farmers, breeders and fishers	21	51	41.18%
Food processing industry	46	391	11.76%
Retailers	24	321	7.48%
Food service	14	423	3.31%
Wholesalers	3	28	10.71%
Service providers	193	785	24.59%
Support activities	9	92	9.78%
Technology suppliers	80	159	50.31%
Total	412	2295	17.95%

Table 4.5 Percentage of sustainability oriented startups per supply chain stage.
Sourch: Own elaboration of agri-food database of Politecnico di Milano – School of Management.

The stages in which a sustainable orientation seems more likely to be pursued are "Input companies", "Technology suppliers" and "Farmers, breeders and fishers". Coherently with what has been envisaged earlier, "Food service" appears to be the stage in which the implementation of a sustainable orientation is more difficult to achieve.

4.3 Geographical Distribution of Startups

For what concerns geographical distribution, the most represented country in the database is United States, with 862 agri-food startups. All the countries which are represented in the database by at least 10 agri-food startups are shown in table 4.6, ordered by decreasing number of startups. The results are mostly coherent with Caliceti (2017)'s work. Despite some countries exchanged their positions in the list, 9 of the 10 most represented countries are the same. The Netherlands were in the top ten in the elder report, which are now replaced by France, as shown in the new ranking.

Country	# agri-food startups per country	$\frac{\#agri-food\ startup\ per\ country}{\#Agri-food\ startups\ in\ the\ database}$
United States	862	39,6%
India	240	11,0%
United Kingdom	195	9,0%
Australia	59	2,7%
Canada	58	2,7%
France	48	2,2%
Italy	47	2,2%
Brazil	42	1,9%
Germany	39	1,8%
Spain	39	1,8%
Israel	36	1,7%
The Netherlands	35	1,6%
Singapore	28	1,3%
Switzerland	24	1,1%
Mexico	22	1,0%
China	21	1,0%
Ireland	21	1,0%
Portugal	21	1,0%
Nigeria	20	0,9%
Turkey	20	0,9%
Indonesia	14	0,6%
Belgium	12	0,6%
Finland	10	0,5%
Malaysia	10	0,5%
South Africa	10	0,5%
South Korea	10	0,5%
United Arab Emirates	10	0,5%

Table 4.6 Most represented countries in the agri-food startups database.
Source: Own elaboration od agri-food startups database of Politecnico di Milano – School of Management.

Furthermore, figure 4.1 provides a visual tool in order to understand and clarify the geographical dispersion of the agri-food startups. In order to have a meaningful representation, United States (862), India (240) and United Kingdom (195) have been considered as equal top rated in the graph (100), otherwise the rest of the countries would have been represented as white.

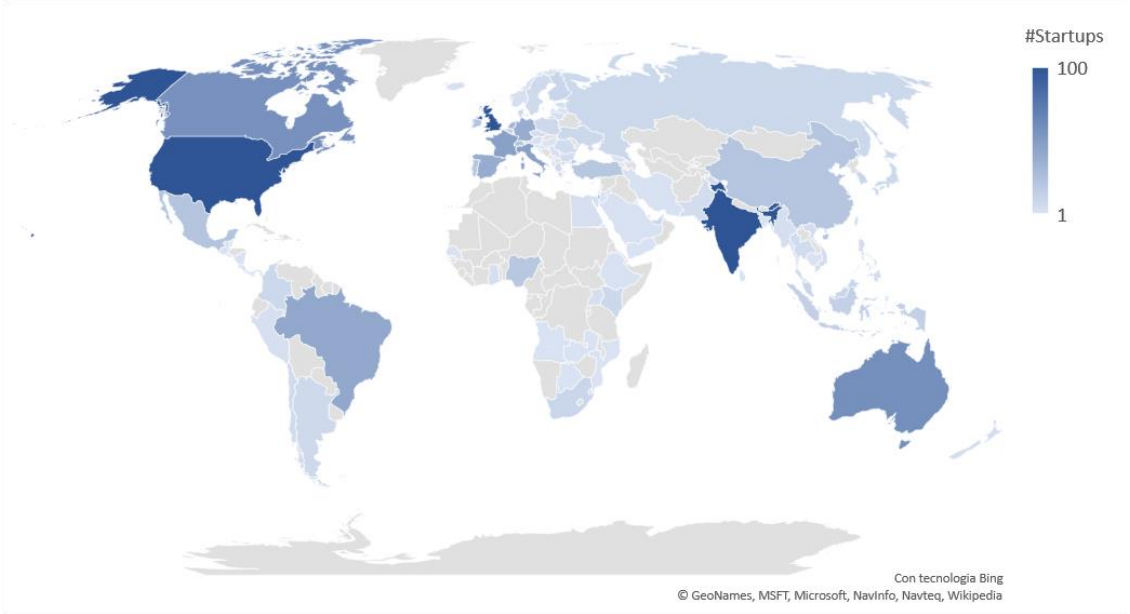


Figure 4.1 Geographical distribution of agri-food startups density per country.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Focusing on SOs, the ranking is shown in table 4.7. The remarkable insight on these data is the same pointed out by Caliceti (2017)'s work, despite Israel is not even present in the top 10 countries per startup numerosity (11th with 36 agri-food startups), it is ranked as 4th looking at the SOs numerosity. On the other hand, despite Germany was in the list of top 10 countries per numerosity of agri-food startups, it appears in the database only 4 times if we look at the SOs.

Country	# SOs per country	$\frac{\#SOs\ per\ country}{\#SOs\ in\ the\ database}$
United States	159	39,6%
United Kingdom	30	7,5%
India	25	6,2%
Israel	20	5,0%
Italy	14	3,5%
Australia	13	3,2%
The Netherlands	12	3,0%
Canada	11	2,7%
Brazil	10	2,5%
France	10	2,5%
Spain	9	2,2%
Ireland	6	1,5%
Nigeria	6	1,5%
Finland	4	1,0%
Germany	4	1,0%
Indonesia	4	1,0%
Portugal	4	1,0%
South Africa	4	1,0%
Mexico	3	0,7%
Singapore	3	0,7%
Turkey	3	0,7%
China	2	0,5%
Belgium	1	0,2%
Malaysia	1	0,2%
South Korea	1	0,2%
Switzerland	1	0,2%
United Arab Emirates	1	0,2%

Table 4.7 Most represented countries in the agri-food startups database, ordered per number of SOs.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

However, the number of SOs in a country is directly affected by the number of agri-food startups in that country. In order to get a better insight on the sustainable specialization of a country, a further analysis will be performed. The analysis will be based on the Balassa Index applied on this specific topic. In particular, the Balassa Index will be computed as follow:

$$Balassa\ Index_i = \frac{\frac{X_i^s}{X_i^s + X_i^{ns}}}{\frac{\sum_i X_i^s}{\sum_i (X_i^s + X_i^s)}}$$

Where:

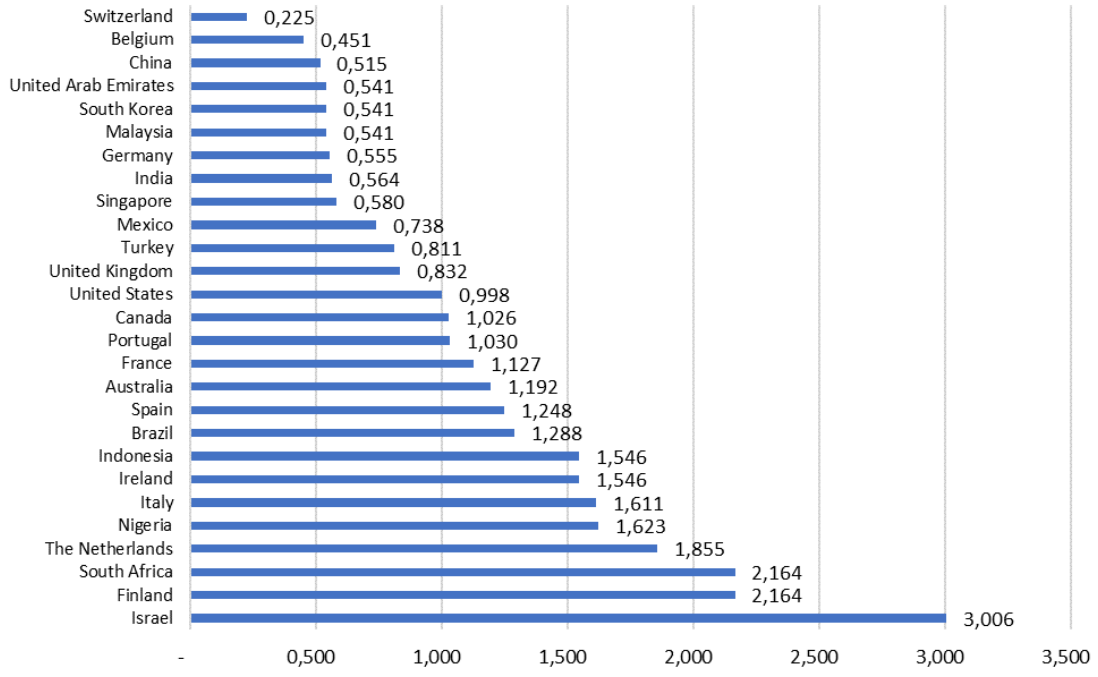
X_i^s stands for number of SOs in country i

X_i^{ns} stands for number of non SOs in country i

i=1,…N stands for the considered country

$$Balassa\ Index_i = \frac{\frac{Sustainabiliy\ Oriented\ Startups_{Country_i}}{Agri - food\ Startups_{Country_i}}}{\frac{\sum_i Sustainability\ Oriented\ Startups_{Country_i}}{\sum_i Agri - food\ Startups_{Country_i}}}$$

To get some more detailed insights, the value of the Balassa Index must be compared with 1; in fact, if the Balassa Index for a country is higher than 1, the startups belonging to the agri-food industry of that country will be identified as specialized towards sustainability.



Graph 4.1 Visual representation of the agri-food sustainability orientation per country, through the Balassa Index. Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The graph 4.1 provides a visual representation of the Balassa Index for every country with at least 10 agri-food startups registered in the database. The data would have been otherwise meaningless, for example, if the Balassa Index had been computed for a country with only one agri-food startup registered and, by chance, sustainable oriented.

Despite the first position of the United States regarding the numerosity of SOs, they are characterised by a Balassa Index slightly lower than 1 (0.998). Therefore, it is not possible to classify the United States' agri-food sector as specialized in sustainability.

The values of the Balassa Index for Germany (0.555) and Israel (3.006) are coherent with what has been stated earlier. Furthermore, Israel's startups belonging to the agri-food industry resulted the most specialized towards sustainability, followed by Finland and South Africa (both 2.164). The positions of Israel and Germany are coherent with Caliceti (2017)'s findings, while the specialization of Finland and South Africa is completely new with respect to the previous results; in fact, these two countries have not been reported among the best performers by Caliceti (2017).

Figure 4.2 shows the geographical dispersion of the agri-food sector specialization in sustainability per country.

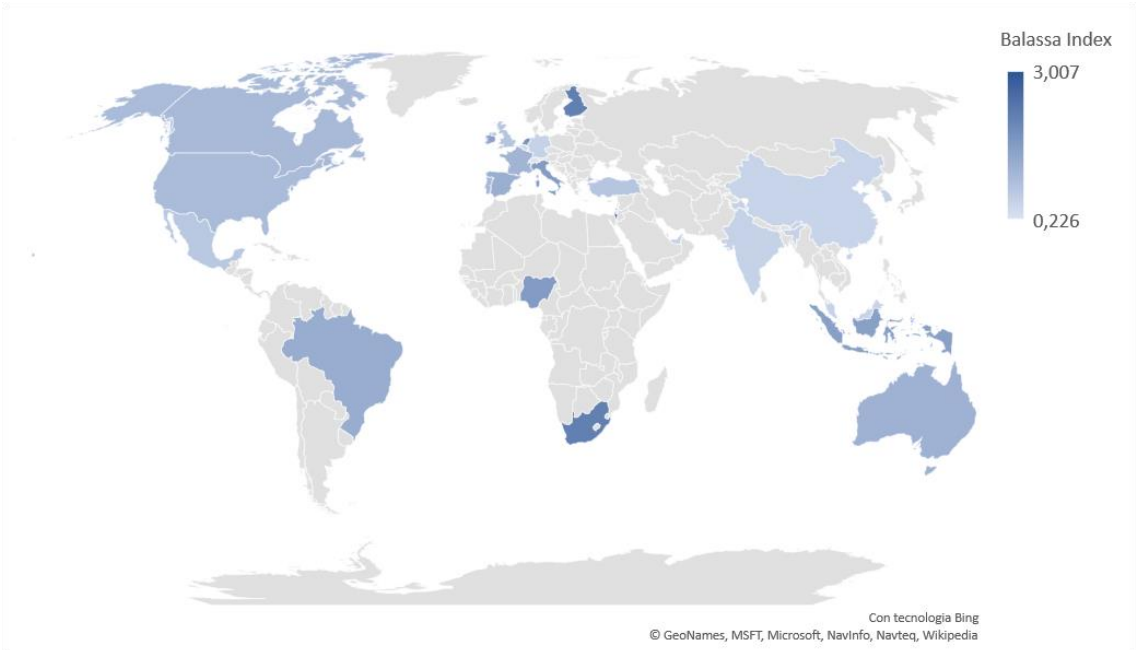


Figure 4.2 Geographical distribution of agri-food startups specialization in sustainability orientation per country. Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

However, the sustainability specialization of the agri-food industry of the mentioned countries has been analysed while neglecting the specialization of the country in the agri-food industry.

This is the reason why the following index is proposed; it represents a different adaptation of the Balassa Index which aims at identifying the countries' specialization in the agri-food industry.

For this calculation, another type of information is necessary, which has not been presented before. The data used for this index is the overall number of startups belonging to any possible industry, founded in the last 5 years in each country. In order to be robust with the data available concerning the agri-food industry, this information have been retrieved from Crunchbase, using as filters the foundation date and the country of origin.

In particular, the basic structure of the Balassa Index considered will be the same as the previous one:

$$Balassa\ Index_i = \frac{\frac{X_i^a}{X_i^a + X_i^{na}}}{\frac{\sum_i X_i^a}{\sum_i (X_i^a + X_i^{na})}}$$

Where:

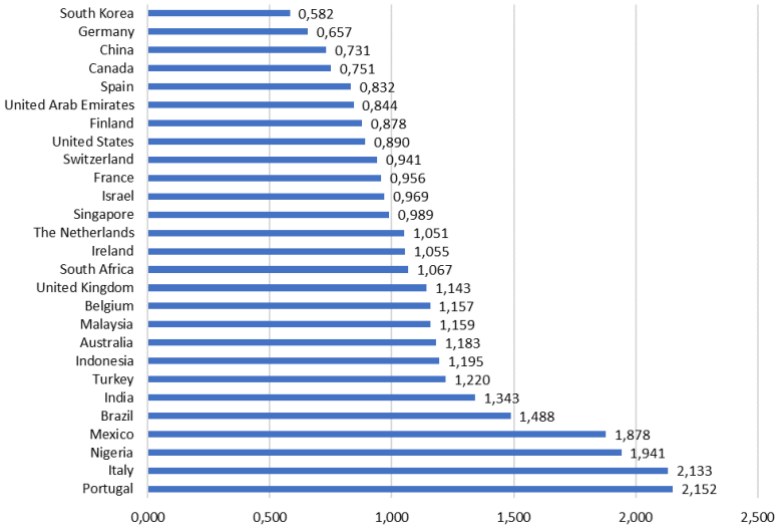
X_i^a stands for number of agri-food startup in country i

X_i^{na} stands for number of non-agri-food startup in country i

i=1,…N stands for the considered country

$$Balassa\ Index_i = \frac{\frac{Agri - food\ startups_{Country_i}}{Startups_{Country_i}}}{\frac{\sum_i Agri - food\ startups_{Country_i}}{\sum_i Startups_{Country_i}}}$$

The logic that has to be followed in reading these numbers is similar to the one described above: if a country shows an index higher than 1, it means that the country is specialized in the agri-food industry.



Graph 4.2 Visual representation of the agri-food specialization per country, through the Balassa Index
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management

The countries considered for this analysis are the same analysed above (i.e. only those countries represented by at least 10 agri-food startups in the database).

Portugal and Italy result from the analysis as the two most specialized countries in the agri-food industry, they are the only countries with a Balassa Index higher than 2. On the other hand, South Korea and Germany are classified as the least specialized countries in this sector.

In order to have a better idea of the geographical dispersion of this indicator and to find some geographical drivers related to it, it is possible to look at figure 4.3.

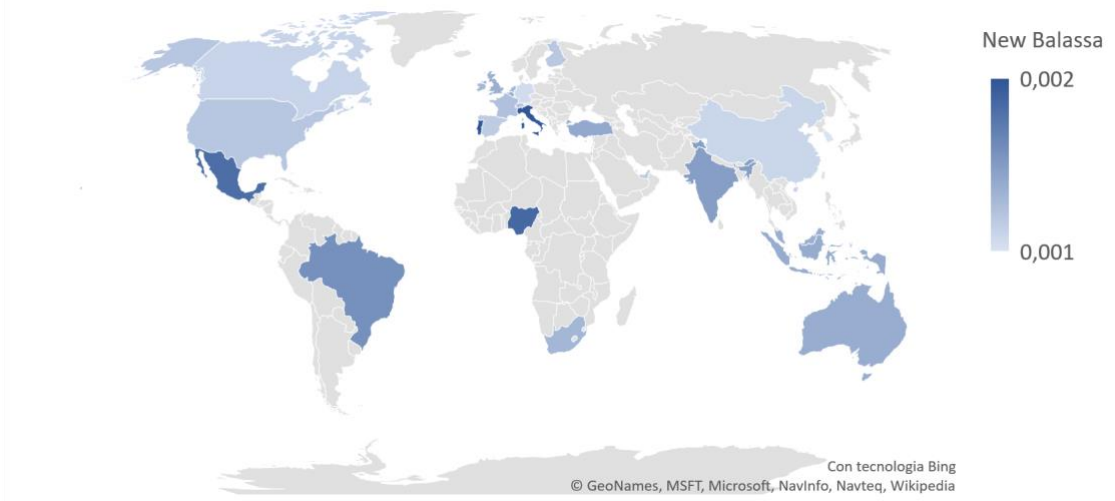


Figure 4.3 Geographical distribution of startups specialization in the agri-food industry per country.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

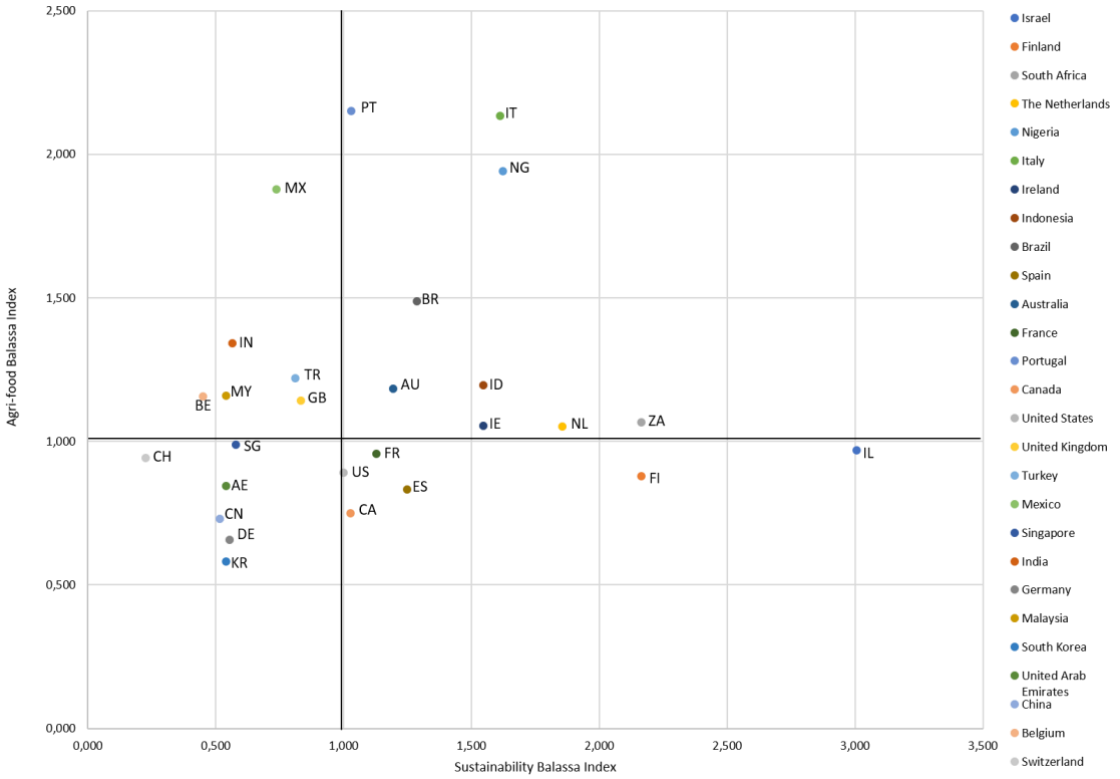
Eventually, to have some insights on the relation between the two Balassa Indexes, their values have been reported in table 4.8 and will be further analysed through a graphical representation.

The data do not seem to show any kind of relation among the two values. In fact, looking for example at Israel, it is already shown that the country is outperforming all the other regions in terms of agri-food startups sustainability specialization, while it does not require any particular observation for what concern the specialization of the country in the agri-food industry (the Agri-food Balassa Index of Israel is 0.969). On the contrary, Portugal represents an example in which the Sustainability Balassa Index does not show sign of sustainability specialization, while the Agri-food Balassa Index shows a very high specialization in the agri-food sector (i.e. the two values are respectively 1.030 and 2.152).

Country	Sustainability Balassa Index	Agri-food Balassa Index
Israel	3.006	0.969
Finland	2.164	0.878
South Africa	2.164	1.067
The Netherlands	1.855	1.051
Nigeria	1.623	1.941
Italy	1.611	2.133
Ireland	1.546	1.055
Indonesia	1.546	1.195
Brazil	1.288	1.488
Spain	1.248	0.832
Australia	1.192	1.183
France	1.127	0.956
Portugal	1.030	2.152
Canada	1.026	0.751
United States	0.998	0.890
United Kingdom	0.832	1.143
Turkey	0.811	1.220
Mexico	0.738	1.878
Singapore	0.580	0.989
India	0.564	1.343
Germany	0.555	0.657
Malaysia	0.541	1.159
South Korea	0.541	0.582
United Arab Emirates	0.541	0.844
China	0.515	0.731
Belgium	0.451	1.157
Switzerland	0.225	0.941

Table 4.8 Balassa Indexes values for the sustainability specialization of the agri-food industry per country and for the specialization of the country in the agri-food industry itself.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The graph 4.3 helps the analysis in identifying the existence of a possible relation between the two indexes. Using the values 1 in both axes as a natural threshold for the Balassa Indexes, it is possible to identify four different quadrants. It is immediate to associate each quadrant with a specialization of the country's startups in the agri-food industry (i.e. the upper quadrants) or with a specialization of the agri-food startups towards a sustainability orientation (i.e. right quadrants).



Graph 4.3 Graphical representation of the Balassa Index values for the sustainability specialization of the agri-food industry per country in relation with the Balassa Index values for the specialization of the country in the agri-food industry itself.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

For clarification reasons, a case for each quadrant will be analysed below:

- Bottom-left quadrant

  The countries represented in this quadrant are not showing neither an agri-food specialization of the startups based in the country, neither a specialization of the agrifood startups towards sustainability. An example is South Korea, with an Agri-food Balassa Index of 0.582 and a Sustainability Balassa Index of 0.541.

- Bottom-right quadrant

  The countries represented in this quadrant are not showing a specialization of their startups in the agri-food industry, while the agri-food startup are showing a high specialization into sustainability orientation. An example is Finland, despite the low Agri-food Balassa Index value (0.878) the startups in the agri-food industry are characterized by a strong specialization in the sustainability orientation (the Sustainability Balassa Index is 2.164, the second highest value).

- Top-right quadrant

  The countries in this quadrant are showing cases of startups with a specialization in both the topics, the agri-food industry and the sustainability orientation within this industry. An example is Italy, characterized by an Agri-food Balassa Index of 2.133 and a Sustainability Balassa Index of 1.611.
- Top-left quadrant

  The countries in this quadrant are showing cases of startups with a specialization in the agri-food industry, but inside of the agri-food industry, these startups are not showing particular specialization for what concerns sustainability. An example is Mexico, characterized by an Agri-food Balassa Index of 1.878 and a Sustainability Balassa Index of 0.738

However, given the homogeneous dispersion of the population within the four quadrants, no patterns or relation between the two indexes can be pointed out.

In conclusion, it is important to remark that the quality of the data is compromised by the absence of information about the location of 118 startups out of the 2295. No information has been collected about the location of these startups neither from the intelligence tool Crunchbase, neither form secondary sources (i.e. startups website and Google). Among the startups for which it has not been possible to find information on their location, 10 have been classified as sustainable oriented (out of the 412 SOs).

4.4 Financial analysis

The financial analysis focuses on the funds collected by startups. Since the collected fund is the only financial information available from the intelligence tool crunchbase, this will be used in order to assess the startups performances. In particular, it is considered that, the higher the amount of funds collected by a startup, the higher the ability of the startup to perform in the business.

The comparison of the percentage of funded SOs and Non-SOs, and the average amount of funds collected by the funded startups will be used in order to assess the possibility to consider the sustainability orientation of the agri-food startups as a driver for the collection of funds.

The tables below show the data aggregated per year as well as a comprehensive view. The tables 4.9 and 4.11 show the percentage of funded startups, respectively SOs and Non-SOs. The tables 4.10 and 4.12 show the absolute value of the founds in US dollars and the average value of the funds, considering only the funded startups.

Sustainability Oriented startups			
Year	**% Funded**	**% Not funded**	**Total #SOs per year**
2013	57%	43%	113
2014	59%	41%	119
2015	45%	55%	105
2016	37%	63%	57
2017	22%	78%	18
Total	50%	50%	412

Table 4.9 Percentage of funded and non dunted SOs per year.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Sustainability Oriented startups			
Year	**Total funding per year (US$)**	**Average funding per financed startups (US$)**	**# financed startups**
2013	304,665,770	4,760,403	64
2014	208,019,292	2,971,704	70
2015	216,564,309	4,607,751	47
2016	34,070,340	1,622,397	21
2017	6,000,000	1,500,000	4
Total	769,319,712	3,734,562	206

Table 4.10 Total and average funding amount of SOs in the database
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Non Sustainability Oriented startups			
Year	**% Funded**	**% Not funded**	**Total # non SOs per year**
2013	43%	57%	494
2014	43%	57%	500
2015	40%	60%	401
2016	33%	67%	299
2017	22%	78%	186
Total	39%	61%	1880

Table 4.11 Percentage of funded and not funded Non-SOs per year
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Non Sustainability Oriented startups			
Year	**Total funding per year (US$)**	**Average funding per financed startups (US$)**	**# financed startups**
2013	2,500,210,805	11,793,477	212
2014	1,478,471,814	6,941,182	213
2015	562,442,186	3,509,014	160
2016	1,638,008,845	16,545,544	99
2017	41,177,510	1,004,393	41
Total	6,220,311,160	8,579,740	725

Table 4.12 Total and average funding amount of Non-SOs in the database
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

From the data it is possible to gather some interesting insights. Looking at the agglomerated information collected in the tables, it is possible to see that SOs are more likely funded than Non-SOs, in fact, 50% of the SOs sample has been funded, while the percentage for the Non-SOs accounts for 39% of the Non-SOs sample.

On the other hand, concerning the average value of the funds, the Non-SOs seem to experience a higher average value. Even looking at the year-by-year data, the average funds value for Non-SOs is higher for every year, but 2017.

The descendent trend of both, the percentage of funded startups and the value of the funds (both the absolute and the average values) can be explained by the fact that young startups are still in the process of collecting funds. The older the startup, the higher the likelihood of being already funded, since it had more time to look for funders and their projects will be more concrete and tangible.

For three startups it has not been possible to identify the financed dates because they did not disclose this information with the intelligence tool Crunchbase. However, none of these startups has been able to collect funds, neither is showing a sustainable orientation. Therefore, we can assume that the biasedness that may result from this lack of information is negligible.

Concerning the geographical dispersion of funds and maintaining the focus on the agri-food industry, it is interesting to observe the differences between developed and developing countries (The countries have been divided into the two categories according to the International Monetary Fund's World Economic Outlook Database (2018)).

Country group	Average amount of funds collected (US$)	Total amount of funds collected (US$)
Developed countries	6,839,716	5,054,550,324
Developing countries	10,785,350	1,909,006,944

Table 4.13 Average and total amount of funds collected by agri-food startups based respectively in developed and developing countries.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Table 4.13 shows that, despite the fact that the total amount of funds collected by startups based in developed countries is higher than the one collected by startup based in developing countries, the situation is the opposite if it is considered as unit of analysis the average amount of funds collected by startups.

In order to observe more in deep the results, table 4.14 shows the percentage of startups which have been able to collect funds, divided into the two countries-groups.

Country group	$\frac{\#\, funded\ agri-food\ startups_{Country-group\ i}}{\#\, agri-food\ startups_{Country-group\ i}}$
Developed countries	44%
Developing countries	35%

Table 4.14 Percentage of funded startups per country group.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The table above shows that agri-food startups based in developed countries are more likely to be funded.

It is interesting to analyse if the insights that are emerging from the funds geographical dispersion are steady even if the sample is limited to those startups classified as Sustainable Oriented. The following tables (table 4.15 and table 4.16) show the same computations for the new sample.

Country group	Average amount of funds collected (US$)	Total amount of funds collected (US$)
Developed countries	3,345,589	585,487,055
Developing countries	5,930,376	183,841,657

Table 4.15 Average and total amount of funds collected by SOs based respectively in developed and developing countries.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Country group	$\frac{\#\, funded\ SOs_{Country-group\ i}}{\#\, SOs_{Country-group\ i}}$
Developed countries	54%
Developing countries	40%

Table 4.16 Percentage of funded SOs per country group.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The tables show coherence with the insights previously elaborated.

Eventually, the analysis showed some insights on the amount of funds collected by startups. Firstly, the year-by-year difference between SOs and non-SOs has been analysed. Non-SOs resulted as steadily capable to collect a higher average amount of funds than SOs. On the other hand, the percentage of funded startups is lower for non-SOs rather than for SOs. It seems from the analysis that SOs are more likely funded, but the amount of funds collected is generally lower than the one collected by non-SOs. Moreover, some insights in the geographical dispersion of funds have been collected in order to analyse the difference between developed and developing countries. It results that, looking at the total value of funds collected, the developed countries take the lead, but if the average amount of funds collected is considered, the developing countries result the ones with the higher value. Furthermore, the startups based in developed countries seem more likely to be funded than the one based in developing countries. The same two country-groups have been analysed limiting the sample to the SOs, but the same results as mentioned for the overall industry have emerged.

4.5 Most pursued Sustainable Development Goals (SDG)

As described in the "Methodology" chapter, for each startup it has been identified a maximum of 3 pursued sustainable development targets, the main sustainable development target pursued and the related sustainable development goal.

The numerical results are reported in the tables present below, grouped by main sustainable development target pursued (table 4.17) and main SDG (table 4.18). Moreover, table 4.19 provides a list of all the considered targets and the number of companies that are pursuing that specific sustainable target (without discrimination between main target or not).

Main target	Frequency	Relative frequency
2.3 – Double the agricultural productivity and small-scale producers' incomes	95	23,1%
2.4 – Ensure sustainable food production and resilient agricultural practices	57	13,8%
9.4 – Upgrade infrastructure and retrofit industries to make them sustainable	50	12,1%
12.3 – Reduce the per capital global food waste	48	11,7%
12.2 – Sustainable management and efficient use of natural resources	23	5,6%
2.1 – End hunger and ensure food access	20	4,9%
12.4 – Environmental management of chemical and all wastes throughout their life cycle	18	4,4%
6.4 – Increase water efficiency	16	3,9%
8.9 – Device and implement policies to promote sustainable tourism	16	3,9%
11.4 – Protect and safeguard the world's heritage	15	3,6%
15.1 – Ensure sustainable use of terrestrial and inland freshwater ecosystems and their services	15	3,6%
2.2 – End all forms of malnutrition	8	1,9%
6.3 – Improve water quality	7	1,7%
12.8 – Ensure awareness and information about sustainable development	6	1,5%
12.6 – Encourage companies to implement sustainable practices	4	1,0%
8.5 – Employment and decent work for every woman	4	1,0%
15.6 – Promote benefit sharing	3	0,7%
14.4 – Effectively regulate harvesting and overfishing	2	0,5%
2.5 – Maintain the genetic diversity	2	0,5%
4.4 – Increase the number of skilled youth and adults	2	0,5%
17.7 – Promote environmental sound technologies in developing countries on favourable terms	1	0,2%

Table 4.17 Main sustainable development target and number of stratups pursuing it.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Main SDG	Frequancy	Relative frequency
2 – End hunger, achieve food security and improved nutrition and promote sustainable agriculture	181	43,9%
12 – Ensure sustainable consumption and production patterns	100	24,3%
9 – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	49	11,9%
6 – Ensure availability and sustainable management of water and sanitation for all	24	5,8%
8 – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	20	4,9%
15 – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably	18	4,4%
11 – Make cities and human settlements inclusive, safe, resilient and sustainable	15	3,6%
4 – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	2	0,5%
14 – Conserve and sustainably use the oceans, seas and marine resources for sustainable development	2	0,5%
17 – Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	1	0,2%

Table 4.18 Main Sustainable Development Goal pursued and number of startups pursuing it.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Target	Frequency	Relative frequency
2.3 – Double the agricultural productivity and small-scale producers' incomes	123	19,8%
2.4 – Ensure sustainable food production and resilient agricultural practices	88	14,2%
9.4 – Upgrade infrastructure and retrofit industries to make them sustainable	76	12,3%
12.3 – Reduce the per capital global food waste	68	11,0%
12.2 – Sustainable management and efficient use of natural resources	42	6,8%
6.4 – Increase water efficiency	36	5,8%
12.4 – Environmental management of chemical and all wastes throughout their life cycle	34	5,5%
2.1 – End hunger and ensure food access	25	4,0%
11.4 – Protect and safeguard the world's heritage	18	2,9%
8.9 – Device and implement policies to promote sustainable tourism	17	2,7%
15.1 – Ensure sustainable use of terrestrial and inland freshwater ecosystems and their services	15	2,4%
6.3 – Improve water quality	14	2,3%
4.4 – Increase the number of skilled youth and adults	13	2,1%
12.8 – Ensure awareness and information about sustainable development	12	1,9%
8.5 – Employment and decent work for every woman	11	1,8%
2.2 – End all forms of malnutrition	9	1,5%
12.6 – Encourage companies to implement sustainable practices	6	1,0%
14.4 – Effectively regulate harvesting and overfishing	3	0,5%
15.6 – Promote benefit sharing	3	0,5%
17.7 – Promote environmental sound technologies in developing countries on favourable terms	3	0,5%
2.5 – Maintain the genetic diversity	2	0,3%
8.8 – Protect labour rights and promote safe work	2	0,3%

Table 4.19 Sustainable development target and number of startups pursuing them.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Targets 2.3 and 2.4 are the most pursued sustainable target in both the classifications. They are respectively "By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities

for value addition and non-farm employment" and "By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality". Consequently, the SDG 2 results as the most pursued by the SOs, it is described as "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" (2030 Agenda of Sustainable Development, 2015).

4.6 Analysis of the implemented sustainable business models

The last step of the database analysis is devoted to the answer of the first research question. Each startup has been assigned to one of the 8 archetypes described by Bocken et al. (2014). The business model implemented by the startup has been the driver of the classification in one of the archetypes, according to the company's "value proposition", "value creation & delivery" and "value capture".

The results of the classification are reported in table 4.20.

Archetype	# Agri-food Startups	#Agri-food Startups – Caliceti (2017)
O1-"Repurpose for society/environment"	103	105
O2-"Develop scale up solutions"	14	15
S1-"Promote functionality rather than ownership"	3	2
S2-"Adopt a stewardship role"	43	41
S3-"Encourage sufficiency"	4	3
T1-"Maximize energy and materials efficiency"	173	145
T2-"Create value from waste"	27	21
T3-"Substitute with renewables and natural processes"	45	49
Total	412	381

Table 4.20 Distribution of the archetype described by Bocken et al. (2014) within the sample.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The table above shows, per each archetype, the number of firms whose business model has been classified within the boundaries of the specific archetype.

The data are showing the archetype T1-"Maximize energy and material efficiency" as the most implemented by SOs (173 SOs). The second and third archetypes for implementation by SOs are O1-"Repurpose for society/environment" (103 SOs) and T3-"Substitute with renewables and natural processes" (45 SOs). The overall ranking of the archetypes implementation by SOs is coherent with the findings of Caliceti (2017)'s research.

For what concerns the "Maximize energy and material efficiency" (T1) archetype, its popularity among startups has been driven by businesses selling data analysis tools in order to increase the efficiency of the farmers, or even of retailers through demand management tools. Moreover, several startups in the sample are selling structures and technologies for aquaponics and aeroponics. Therefore, the most popular supply chain stages represented in the T1 archetype are Service providers (76 SOs) and Technology suppliers (72 SOs).

The size of the sample portion of startups falling into the classification O1-"Repurpose for society/environment" is remarkable. Service providers is the most represented supply chain stage in this archetype (69 SOs), while the second and the third most represented stages are respectively Retailers (16 SOs) and Food processing industry (8 SOs). The high numerousness of startups falling in this classification is an indicator of the growing awareness in the world of the importance of sustainability aspect and the increasing need of sustainable business models' implementation. These startups are devoting their business model to sustainability and they provide hope for the welcomed sustainable revolution.

If we look at the macro-category of Bocken et al. (2014) classification, the most common between the startups in the sample is "Technological oriented innovation". 245 startups, more than half of the sample (59.47%), are implementing a business mode which is classified in this category. This result is not surprising, since the analysis showed two of the three archetypes included in the macro-category as the first and the third most implemented by SOs.

The least implemented business model archetypes are, once again coherently with Caliceti (2017)'s research, the S3-"Encourage sufficiency" and S1-"Promote functionality rather than ownership". The motivation of the low implementation rate of the latter might be the same described by Caliceti (2017), i.e. the high perishability of the products that are the output of the agri-food industry is leading towards the individual "buy and consume" customer's approach rather than a "pay per use" one. On the other hand, the low number of startups implementing the S3 archetype is an interesting insight, since sufficiency is key in the implementation of a sustainable business model.

Interesting insights might emerge looking also at the main target and the main sustainable development goal pursued by the archetypes. As it is predictable from the previous analysis, the majority of the firms have been classified as pursuing the SDG 2: "End hunger, achieve food security and improve nutrition and promote sustainable agriculture". It is the most pursued SDG for all the archetypes apart for T2-"Create value from waste". Firms whose business model has been catalogued as T2, are represented by the SDG 12 as the most pursued: "Ensure sustainable consumption and production patterns". In particular, the target 12.3 has been assigned as "Main target" for 16 T2 startups out of 27. The target is described as "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses". The description of the target accurately describes the main purpose and the value proposition of the majority of the startups classified in this archetype. The T2-"Create value from waste" and the insights of the archetype analysis will be further described in the next dedicated chapter.

While trying to identify the drivers of the implementation of one specific business model archetype, the first dimension that this thesis is going analyse in detail is the geographical dispersion. As pointed out by Caliceti (2017) mentioning Godfray et al. (2010), the cause of the paradox of food insecurity and food waste may be very different. If we look at the food waste side, Godfray (2010) pointed out that in developed countries the biggest portion of food waste is due to the consumers' culture and habits. On the other hand, in developing countries the issue of food waste is mainly driven by the lack of adequate infrastructures. In order to get an idea of the specialization of a country agri-food startups for each archetype, it could be possible to compute the relative Balassa Index. However, In order to be robust with the logic applied in the previous indexes, the calculation would

need to be done only on those countries with more than 10 sustainable startups. But, since the countries of the sample are represented by a low number of startups, the data may lose significance.

Those are the reasons why, instead of computing the Balassa Index, a more general and aggregate indicator has been considered. The countries have been divided into two categories, "Developed" and "Developing", coherently with the above analysis and therefore according to the International Monetary Fund's World Economic Outlook Database (2018). Considering the two categories, their distribution in the 3 macro-categories of Bocken et al. (2014) archetype has been computed and it is shown in table 4.21.

Archetype	Developed	Developing
% of organizational startups	22.5%	46.1%
% of social startups	12.5%	11.0%
% of technological startups	65.0%	42.9%

Table 4.21 Distribution of startups among macro-categories of archetypes in developed and developing countires. Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The data show a major focus of the startups based in developed countries in the technological archetypes. On the other hand, startups based in developing countries seem to be more focused on the organizational archetypes. The results lead to similar findings of Caliceti (2017)'s work. However, since it has been used a different indicator to compute the distribution of startups, it is not possible to compare the numerical values of the two researches.

The last figure that has been analysed concerning the archetypes distribution is the amount of funding that startups have been able to collect. As mentioned above, funding amount is the only information in the database that might be used to assess the startups' performances.

Archetype	Total funding (US$)	Average funding (US$)	Ranking on average funding
O1-"Repurpose for society/environment"	213,883,222	4,649,635	3
O2-"Develop scale up solutions"	118,272,000	23,654,400	1
S1-"Promote functionality rather than ownership"	948,990	474,495	7
S2-"Adopt a stewardship role"	73,824,846	3,209,760	4
S3-"Encourage sufficiency"	-	-	8
T1-"Maximize energy and materials efficiency"	205,862,423	2,450,743	5
T2-"Create value from waste"	11,995,348	749,709	6
T3-"Substitute with renewables and natural processes"	144,533,243	4,817,775	2
Total	769,319,712	3,734,562	

Table 4.22 Total and average funding per archetype.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The archetype that collected the highest average funding amount is O2-"Develop scale up solutions" (23,654,400 $). The average funding amount of this archetype is almost five times bigger than the average funding amount of the second highest value (i.e. T3-"Substitute with renewables and natural processes", 4,817,775 $) and more than six times bigger than the average funding amount of the SOs (3,734,562 $). An interesting insight is that it is even bigger than the average funding amount computed for the Non-SOs in the database (8,579,740 $), despite the above analysis showed a higher amount of funding collected by Non-SOs rather than the average amount collected by SOs.

The results are in line with Caliceti (2017)'s analysis, mainly because the O2-"Develop scale up solutions" value of funding amount is affected by the startup Sundrop Farms. The English firm is present in both the databases and it reports a total funding amount value of 100,000,000 $.

The archetype O1-"Repurpose for society/environment" is the only one whose position in the ranking has changed if compared with Caliceti (2017). It was ranked as fifth for

average funding amount, with a value of 2,021,331 $ that has more than doubled in the current sample. Another change in the ranking is the position of the archetype S3-"Encourage sufficiency". It was represented by only one funded startup, Fiddlehead Technology. The Canadian startup has been founded in 2012, therefore it has not been considered in this research.

Moreover, the average amount of funds collected per archetype is increasing for all the values but for the mentioned case S3-"Encourage sufficiency" and for S1-"Promote functionality rather than ownership", for which the value is slightly decreasing (478,580 $ was the figure in Caliceti (2017)'s work).

Interesting insights might emerge by the number of startups funded per each archetype. The values are reported in table 4.23 below.

Archetype	# of funded startups per archetype	% of funded startups per archetype
O1-"Repurpose for society/environment"	46	45%
O2-"Develop scale up solutions"	5	36%
S1-"Promote functionality rather than ownership"	2	67%
S2-"Adopt a stewardship role"	23	53%
S3-"Encourage sufficiency"	-	0%
T1-"Maximize energy and materials efficiency"	84	49%
T2-"Create value from waste"	16	59%
T3-"Substitute with renewables and natural processes"	30	67%
Total	206	50%

Table 4.23 Percentage of funded startups per archetype.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

The startups catalogued as S1-"Promote functionality rather than ownership" and T3-"Substitute with renewables and natural processes" seem the more likely financed. The 67% of the startups in these archetypes have been financed. The data is more significative

if we consider only the T3-“Substitute with renewables and natural processes” archetype, given the numerousness of the archetype sample.

4.7 Conclusions

After the information collected in the database have been analysed, it has been possible to extract some insights on the geographical dispersion, the distribution of startups along the food value chain and the distribution of funds among startups.

The goal of this chapter was to highlight an answer for the first question emerged from the analysis.

RQ1: What are the most implemented business models by the agri-food Sustainability Oriented startups?

- **RQ1a:** What are their characteristics in terms of supply chain stage in which they operate, geographical distribution, ability to collect funds, and typology of sustainability orientation pursued?

- **RQ1b:** What are differences and similarities that emerge from a comparison with the analysis performed by Caliceti (2017)?

The archetype T1-“Maximize energy and materials efficiency” has been described as the most implemented by agri-food SOs Moreover, for each archetype, the geographical dispersion in developed and developing countries and the funds collection has been analysed.

Concerning the distribution of startups along the food value chain and the sustainability topic, it is important to highlight that “food service” has been identified as the worst-performing stage, according to the startup implementation of a sustainability orientation. Only 3.31% of the startups in the sample operating in the “food service” stage have been described as SOs. Furthermore, focusing on the main objective of the chapter, the research of an answer to the first research question, the most important findings are the discoveries of the most pursued SDG ad the most implemented archetype. The SDG 2 resulted the most pursued by SOs. It is the most appropriate to be tackled, given the scope of the agri-food industry. However, it has been discovered that the most pursued SDG for the

archetype T2-“create value from waste” is different, it resulted to be SDG 12. The nature of the businesses included in this archetype and further insights will be provided in the next chapter.

Finally, the results have shown the data to be mostly coherent with the findings pointed out by Caliceti (2017). The only remarkable difference is the specialization in the sustainability orientation of the startups operating in South Africa and Finland.

5. *T2 archetype, Create Value from Waste*

This chapter aims at defining the answer to the second research question of this dissertation. As presented in chapter 3: "Methodology", the purpose of this research question is to investigate in depth the archetype recognized by Bocken et al. (2014) as T2: "Create Value from Waste" applied to the agri-food industry and to identify the drivers that can lead a firm to implement this sustainable business model. The methodology used is the case study analysis, as explained in chapter 3: "Methodology".

Consequently, this chapter will be structured as follow:

1) Presentation of the T2 startups retrieved from the database analysis
2) Focus on agri-food service providers, business model canvases and decision trees analysis
3) Case study sample definition
4) Business cases description
5) Within cases analysis
6) Cross cases analysis
7) Final analysis and assessment of drivers and barriers
8) Description of T2 startups not falling into the food waste hierarchy
9) Conclusions

5.1 T2 startups

The previous chapter illustrates the results obtained from the analysis of the updated database. Among the analysis performed, it is possible to focus on the T2 archetype. The database shows that, between the years 2013 and 2017, Crunchbase records 27 sustainable oriented startups operating towards this type of technological innovation.

The following table (Table 5.1) lists all the 27 startups, with their information, obtained by the intelligence tool and, when necessary, completed by an online research.

Company Name	Founded Year	Country	Website	Operating Status	# of Employees	supply chain stage	Activities	Total Funding Amount	SDG Assigned	Main target	Targets list
Atlas Organics	2013	United States	http://www.atlasorganics.net	Active	11-50	Input companies	20.15	$ 854.000,0	6	6.3	6.3
BigZpoon Inc.	2015	United States	https://www.bigzpoon.com	Active	1-10	Service providers	63.11	$ -	12	12.3	12.3
BIO-LUTIONS	2015	Germany	http://www.bio-lutions.com/	Active	1-10	Support activities	17	$ -	6	6.3	6.3; 9.4; 12.4
BuffetGO	2015	United States	http://www.BuffetGoUSA.com	Operating	01-10	Service providers	62.10; 63.11	$ -	2	2.1	2.1
Entomics	2015	United Kingdom	http://www.entomics.com/	Active	1-10	Input companies	10.91; 20.15	$ 50.000,0	12	12.3	12.2; 12.3
Epic CleanTec	2015	UnitedStates	http://epiccleantec.com/	Active	NA	Input companies	20.15	$ 1.037.000,0	6	6.3	6.3
Foodcloud	2013	Ireland	http://foodcloud.net/	Operating	01-10	Service providers	63.11	$ -	12	12.3	2.1; 12.3
Foodhero	2015	Italy	http://www.foodhero.it	Active	NA	Service providers	63.11	$ -	12	12.3	12.3
Froodly Oy	2015	Finland	http://froodly.com/	Operating	01-10	Service providers	63.11	$ -	12	12.3	12.3
Goodr	2016	United States	https://goodr.co/	Active	1-10	Service providers	62.01; 63.11	$ -	12	12.3	12.3

Company Name	Founded Year	Country	Website	Operating Status	# of Employees	supply chain stage	Activities	Total Funding Amount	SDG Assigned	Main target	Targets list
Grablr	2016	United States	https://www.grablr.com/	Operating	01-10	Service providers	62.01; 63.11	$ 50.000,0	12	12.2	12.2
Grabz (Bon Harvest)	2016	United States	http://www.grabz.net	Active	1-10	Service providers	63.11	$ 125.000,0	12	12.3	12.3
Imperfect Produce	2015	United States	http://www.imperfectproduce.com	Operating	11-50	Retailers	47.91	$ 40.000,0	12	12.2	12.2
JustNow	2013	Romania	http://www.justnow.co	Active	NA	Service providers	62.01; 63.11	$ 15.000,0	12	12.3	12.3
KDC Ag	2014	United States	http://kdcag.com/	Operating	NA	Input companies	10.91; 20.15	$ -	9	9.4	9.4
OLIO	2014	United Kingdom	https://olioex.com/	Operating	NA	Service providers	63.11	$ 2.200.000,0	12	12.3	12.3
OptiMiam	2014	France	http://www.optimiam.com	Operating	01-10	Service providers	63.11	$ 555.183,0	12	12.3	12.3
Pan Biyoteknoloji	2014	Turkey	http://pan.com.tr	Operating	NA	Input companies	10.91	$ -	12	12.3	12.3
Replate	2016	United States	http://www.replate.org	Active	1-10	Food service	56	$ 600.000,0	2	2.1	2.1; 2.2; 12.3
ResQ Club	2014	Finland	https://resq-club.com/	Operating	NA	Service providers	63.11	$ 446.688,0	12	12.3	12.3
Ripe List	2014	United States	http://ripelist.com/	Operating	01-10	Service providers	63.12	$ -	11	11.4	11.4

Company Name	Founded Year	Country	Website	Operating Status	# of Employees	supply chain stage	Activities	Total Funding Amount	SDG Assigned	Main target	Targets list
RISE Products	2017	UnitedStates	http://www.riseproducts.co/	Active	1-10	Food processing industry	10.61	$ 150.000,0	6	6.3	2.4; 6.3; 12.3
Seedling LLC	2016	United States	http://www.seedling-phl.com	Active	1-10	Farmers, breeders and fishers	01.13	$ -	6	6.3	2.4; 6.3; 6.4
Spare Fruit	2016	United Kingdom	http://www.sparefruit.com/	Active	1-10	Food processing industry	10.39	$ 478.312,0	12	12.3	12.2;12.3
Spoiler Alert	2015	United States	https://www.spoileralert.com/	Operating	01-10	Service providers	63.11	$ 2.600.000,0	12	12.3	12.3
Takestock	2014	United Kingdom	http://www.takestock.com	Operating	01-10	Service providers	63.11	$ 460.660,0	12	12.3	12.3
Full Harvest	2014	United States	https://fullharvest.com/	Operating	01-10	Retailers	63.11	$ 2.000.000,0	12	12.3	12.3

Table 5.1 Data collected on the 27 startups classified as T2: Create value from waste.
Source: Own elaboration of agri-food startups database of Politecnico di Milano – School of Management.

Since the objective of the research is to study the "Create value from waste" archetype, in this first step it is possible to classify the startups through the food waste hierarchy model (Papagyropoulou et al., 2014), already presented in the previous chapters. In the following figure (Figure 5.1) all the startups have been assigned to a specific level of the hierarchy, according to their approach towards the management of surplus food/food waste.

PREVENTION:	
10 Service Providers	Bon Harvest, BigZpoon, BuffetGo, FoodHero, Froodly, Grablr, JustNow, Optimiam, ResQ Club, TakeStock
2 Retailers	Full Harvest, Imperfect Produce
REUSE:	
6 Service Providers	FoodCloud, Goodr, Olio, Replate, Ripelist, Spoiler Alert
RECYCLE:	
3 Input Companies	Atlas Organic, Entomics, KDC Ag
1 Support Activities	Bio-Lutions
1 Farmers, breeders, Fishers	Seedling

Figure 5.1 T2 Startups assigned to the Food Waste Hierarchy

As explained in chapter 3: Methodology, the next step is to decide which startups will be selected to proceed with further analysis. The key factors that led the decision are the numerosity of the "Service providers" startups in the sample, and the fact that "Service providers" is the only supply chain stage that is present in more than one layer of the Food Waste Hierarchy. Therefore, this is the only stage on which it could be possible to analyse

the reasons that lead a startup to operate in one specific level of the hierarchy. Moreover, the evaluation of drivers throughout different supply chain stages would have been meaningless, since, the main driver would have been the supply chain stage in which the startups operate.

For this reason, in order to have the possibility to meaningfully study heterogeneous cases, the category service providers have been identified as the most interesting and valuable stage of the supply chain to study; therefore, the startups operating in this supply chain stage have been chosen to be further analysed.

Eventually, from here onwards, the discussion will focus on startups recognized by the activities they perform as service providers, which is the most represented stage of the whole agri-food supply chain, chapter 4 "Database analysis".

A short notice must be made in order to specify why in the hierarchy there are only 25 startups instead of the original 27.

The startup Epic CleanTec is not represented in the hierarchy since it aims at transforming wastewater solids into organic soil amendment, which can be used to grow crops. The input of this transformation is wastewater, which cannot be identified as food waste, and, therefore, this startup cannot be represented in the food waste hierarchy.

Moreover, the last startup, Pan Biyoteknoloji, which is still operating (Crunchbase source, 18/07/2018), is not reachable from any online source, and therefore, it is not possible to recognize the level of the hierarchy in which it operates in.

5.2 T2 Service Providers and Sample definition

The service providers present in the database that are pursuing a T2 archetype are 16, out of a total number of 27 startups recognized with this archetype.

For each one of the 16 startups a background analysis has been made. This analysis consisted in the construction of the 16 business model canvases which have been drawn through the identification of each one of the 9 blocks of the canvas, thanks to the information collected online, through startups websites and Crunchbase. Moreover, in order to better visualize and study the different businesses, a decision tree for each one of

the 9 blocks has been built to be able to compare the startups and to highlight differences and similarities.

The business canvases of the startups used for the case studies will be presented in the paragraph 5.3 of this chapter. This section instead will focus on the decision trees built to summarize the 16 startups.

Looking separately at each block among the different canvases it has been possible to identify some common elements and some dissimilarities that characterize the businesses.

First of all, since from the analysis it emerged that the service providers are present in two levels of the food waste hierarchy, the primary decision node to address is the reason why to adopt one surplus food management or the other, more precisely, why to operate at the prevention or at the reuse level of the hierarchy.

Once this factor has been addressed, it has been possible to divide each block into different branches. Hereafter, the blocks are presented in order to give firstly a clear definition of them.

- Value proposition: It analyses the purpose of the startup, its final goal. What it aims to achieve through the implementation of the business model "Create value from waste". The main drivers addressed with this block are the ones which led the startups to the decision of positioning in a specific layer of the Food Waste Hierarchy.
- Customer segment: It analyses the specific stage of the food value chain in which the startup operates, and which are the actors that participate in the operations of the startup. Startups might perform their activity with different players of the supply chain from farmers to final customers.
- Channels: It analyses the different means through which the startups are reaching their customers. These can be websites, mobile applications, physical channels.
- Customer relationship: It analyses the means through which the startups are engaging customers in their sustainable business model.
- Key resources and key activities: These blocks are very linked to each other. They analyse the activities the companies are performing in order to implement a sustainable business model, and the resources which the startups are exploiting to complete their key activities.

- Key partners: Relevant players and actors involved in the business, which can be represented by other players external to the customers.
- Cost structure: It is a consequence of all the previous block, it analyses all the costs faced by the startups. It is clearly a consequence of the key activities performed and key resources exploited.
- Revenue stream: It analyses the revenue model of the startups, identifying the source of revenues and their characteristics.

In the following pages the decisions trees identified through the business canvases are shown. The decision tree of the key partners is not represented since, in the businesses analysed, there are not relevant actors rather than the customers, and, therefore, the resulting tree would be the same as the customer segment one.

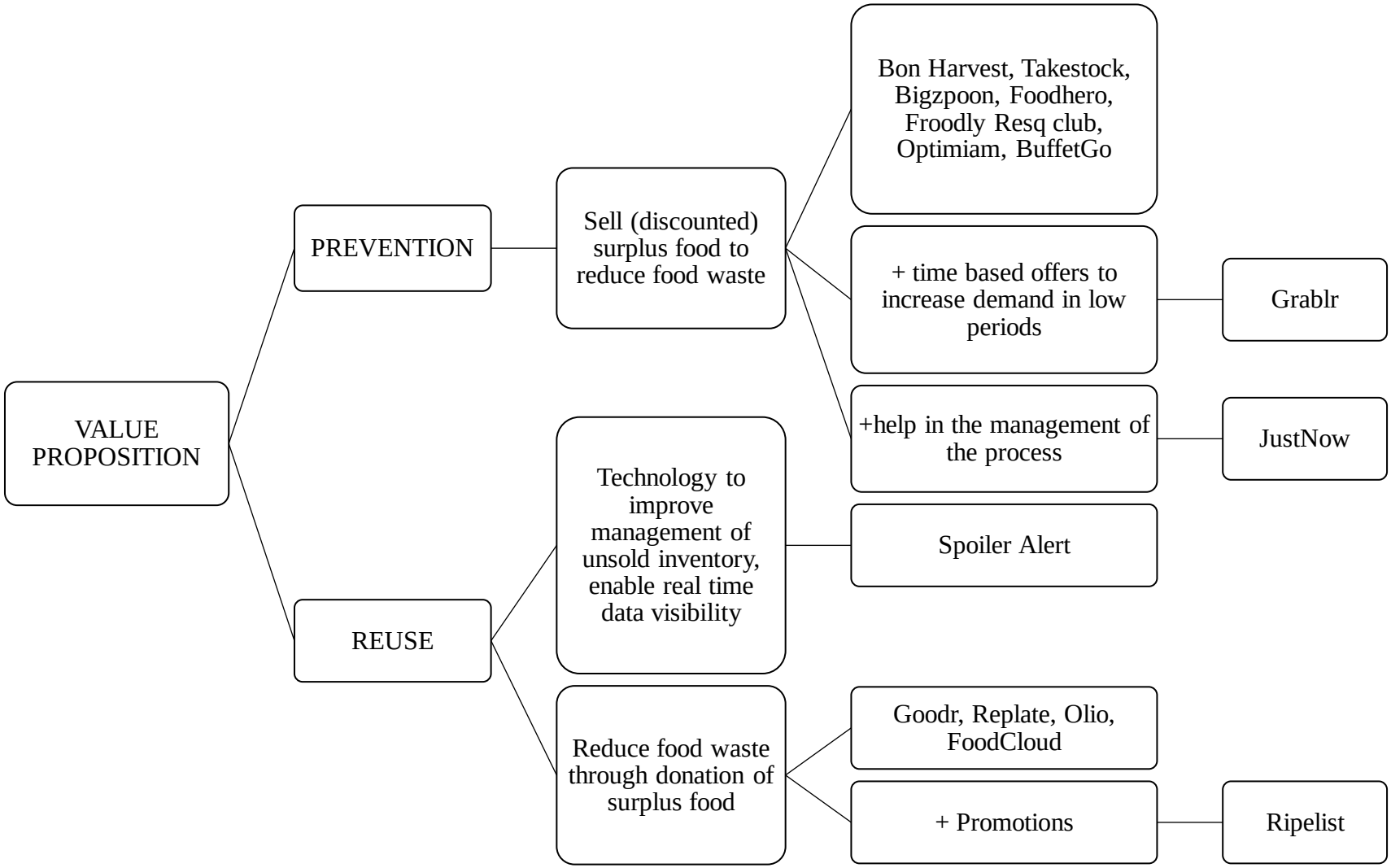


Figure 5.2 Value Proposition decision tree

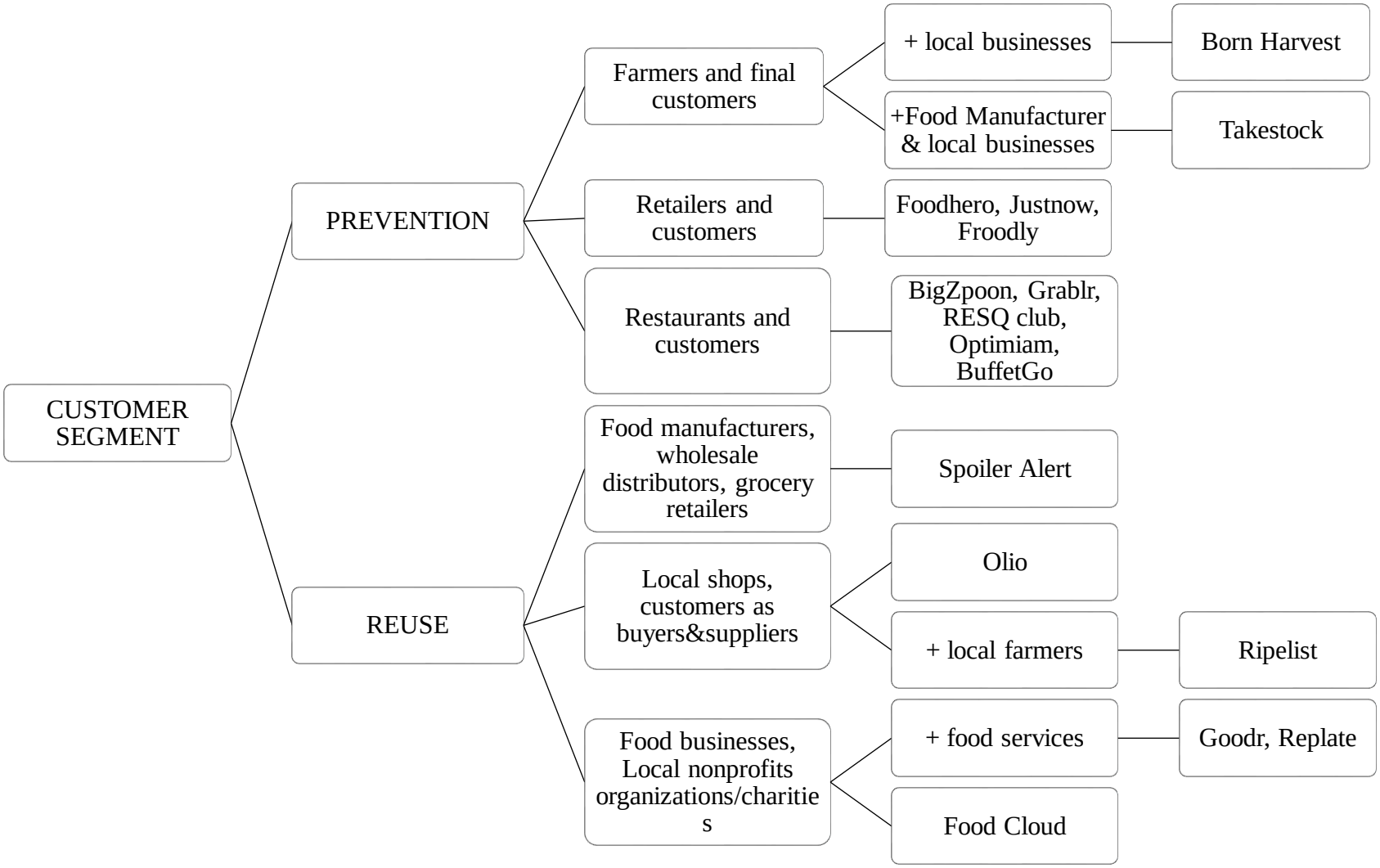


Figure 5.3 Customer Segment decision tree

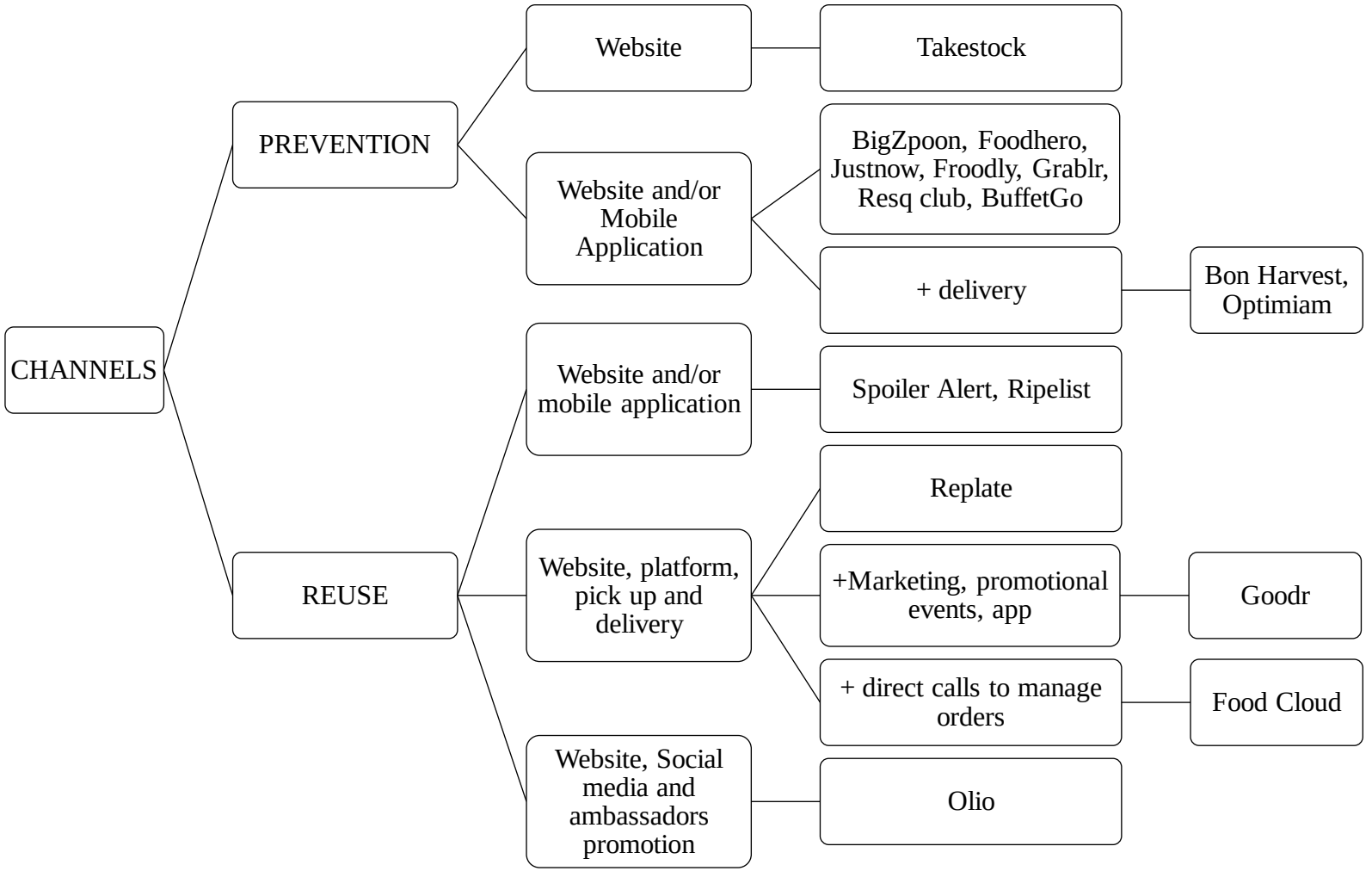


Figure 5.4 Channels decision tree

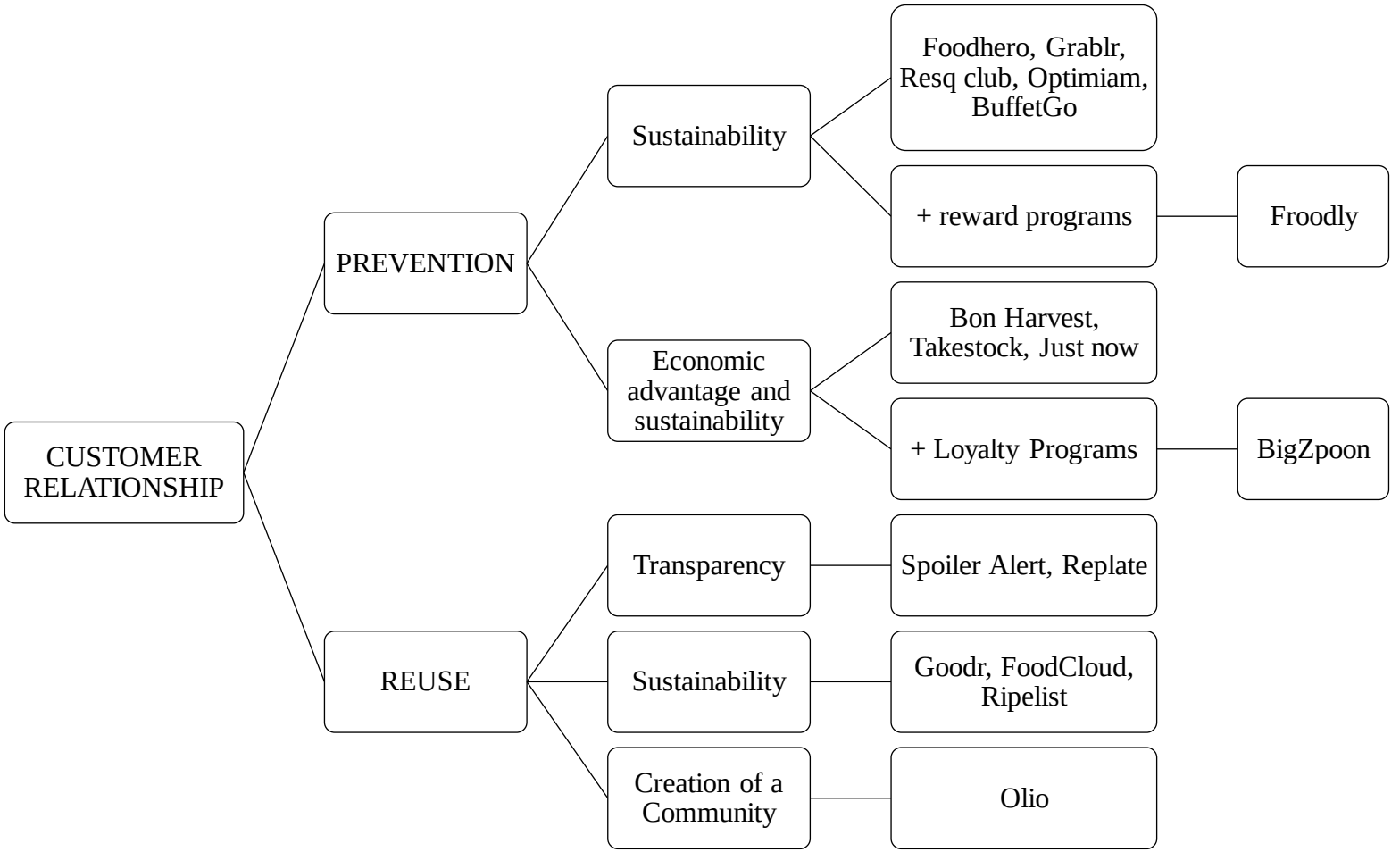


Figure 5.5 Customer Relationships decision tree

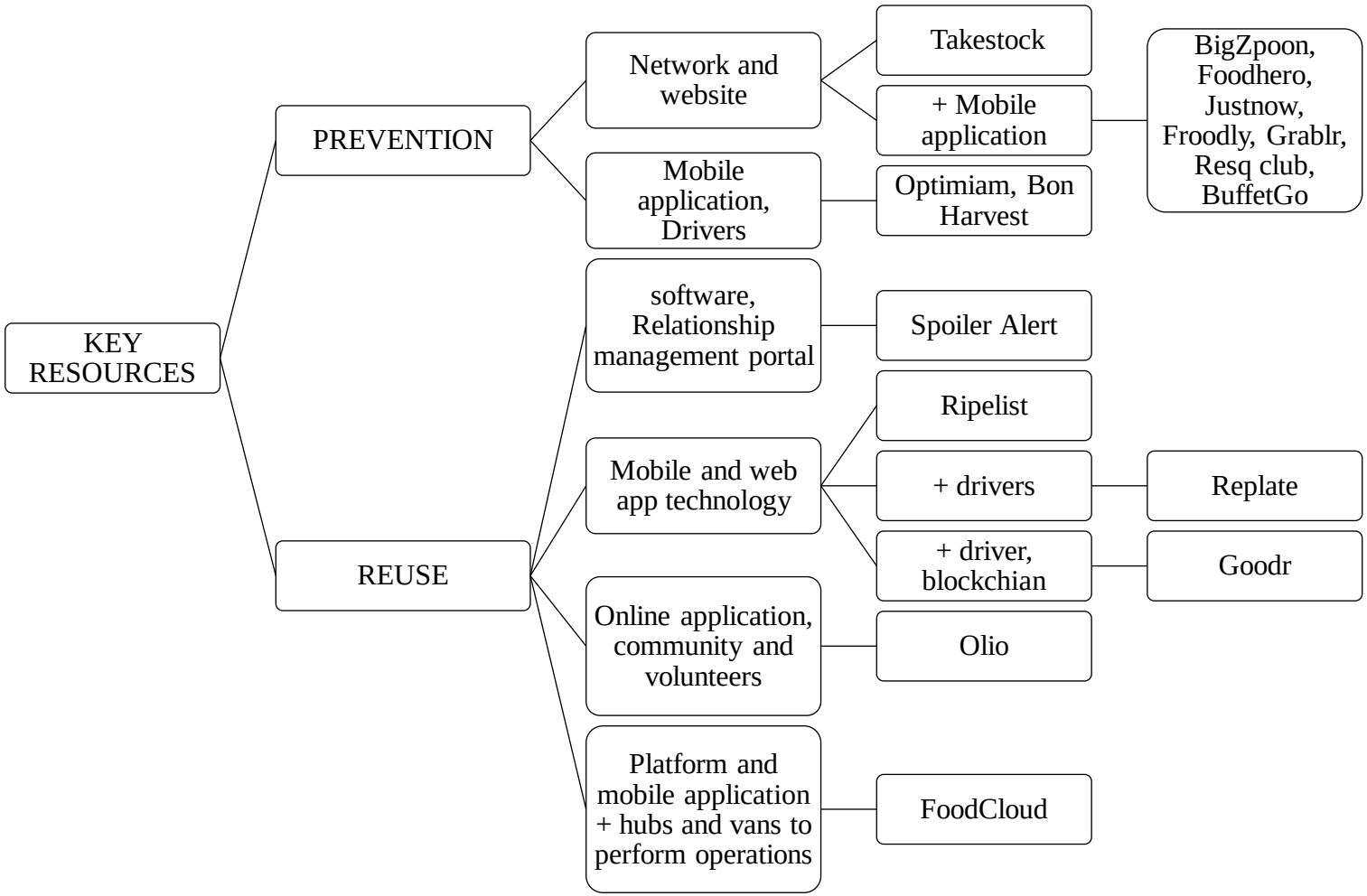


Figure 5.6 Key Resources decision tree

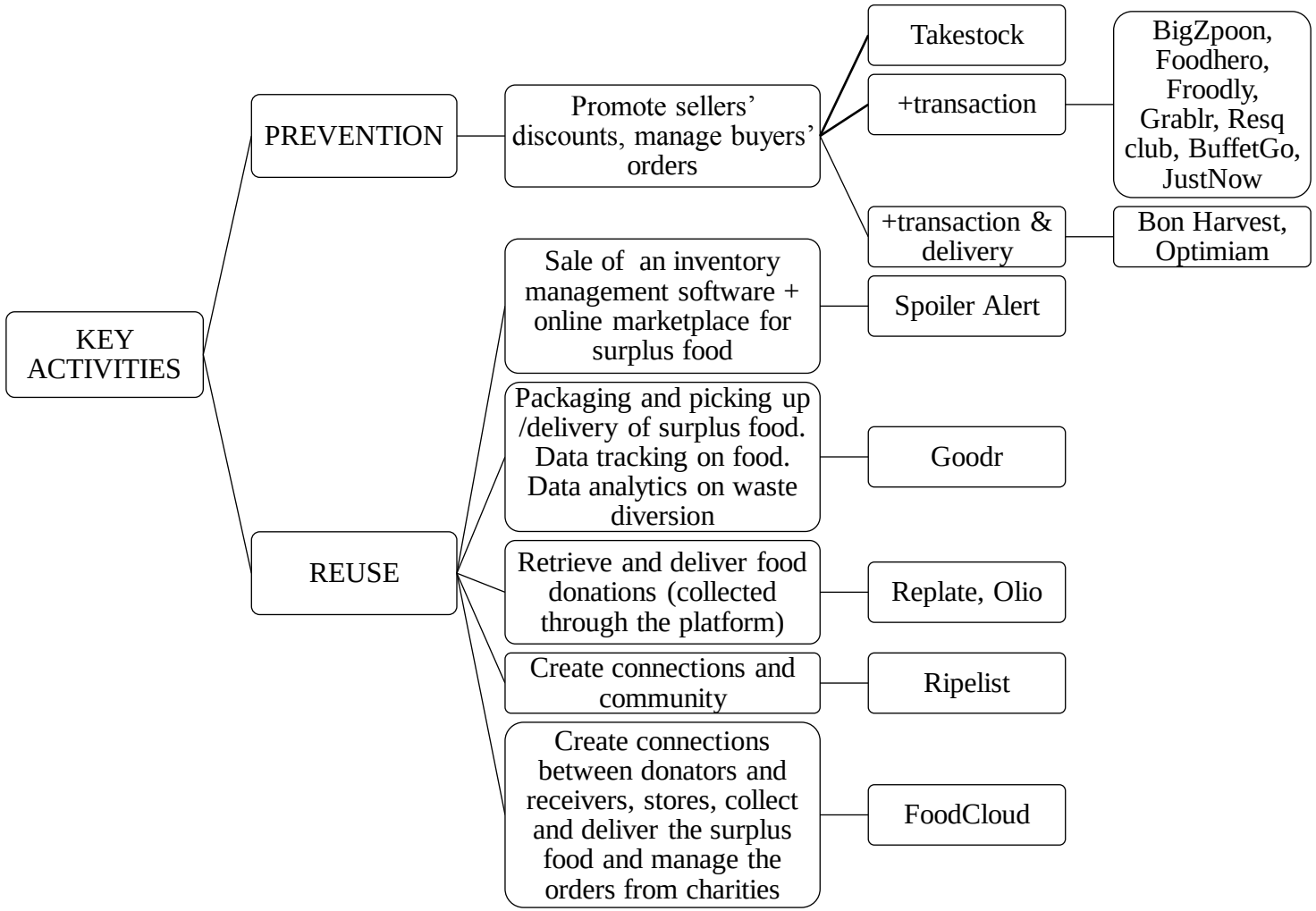


Figure 5.7 Key Activities decision tree

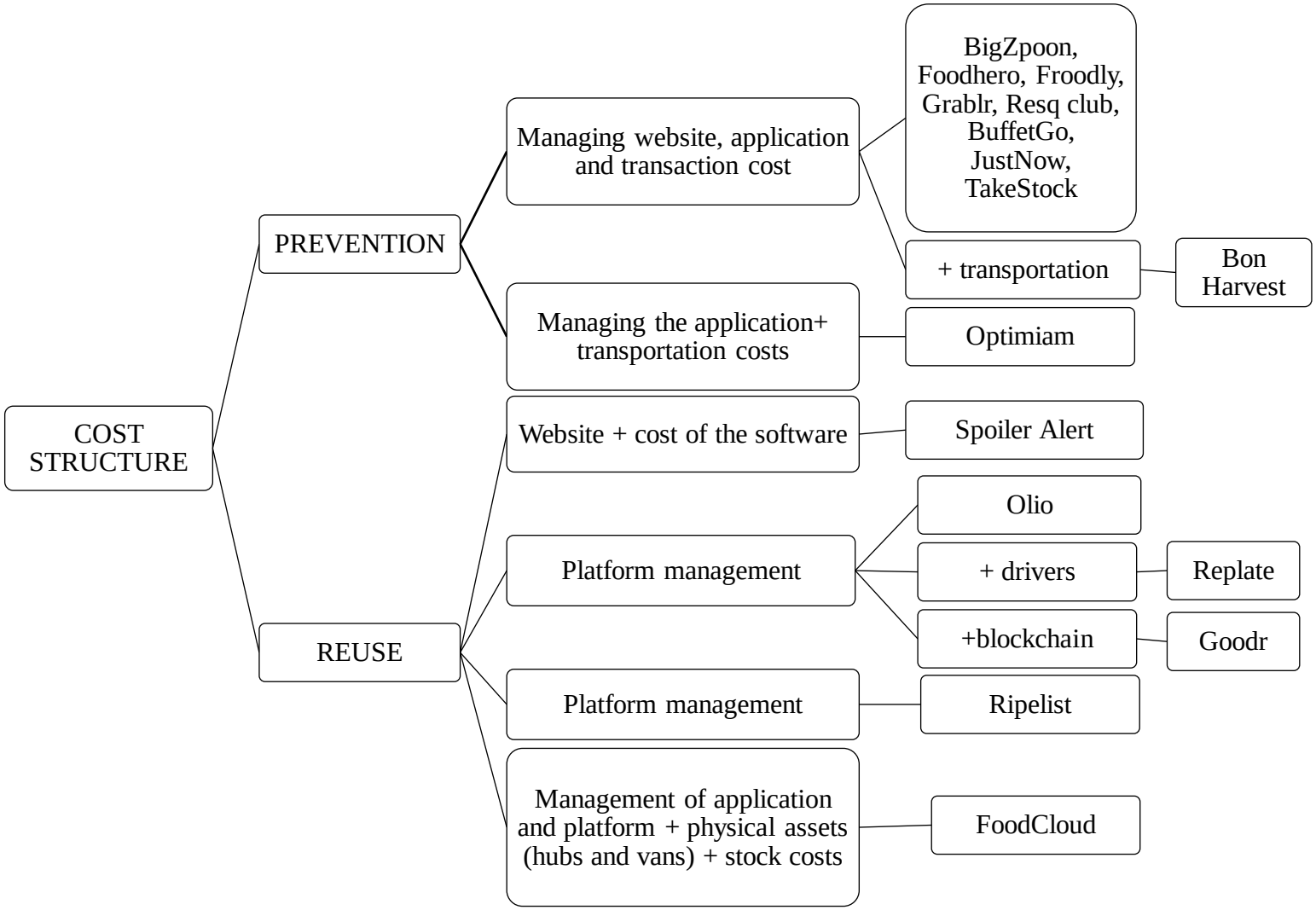


Figure 5.8 Cost Structure decision tree

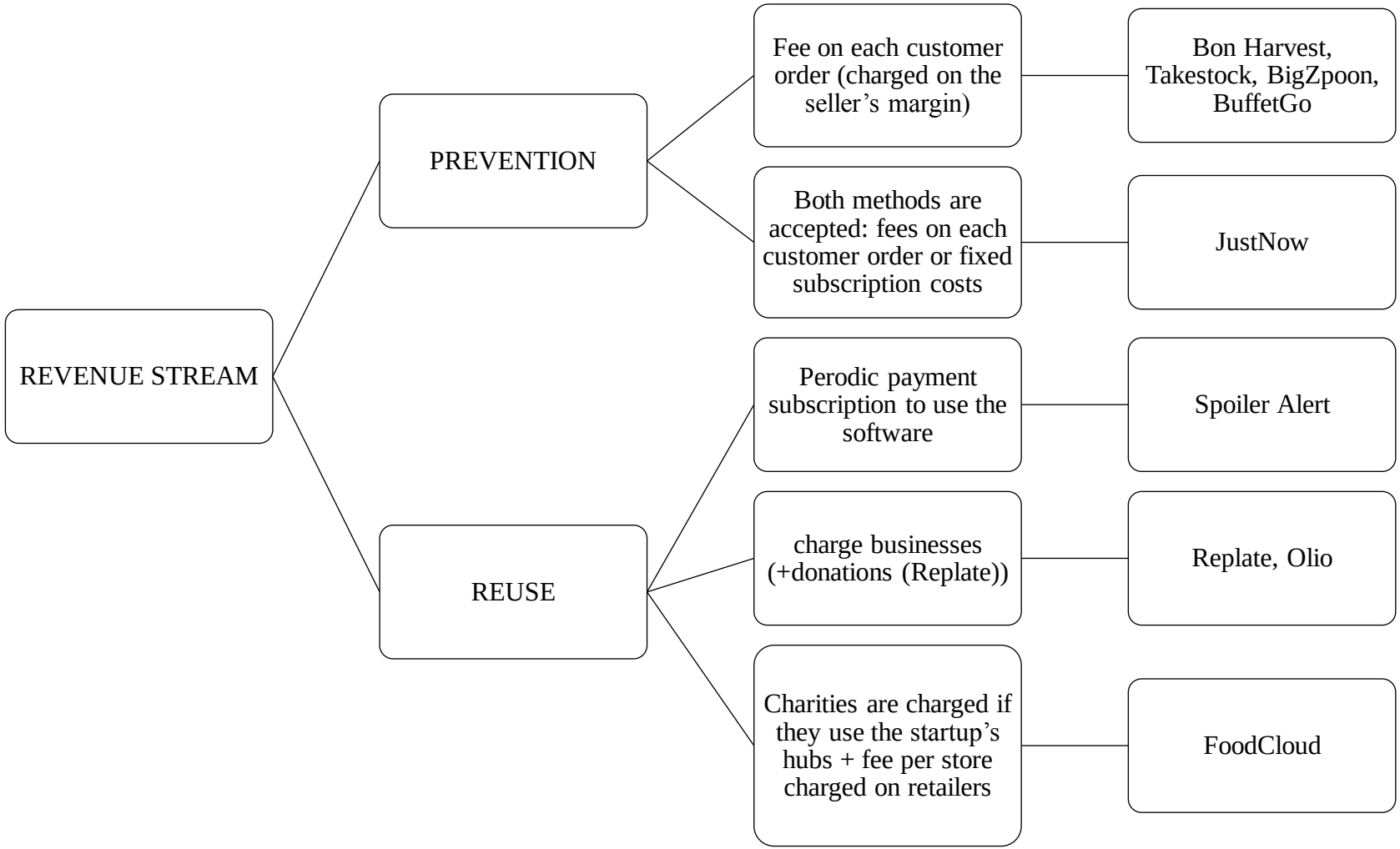


Figure 5.9 Revenue Stream decision tree

From these decisional milestones, it is possible to evaluate which firms are the most suitable for the case studies analysis.

Firstly, to achieve more robust results, a multiple case study has been developed. In order to capture heterogeneous elements which could lead at obtaining a satisfying answer the sample of cases must represent different patterns of actions. For this reason, the case studies must address both levels of the surplus management: prevention and reuse. Therefore, the sample of analysis must contain at least two startups belonging to the reuse stage and two belonging to the prevention one. Moreover, in order to choose the best cases, the decision trees and the business model canvases have been studied.

From the branches it is possible to group the startups according to common features of their business models.

Prevention	Reuse
FoodHero, JustNow, Froodly	Olio
BigZpoon, Grablr, ResQ Club, BuffetGo	Goodr, Replate
Bon Harvest, Optimiam	FoodCloud
TakeStock	Spoiler Alert

Table 5.2 Service Provides grouped by similarities

Once these groups have been recognized, the list of firms to interview has been drawn.

For what concerns the prevention stage, since the number of startups present is higher than the sample of the reuse startups, it has been chosen to select 5 cases: FoodHero, BuffetGo, Bon Harvest, Optimiam, TakeStock.

For the reuse stage the startups chosen resulted: Olio, Replate and FoodCloud. The choice was driven by the differences they have in the activities they perform, the resources they rely on and the customer base on which they build their business around. All these features are summarised in the decisional trees presented above.

As it is possible to notice, the startups chosen are part of different groups represented in table 2, in order to be able to cover all the possible aspects of this archetype.

Finally, in order to draw a case study, it has been necessary to contact each startup and to perform the interviews. In order to prevent the negative impact of the potential case where a startup would not be interested or would not allow the interview, another list of startups for the case studies has been created with the remaining firms of table 2.

5.3 Case Studies Description

In this section of the chapter the startups analysed in the business cases will be shortly introduced, in order to be able to have an overview on the cases and be able to better understand the interviews which will be described further on.

5.3.1 BigZpoon

BigZpoon was founded in California in 2015. The startup aims at reducing food waste and at creating a win-win-win solution for restaurants, customers and environment.

The startup offers a platform which enables the connection between the two actors of the chain: customers and food services. The platform presents discounted meals to customers, supplied by those restaurants that have food in excess. The solution is win-win-win:

1. Restaurants are able to increase their revenues, their customer base and decrease food waste;
2. End users can save money by finding offers on meals and contribute to reduce food waste through the usage of the platform;
3. There is a positive contribution on the environmental aspect since food waste is reduced.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Key partners are both, consumers and food services. Consumers provide the demand and food services provide the offer</td>
<td>KEY ACTIVITIES

Promote food services menu and discounts, manage consumers’ orders, manage transactions</td>
<td rowspan="2">VALUE PROPOSITION

Allow consumers to enjoy delicious food, while saving money and helping the environment, reducing the amount of food that is thrown away</td>
<td>CUSTOMER RELATIONSHIP

Sales effort for restaurants; Marketing efforts and a Loyalty Program for</td>
<td rowspan="2">CUSTOMER SEGMENTS

End-Customers and food services (restaurants, cafes, bakeries, small shops, etc.)</td>
</tr>
<tr>
<td>KEY RESOURCES

Mobile application, website and Network</td>
<td>CHANNELS

Platform, website, mobile application, social media, phone calls, emails, representatives</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

4 areas of costs: marketing, sales, engineering, operations</td>
<td colspan="2">REVENUE STREAMS

The join of the application is free of charge. A fee is applied to each payment transaction made from the customer to BigZpoon</td>
</tr>
</table>

Figure 5.10 BigZpoon - Business Model Canvas

5.3.2 JustNow

JustNow was born in South Africa and started operating in 2017. The founder is Alexandre Vellieux, French man who moved to South Africa during his adult life. The startup offers a platform which operates as a marketplace in order to connect food retailers, such as supermarkets, small stores, cafes, bakeries and final customers.

The end user receives customised notifications on food about to expire which is offered at discounted price by retailers. The retailers can increase their profits from the sales of food that would otherwise go into waste. The startup main costs are the management of the application and the acquisition of the customer base. Moreover, revenues are created through the application of fees paid by the food businesses.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Key partners are both, consumers and retailers. Consumers provide the demand and food businesses provide the offer</td>
<td>KEY ACTIVITIES

Connect retailers and end users</td>
<td rowspan="2">VALUE PROPOSITION

Allows consumers to enjoy food while saving money and helping the environment, and helps retailers to reduce the amount of food waste</td>
<td>CUSTOMER RELATIONSHIP

Customers are engaged through on site marketing performed by promoters and by social media advertising</td>
<td rowspan="2">CUSTOMER SEGMENTS

End-Customers and Retailers (supermarkets, cafes, bakeries, small shops, etc.)</td>
</tr>
<tr>
<td>KEY RESOURCES

Mobile application, website</td>
<td>CHANNELS

Platform, website, mobile application, social media, flayers, posters, representatives</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

Management and Development of the application

Customer acquisition</td>
<td colspan="2">REVENUE STREAMS

The food businesses are charged, they can choose to pay a fixed monthly fee or to pay a commission for each product sold</td>
</tr>
</table>

Figure 5.11 JustNow - Business Model Canvas

5.3.3 Replate

Replate was born in California, USA, in 2016. Through its platform, the startup allows to connect charities and people in need with food businesses. The purpose of Replate is to reduce food waste through the donation of surplus food produced by companies' canteens and catering services to charities and non-profit organizations. Occasionally the startup operates also with food manufacturers, rescuing their surplus food. The main activities performed are the supply of the marketplace through the platform and the pick-up and delivery logistics services done by their own employees. The revenues are created by charging the food businesses with a subscription plan.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Charity organizations, food businesses</td>
<td>KEY ACTIVITIES

Through the platform businesses can donate food.

Drivers package, retrieve and deliver the food donation</td>
<td rowspan="2">VALUE PROPOSITION

Reduce food waste and feed people in need through the donation of surplus food by food businesses</td>
<td>CUSTOMER RELATIONSHIP

Transparency between donors, drivers and charities</td>
<td rowspan="2">CUSTOMER SEGMENTS

Businesses, Charities and people in need</td>
</tr>
<tr>
<td>KEY RESOURCES

Platform

Drivers (food rescuers)</td>
<td>CHANNELS

Platform
Blog
Pickup and delivery</td>
</tr>
<tr>
<td colspan="2">COST STRUCTURE

Food rescuers
Platform management</td>
<td colspan="3">REVENUE STREAMS

Replate is 100% non-profit. All donations are 100% tax deductible.
Replate charges the businesses for the service of picking up and handling the food. (offer different plans for the businesses).
Private donations</td>
</tr>
</table>

Figure 5.12 Replate - Business Model Canvas

5.3.4 Olio

Olio was created in the United Kingdom in 2014 by Tessa Cook and Saasha Celestial-One. Their idea was born when they realized that, among the millions of apps existing, there was not one in the UK with the function to share surplus food between local communities.

Their innovative concept aims at connecting people through a platform, which works as a marketplace to share surplus food. The business is based on a strong sense of community, people and local retailers can share the food they have in excess. Whoever can sign up and share surplus food and/or request it. Olio key resource are the so-called Food Waste Heroes, volunteers that pick up the food from retailers and share it on the platform so that end-users can have access to it.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Local businesses and community.
13.000 Volunteers ambassadors.
1.500 food waste heroes (volunteers) that collect surplus food and share it on OLIO</td>
<td>KEY ACTIVITIES
Connect people and businesses through the app where surplus food is uploaded from users;
FWH collect surplus food and share it with the community</td>
<td rowspan="2">VALUE PROPOSITION

Connect people with each other and with stores to reduce food waste.
Makes people more aware through OLIO ambassadors</td>
<td>CUSTOMER RELATIONSHIP
OLIO built a strong community where customers and volunteers can share food, meet, connect to each other under the common interest of not wasting food</td>
<td rowspan="2">CUSTOMER SEGMENTS

Local shops/retailers, customers and neighbours</td>
</tr>
<tr>
<td>KEY RESOURCES

Online application
Community and volunteers</td>
<td>CHANNELS

Network of ambassadors to promote OLIO and aware customers
Website where to register
Social media</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

Cost of the app management</td>
<td colspan="2">REVENUE STREAMS

OLIO generates revenues by charging businesses for the service it provides via the FWHeroes to enable them to have zero edible food waste stores</td>
</tr>
</table>

Figure 5.13 Olio - Business Model Canvas

5.4 Within Cases Analysis

In this section of the chapter, each interview will be summarised and analysed separately.

The form of each interview is customized, in order to obtain detailed answers based on the single business model. A common structure of the interview has been drawn in order to assure to cover all the fundamental topics in each case.

In fact, the interviews must cover all the main aspects recognized by the 9 blocks of the business model canvas.

The starting questions aim at addressing the history of the firm, the reasons why it has been chosen to work in the agri-food industry and especially why it has been followed a model oriented towards the creation of value from waste.

In the further questions different topics are raised, concerning the blocks of the business canvas, such as customer segment and partners, key resources and activities, cost structure and revenue stream. The questions are developed based on the different aspects of the startups analysed, in order to understand why a business would choose one characteristic instead of the other.

Eventually, the interview aims at identifying the drivers and barriers that lead to the choice of this archetype, and therefore, a series of questions related also to the drivers and barriers discovered through the literature review analysis of chapter 2 have been made.

In the following paragraphs the data collected through the interviews will be described and analysed.

5.4.1 BigZpoon

The CEO Sanjeev Ukhalkar and the COO Cem Yldirim took part at the interview. BigZpoon aims at reducing food waste produced by food services by promoting surplus food at discounted prices through a platform that connects food businesses with final customers.

The two of them were looking for some big global problems in which they could have been able to use their technology experience and help in improving the current situation. They learnt about the food waste paradox while talking to a restaurant owner and discovered that restaurants are the biggest contributors to food waste. Here they found

their opportunity to create a win-win-win solution: for restaurant, customers and environment.

The driver that explains why the startup decided to prevent food waste produced by food service is explained by Cem Yldirim by his statement: "Restaurants are the largest contributors to food waste", this is caused by demand's unpredictability, which implies surplus food production, which represents a negative contribution to food services' margins. The main problem presented in this trend is the fact that there has not been any bridge of communication between demand and supply which could offer a proper solution to the issue.

The reason why BigZpoon decided to promote surplus food instead of donating it is due to the fact that both, the CEO and the COO wanted to create a sustainable business model. From their point of view, the only way to build a sustainable business model is through a win-win solution for both supply and demand, otherwise it cannot last. In this case the benefit is triple, since also the environment wins, through the reduction of food waste and all its implications. Moreover, sometimes it can happen that social and legal issues are constraining restaurants from donating surplus food.

Customer Segment

BigZpoon has two types of customers:

1. Final customers (B2C model), which are addressed by marketing actions; BigZpoon relies on digital marketing campaigns to reach end users and a loyalty program to transform consumers into marketers;
2. Food services (B2B model), which are addressed by sales effort; the communication means used are: phone calls, emails, representative visits to restaurants, referrals, targeted marketing campaigns.

   This segment is represented by restaurants, cafes, local shops, bakeries and small food businesses. All of these actors are represented by different types of models and offers.

The long-term purpose of the business is to be able to implement its model to every type of industry that sells a short shelf life product, e.g. flowers. In fact, the idea would be to expand the model to any type of industry that deals with perishable products.

BigZpoon focuses on this level of the supply chain since the startup believes that this is a very reactive segment and the market concentration is high, since not many competitors are operating in this area. Additionally, in this stage, no profitable solutions were developed to reduce food waste, in fact, it appears from the interview that there are some models that enhance donations, but they are not profitable for food service businesses.

For what concerns the other stages of the agri-food supply chain, the managers believe that opportunities are everywhere, and they are not excluding to expand the business also to upper levels of the supply chain in the future. Nevertheless, they find these other segments much more crowded than the food service one. In fact, this has been identified as the supply chain stage that is offering more opportunities to innovate and scale up.

The startup does not create any new demand or supply, it only enables to connect them through its services. The aim of BigZpoon is to build the bridge between demand and supply, which is the missing element in the chain.

Key Activities and Resources

As already explained, the main activity performed by the startup is to connect the two sides of the marketplace through a platform. Therefore, BigZpoon core asset is the platform itself.

The platform manages the capacity of the surplus food; the system knows the availability of dishes promoted and respects a FIFO (First In First Out) line for the orders.

The final customer is able, through the mobile application, to perform the payment transaction.

An aspect to be considered is why BigZpoon did not choose to supply other activities such as the service of delivering food from restaurants to costumers' houses. The first reason explained by the two managers is the fact that the startup aims at focusing on the core activity of the business, therefore the digital connection of the two parts of the chain. Moreover, the additional reason why a logistics activity would not improve the business is because of the type of user that the business wants to address. The end customers are people who want to save money, therefore, they would not want to spend extra money in logistics services. It is also true that, as the COO explains, customers nowadays are changing their habits, and they are more willing to spend money in delivery services.

Therefore, in the future, it is possible that this activity will be performed by the startup, both through the usage of restaurants' resources or by hiring drivers for delivering the food. The last opportunity would increase the social sustainability aspect, since, through the business it could be possible to create new jobs as well.

Costs and Revenues

The startup cost structure is defined by 4 areas:

1. Marketing, which helps to scale the B2C segment;
2. Sales, which helps to scale the B2B segment, and recruit more restaurants;
3. Engineering;
4. Operations, which support customers.

As said previously, the customer payment is done through the app and it works as follow: the customer pays the meal through the app, and the money are transferred directly to BigZpoon, which subtracts a certain fee from the money received calculated by an evaluation of taxes, service expenses, etc.; the remaining money is then sent to the restaurant.

The reasons why the startup decided to implement this revenue stream instead of other methodologies such as fixed subscription fees are the following:

1. For a new startup it is difficult to ask clients a fixed-paid-in-advanced fee; it is better to apply a variable cost to the businesses in order to assure them that they will be able to gain from this collaboration;
2. Moreover, this charging method is applied on the transaction, and is not explicitly shown to the restaurants, since they receive directly the net revenue; this allows the businesses to not perceive the cost of the marketplace, but only its benefits.

Drivers and Barriers

1. The first driver that appears relevant is the fact that the market nowadays is shifting its preference on access rather than ownership. BigZpoon is offering a service which aims at building the bridge to connect the actors of the marketplace, its purpose is to be a facilitator among them. Therefore, this type of business model requires to be free from any physical aspect. The physical-free element allows the business to make scalability easier.

2. Another important aspect concerns regulations. The question addressed to the startup aims at identifying if nowadays regulations are supporting businesses that act towards the creation of value from waste in the agri-food industry.

   The COO answer is the following: "Governments regulations made our business necessary. They do not allow restaurants to cook their food and sell it the next day, so the law contributes to the problem; of course, regulations are made for healthy and safety reasons, but in this way, they contribute to the problem". This aspect can represent of course an opportunity for BigZpoon. On the other hand, the COO affirms also that "regulations try to convince people and businesses to go greener by reducing food waste; so, we are dealing with regulation by both angles". As a consequence, regulations are acting on both sides but are recognized from BigZpoon CEO as a benefit for this business model.
3. Geographic dispersion can represent a barrier for this industry and this type of business. What are the consequences of this aspect in term of scalability?

   Scaling up for the managers means to scale into 2 different dimensions:

   1. Inside one restaurant: how to make the restaurant more profitable and increase BigZpoon role within the restaurant;
   2. From local to international: starting from one place and then scale the model into other regions and expand the territory where the startup can operate.

   Both the directions are likely to be pursued, according to them.

4. Another barrier that emerged through the literature analysis and wanted to be addressed during the interview is represented by customer habits and cultural heritage, which could limit the actions taken towards the reduction of food waste. In fact, final users could identify surplus food as not wanted food or leftover from other consumers, and, therefore, not appreciate this model or reject it. Therefore, it has been asked to the managers how could it be possible to act positively on this social aspect?

   Firstly, the CEO wants to state that "It is important to correctly communicate to the customer that it is not leftover food what we are selling but fresh food". Consequently, he continues saying that "Some barriers may exist in some part of the world, but the general trend worldwide is moving towards sustainability, so

even if there are such cultural barriers in buying the food that consumers see as surplus food and therefore it may be not good, such barriers will come down over a period of time because of these sustainability initiatives"; eventually it results from this statement that this barrier will come down in the long term since sustainability trend will increase.

5.4.2 JustNow

The interview was carried out with Alexandre Vellieux, founder and CEO of JustNow. The startup aims at reducing food waste through a platform which connects food businesses with final customers. The business started in 2017 and is currently operating in South Africa and Romania.

The reasons why the founder decided to implement this type of business model have origins from his education and background. He was raised by a French family who could not allow any type of waste, from electricity to food. This led him realize the impact of waste and the importance to avoid it.

During his life he married a woman from South Africa and they decided to move there, it was while he was walking in a supermarket when he realized the big amount of food waste produced by supermarkets due to the rapid expiration date of ready to serve and fresh food. From this moment he decided to act towards the reduction of waste within the agri-food industry. He studied other startups that deliver similar services in France, and he discovered Optimiam (French startup present in the database as service provider), which focuses its operations towards restaurants. He decided to implement a similar idea in South Africa but oriented towards retailers, since, in this country, the problem is more evident in this specific stage of the supply chain.

For the founder is important to recognize that: "This model was driven by both environmental and social aspects. Landfills produce lots of gas emission which is damaging the environment; at the same time, there is a social aspect because you want to bring a financial relieve to people who are struggling." There is also another aspect that affect the social condition. In fact, he continues with the statement that "nowadays, there are lots of fast-foods, and it can be cheaper to eat a burger than a good salad, this provoke a health issue; therefore, there is a social impact which lead to a healthy impact".

The main reasons why the business operates at the prevention stage, first ramification of the value proposition decision tree, is explained by the CEO with this statement "There are a lot of laws, especially in South Africa, which is less advanced than Europe for what concerns this topic, that do not allow to distribute food that passed its sale by date". Consequently, due to these regulations, charities must throw away this type of food. Therefore, the startup purpose is to build a win-win solution:

- It helps retailers to reduce food waste costs, increase sales and improve profitability;
- It offers discounts to customers in a country where poverty is widely present and inflation is very high.

Moreover, the CEO states that "this solution could help also charities and NGOs, in fact, at the end of the day, there are still lots of discounted products which are not sold through the platform, which could be donated to these organizations". Eventually, the startup is planning in the long term to create partnerships with these organizations and donate them the surplus food which has not been sold through the platform.

Customer Segment

The business has two types of customers:

1. Final customers, who can buy the discounted food present in the app by presenting a barcode, which represents the promotion, to the cashier of the store;
2. Supermarkets, retailers, food shops, bakeries and cafes. These businesses can upload in the app discounted food which would otherwise become waste.

The most difficult part concerning the creation of a network is recognized by the founder with the customer acquisition process. In fact, he affirms that: "at the beginning, when you want to approach a new retailer you need to show then you have a valid customer base, which is not possible to have without a network of food businesses and viceversa". The most time and cost consuming activity in the creation of the network is reaching final customers. The engagement of new end users is performed mainly by "on-site" marketing, through promoters that walk in the shops, posters and flayers. This type of marketing is combined in parallel with social media advertisement, which targets the geographical area taken under consideration by the startup.

Since there are already lots of retailers that apply promotions in order to sell surplus food, it has been necessary to identify what are the advantages for a shop to be part of the platform. The reasons result very clear to the CEO, the main problem of a retailer is its visibility, which is very low, since it is limited to the single customer that walks in at the right time. The platform can offer to the food businesses to increase their customer range by reaching new customers. Moreover, the application is able to propose customised offers to the single user, according to his/her preference and location.

The reason explained by the founder of why the business is not addressing food services such as restaurants or hotels' canteens is driven by the fact that these systems would need a different set up for the application. The set up required to include also these businesses in the platform need more funds, which are not present at the moment, due to the fact that the startup is self-funded, but, as the CEO highlights, the business would definitely move towards these food services as soon as possible.

Moreover, the startup started by addressing this stage of the supply chain instead of others, such as farmers, manufacturers, etc. simply for the fact that the founder knew a retailer who helped him in developing his concept. Therefore, the startup is not willing to limit its services to specific segments but, its long-term purpose is to address also upper stages of the supply chain.

Eventually, the CEO states that "In order to build a marketplace like this is very tough and time consuming". After 18 months the startup is still struggling in South Africa, due to the fact that, for historical reasons, their culture does not present any value concerning environmental protection and waste reduction. On the other hand, in Europe this movement is faster to develop. What is very important for the founder is "To change people mind-set, which always takes a lot of time".

Key Activities and Resources

JustNow supplies a marketplace service through its mobile application, no other activities such as logistics services or stockage of the food is performed by the startup.

The reason why the business is not able to support logistics services such as the delivery of the food to the clients' house is originated by costs problems. The startup is self-funded and would need more investments to implement these services. Nevertheless, in the long-term they are planning to supply also these activities.

Secondly, the interview is oriented towards the fact that as service provider the startup does not supply any physical channel and does not own any stock itself but operates only as a virtual marketplace through its platform. The founder highlights that a hub-model is "Very capital demanding, because you need to bear the stock and with it you have a lot of risks, so at the beginning it is very risky and difficult to start with that, except if you have lots of funds". Therefore, at the beginning of the startup's life it is easier and safer to start with a hub-less model. Nevertheless, he would be very interested in the future to implement a physical channel for the business.

For what concerns flexibility and scalability, both models can have advantages and disadvantages. The CEO affirms that:

- "A hub-less-model is more flexible and scalable than a physical model. The current model in fact, is compatible with any retailer system". At the beginning is designed the infrastructure which can be combined with any retailer system currently existing. For this reason, scalability is more efficient.
- "A hub-model brings more flexibility because you own your stock and you can do what you want with it; but, in other ways, managing food stock comes with regulations and also health and safety issue that can represent a constraint". Nevertheless, the founder affirms that this model is less scalable than the other.

Costs and Revenues

The startup incurs in two main cost items:

1. The development of the app; the application has two different interfaces, one for end users and one for retailers;
2. The customer acquisition costs.

For what concerns revenues, the startup charges the businesses. The charges can be applied by different methods. It can be asked to subscribe a fixed fee or to apply a fee on each product sold by the retailer. The method is negotiated between JustNow and the retailer and it can be chosen by the business.

Currently the payment transactions happen in the store and not through the app.

Drivers and Barriers

1. The first driver that appears relevant and represent the first factor of decision on the trees, is the fact that the market nowadays is shifting its preference on access rather than ownership. Therefore, is this the reason why JustNow chose the concept of a platform rather than a physical retailer, and, establish a service provider model?

   The CEO affirms that the main reason why the startup is based on a platform is caused by lack of funding and big initial capital to invest in physical channels. Nevertheless, the current model can result more flexible and moreover is definitely more scalable, as explained above.
2. Another important aspect concerns regulations. The question addressed to the startup aims at identifying if nowadays regulations are supporting businesses that act towards the creation of value from waste in the agri-food industry.

   The founder recognizes that in Europe regulations are in favour of these type of businesses. On the other side, in South Africa these more advanced regulations are not present yet, therefore, it is more difficult to apply these models. In this country, businesses are not incentivised towards a change in this field. The way to apply an incremental change is to renovate the laws that regulate these operations.

   Moreover, the limitations implicitly caused by the type of products they are dealing with are of course constraining new possible implementations, but these are set by healthy and safety reasons and must be respected.
3. Geographic dispersion can represent a barrier for this industry and this type of business.

   The main issue that interfere with the startup geographical expansion is the acquisition of new customers, which implies high costs and resources. It is necessary for the business to grow in a sustainable way. It is not possible to expand its operations too fast, but is important to accurately estimate costs and revenues and enlarge the business in a long period framework.
4. Another barrier that raised during this research is represented by customer habits and cultural heritage, which could limit the actions taken towards the reduction of food waste. How is it possible to act on this social aspect?

   JustNow does not suffer this barrier since, in order to overcome this possible obstacle, the startup aims at showing immediately to customers what they would gain through

its service. Therefore, the main focus must be on making immediately visible to the end users the benefits they would obtain through the new model.

5.4.3 Replate

The interview has been performed by videocall to Katie Marchini, directors of operations, and Jonah Price, operations and software associate.

Replate aims at creating a marketplace through a platform and delivering surplus food produced by canteens' companies and catering services to local charities and people in need.

The firm was born from an idea of its founder, immigrated from Syria to California, who was shocked by the coexistence of hanger and food waste.

Among all the possible options of recovering food waste, it has been chosen to donate it to people in need. The reason why the business chose donation as the mean of recovering surplus food is driven by the fact that the type of food they are saving is already prepared, and, therefore, it cannot be legally resold through conventional markets. Eventually, donation is the only way to recover this type of food. Moreover, donation is the best way to reach the people that cannot afford food themselves and must rely on these types of businesses and organizations.

Customer Segment

Replate customers are both local charities and food businesses such as canteens and catering services. Any food insecure non-profit organization con apply and require food. The organizations can express preferences on what they can accept (such as sizes of packages and minimum number of trays).

For what concerns the other side of the marketplace, the platform main actors are canteens and catering services. Restaurants are not participating since they have smaller margins and, with the current model they cannot afford Replate's services. This is the explanation for the decision tree corresponding to the customer segment element. Nevertheless, the startup is working for allowing also this segment to enter the marketplace in a long-term perspective and permit scalability also in this sector.

Eventually, looking at the upper levels of the agri-food supply chain, Replate already operates occasionally with some of these actors, for example, when food brands have an

excess of products, due to changes in the product line, ingredients, etc. they can donate their surplus food through Replate's platform.

The two interviewed recognize that there are multiple benefits for a food business to operate with this startup:

- For a business is cheaper to donate its surplus food through this structure instead of paying for food waste disposal;
- All businesses have a tax reduction due to the donations performed;
- Benefits for good PR (publicity);
- Assure sustainable government requirements;
- Employees satisfaction; in fact, they are more satisfied if they know that food is not thrown away.

It is important to notice that, in this sector, demand is always present, then, it is always possible to find a destination for the surplus food. For this reason, the marketplace is always working with no risks of losing opportunities.

Key Activities and Resources

The main activities provided by Replate are:

- Connecting the different actors of the marketplace through the online platform
- Retrieving and delivering surplus food

The logistics services are performed by direct employees. The advantages of being vertically integrated and not requiring the services of third parties are the following, according their point of view:

- It is required less management effort, in fact, when a third-party provider is necessary, it is more difficult to explain the process and the activities to perform, instead, with its own employees, Replate can rely on continuous learning of its employees;
- Own drivers are more committed, they can assure a certain level of experience and they are able to build a strong connection with donors and receivers. They know the business and they are trained to be able to react correctly to unexpected events, factor which cannot be promised by another provider;

- Own employees permit more logistics flexibility, they are able to adapt the flow of materials when food is rejected or deviated to another destination; this is possible thanks to their own experience.

Replate requires a minimum volume of food in order to be able to pick it up, due to efficiency and scale up reasons. Moreover, the donation of small volumes of food would not be feasible neither for the donors.

Additionally, it has been important to address why Replate decided to rely on employees and not on volunteers to perform the logistics activities. Firstly, volunteers can result unreliable, but since Replate operates "on demand" this characteristic cannot be accepted. Secondly, the startup wants to create jobs and to have a social impact as well, creating additional sustainable value.

Eventually, it is necessary to specify that the cars used by the drivers are owned by the drivers themselves, and only in particular cases, when the volume of food is too large, they rent extra vans.

The last aspect to evaluate, is why Replate does not own the stock of surplus food but operates only as a marketplace. They think that "It is easier and safer to do not own the stock, and more important, this solution results more scalable". Moreover, the main challenge is not the creation of a business that stores the food, since this is already widely implemented, but to connect and share the food to reduce food waste.

Costs and Revenues

Replate is facing logistics costs, as already mentioned, the drivers that perform the pick-ups and the deliveries are employees of the startup and therefore a cost for it. Drivers can perform up to 2 pick-ups per hour, the fee paid by the donators for one delivery is enough to pay one working day of a driver. Moreover, the assets to perform the logistic activities are owned by the drivers, therefore they are not directly affecting Replate's cost structure.

The management of the application is the other main part of Replate's cost structure.

Fees for the subscription are allocated to food businesses and not charities, since, companies have money, and do not suffer for paying the service. Moreover, charities would not have any reasons to pay for leftovers, if they had to pay for it, they would rather buy new fresh food.

An additional source of revenue comes from private donations and government grants, but at the moment this stream is not giving significant results.

Drivers and Barriers

1. The first driver that appears relevant is the fact that the market nowadays is shifting its preference on access rather than ownership. Therefore, is this the reason why Replate chose the concept of a platform rather than a physical retailer? Replate's answer to this question is expressed by a list of advantages given by this type of model:
   - It is a more feasible business model. In fact, there is not much value in owning this type of product, storing food causes more complications and reliability problems;
   - Shelters and food banks are already widely spread, what is missing is the role of the platform, which can fill the gap in the chain;
   - With this type of service scalability is easier, the main problems concern outsourcing capacity;
   - Capacity is more flexible with this concept, with a hub model capacity can result as a constraint;

   Eventually, the COO affirms that: "the concept of a platform allows us to stay more focused on the core activities of the business and enhance our scalability".

2. Another important aspect concerns regulations. The question addressed to the startup aims at identifying if nowadays regulations are supporting businesses that act towards the creation of value from waste in the agri-food industry. Replate is dealing with one federal acting and other several local regulations. These regulations do not allow the reselling of food already served but not eaten. Donations, on the other hand, are submitted to less strict regulations.

   The limitations established by these institutions place "speed" as their main priority, Katie Marchini says that: "the main thing is getting food to recipients in a timely manner, and also to make sure that once it is at the donors it doesn't sit out for more than four hours".

The aspect that could improve time efficiency is traceability, at the moment Replate is trying to institute a barcode system, in order for the drivers to scan the food and have everything tracked.

3. Geographic dispersion can represent a barrier for this industry and this type of business. Replate aims at reducing this constraint by relying on third party providers. The startup main markets are San Francisco and New York. Moreover, they provide occasional pickup and delivery services in other cities across USA by operating through third party providers.
4. Another barrier that raised during this research is represented by customer habits and cultural heritage, which could limit the actions taken towards the reduction of food waste. How is it possible to act on this social aspect?

   Replate recognizes this factor as a problem which is trying to solve with a long-term mission. Katie Marchini affirms that they are "trying to have an impact on this by providing actual impact numbers to each donor that show how much food we saved from them, how much carbon has been saved and how much water has been saved". Eventually, their purpose is to generate strong awareness among users.

   One of the main difficulties is to break down the communication gap existing between caterer and customer, in fact, the former is not able to predict quantities accurately and his main objective is to satisfy the demand, the latter wants enough food to fulfil the entire request.

   Eventually, another issue created from the concept of the business itself is the fact that since Replate exists, food businesses do not have to worry about surplus food because the startup can solve their problem. This is not incentivising at all food businesses in reducing the amount of surplus food produced.

5.4.4 Olio

The interview has been done directly to Tessa Cook, co-founder of Olio. She was raised and lived in a farm in the countryside where she understood the effort and labour needed to grow crop and livestock. During her life she realized how much food waste was produced every day, and she could not cope with it. As a result, she created her business, where through a platform it is possible to connect people to share surplus food with other people living in the same community.

The food is shared for free and customer are not allowed to sell it in the platform. The reason why this choice has been made is due to the demand willingness to pay. At the beginning of the startup life, it was allowed to sell the food with at least a 50% discount, but the good offered was overpriced and consequently not sold, with the result of producing surplus food instead of eliminating it. This is the main reason why in the value proposition tree Olio is placed on the ramification directed toward the reuse and not prevention model.

Further on, the business increased its products portfolio, and allowed consumers to exchange also non-food products through the platform.

Customer Segment

Olio has 3 types of customers:

- End-users, who request or share food in the platform
- Volunteers, the so-called Food Waste Heroes, who collect food from retailers and redistribute it through the platform and app; and the Ambassadors, who spread the world
- Retailers, who share surplus food

At the beginning of its life, Olio involved only users and ambassadors, and did not have the B2B element, therefore, neither retailers nor Food Waste Heroes. The Food Waste Heroes program and the B2B actors have been introduced to be able to supply the demand, which was too high to be managed only by private home donations. In fact, the only way to increase volumes and have high quality products was to introduce retailers in the marketplace.

For what concern charities, they can have access to the application and request food, but their role is the same as a private end-user, and they do not have any special treatment.

Moreover, Olio affirms that demand is always present and way higher than the offer, and even when they enter a new market they can easily reach final users through the network of local ambassadors. In order to meet demand requests, retailers were introduced in the network, because they produce waste almost every day with much higher volumes than private citizens and can guarantee high quality. Eventually, this is the reason why the founders decided to introduce the B2C element in their business customer base.

Key Activities and Resources

Olio is able to connect the community through its services. Moreover, it supplies the pick-up of food from retailers through the network of Food Waste Heroes. The volunteers walk to the retailers, pick up the food, take it to their own home, add the good to the app just like a regular user and wait for the orders. The end-customers can require the food uploaded and pick it up at the volunteer's house. On the other hand, if an end-user wants to share his/her home surplus food he/she can post it in the app and, on the same way, another user can request it and pick it up at the donator's house.

The advantages recognized by the startup to be a community-oriented business are the following:

1. The community angle is what makes using the app so enjoyable for the end-user, they enjoy meeting the neighbours and feeling connected to the local community. Moreover, it makes them feel safer and keener to share food within their own community;
2. Secondly, nobody knows a local community better than someone who lives in it. This is why the ambassadors model is very effective.

The overall network is built by reaching firstly the ambassadors and through their help Olio is able to spread the word and build the community network.

Olio is able to overcome the obstacle of volunteers' reliability since:

- The startup requires the volunteers a limited effort of 1 or 2 hours per week;
- Volunteers are hyper local; therefore, they are very close to the retailers, this characteristic makes the model very convenient;
- It exists a back-up mechanism where, if the volunteer is unable to pick up the food, he/she can access to a WhatsApp group with other local volunteers and can ask them to pick up his/her lot; this structure assures high flexibility and, eventually, no supply opportunities are lost.

Through this explanation it is possible to evaluate the choice of the key resources of the business and its consequence cost structure.

Food collected by Food Waste Heroes is stored at their place for a very short period of time, on average the food is redistributed between 1 or 2 hours after being collected from the shop. Any storage is done in full compliance with the food safety management system.

Costs and Revenues

The only cost of the service provider is the management of the application. All the additional activities, such as marketing and logistics are managed through volunteers, which, by definition, do not represent a cost.

Olio charges food businesses because retailers at the moment would have already to pay for that food to be taken off to landfill, therefore, it would still be convenient for them to redistribute it instead of disposing it. Moreover, stores employees are angry at throwing food away, and they know that food waste is not acceptable. Additionally, food businesses are the actors who use more frequently and with higher volumes the services supplied by Olio, therefore, charging them is more efficient than charging the demand, which instead is split among many different people.

Drivers and Barriers

1. The first driver that appears relevant is the fact that the market nowadays is shifting its preference on access rather than ownership. Therefore, is this the reason why Olio chose the concept of a platform rather than a physical retailer? Olio co-founder thinks that "retailers and food channels take liability over the food itself, which increase risk and complexity", moreover, this model is far harder to scale, which is the implicit objective of every startup.
2. Another important aspect concerns regulations. The question addressed to the startup aims at identifying if nowadays regulations are supporting businesses that act towards the creation of value from waste in the agri-food industry.
   The co-founder is not considering regulations as a barrier to the implementation of this business mode. However, she thinks that there is still place for regulations to help and support this kind of business.
3. Geographic dispersion can represent a barrier for this industry and this type of business. Olio is very focused on the UK territory, and specifically in the London area. The team is very focus, the objective is to expand and scale up, but the co-founder recognizes that is not possible to grow all at once.

4. Another barrier that raised during this research is represented by customer habits and cultural heritage, which could limit the actions taken towards the reduction of food waste. How is it possible to act on this social aspect? The co-founder recognizes this as a big barrier, but she also affirms that it is possible to overcome it by starting where change is easier to take place, and then go down towards all directions. The co-founder affirms that "It is important to start from earlier adopters, then retailers, manufacturers, smaller businesses and eventually to the main stream. This job does not concern only Olio or other startups but is a work that must be done by the media, the government and multiple other parties".

5.5 Cross cases analysis

In this section the analysis is focused on cross-case studies. The results of the interviews presented in the previous paragraphs will be studied through a comparison approach. The correlations will be performed firstly within both stages of the food waste hierarchy, and, secondly, between the two levels of the hierarchy.

5.5.1 Cross-analysis within the prevention stage

The study performed in this first part is between the two startups that operate at the prevention level: BigZpoon and JustNow.

The first main difference that the two startups face is their locations, which consequently causes differences in culture, lifestyle, regulations, etc. BigZpoon is based in California, while JustNow operates in South Africa and Romania.

The founders of the two businesses based their idea on the concept of a win-win-win solution; in fact, they wanted to create a model which could benefit customers, food businesses and environment. The interests of the 3 parts are explicit and well defined: customers would save money due to the products' lower prices, restaurants and retailers would increase their profit due to an increase of sales and decrease disposal costs, eventually the environment would gain from the reduction of food waste, which implies a reduction of greenhouse gas emission.

Customer Segment

One of the differences between the two businesses is the customer segment on the supply side of the marketplace to which the platform is offered. In fact, JustNow delivers the

service mainly to retailers (supermarkets, small shops, bakeries), while BigZpoon major customers are restaurants, bakeries and cafes. The explanations for this disparity are the following:

- BigZpoon founder affirms that the decision to approach food services is based on the fact that they are the biggest contributors to food waste in the supply chain and, moreover, he states that no many actors are interested in this segment and consequently is less crowded than the others, therefore, it offers more opportunities to implement new businesses. Nevertheless, as the analysis reported in 4 "Database analysis" show, the food services stage of the agri-food supply chain results to be the stage in which the implementation of a sustainable business model is more difficult to achieve. Moreover, the startup aims at reaching all those sectors where products have a limited shelf life, this explains the reason why the firm addressed food services in the agri-food supply chain.
- On the other hand, the founder of JustNow states that, in South Africa, where the business was born, the food waste issue is more evident and represented at the retailers' level.

The statement that must be highlighted for what concerns the customer base of the two platforms is that both startups are willing to increase the range of their users, going towards different stages of the supply chain, where interesting opportunities could emerge. Since both firms are at the beginning of their life it has been natural for them to start operating with one player of the chain, in order to be able to enlarge the network in the future.

Eventually, the creation of the network for the two startups follows a different path. BigZpoon affirms that they are not creating anything new, the marketplace is already existing, what they are creating is the missing bridge which can fill the communication gap present between the two actors of the arena. The founder of JustNow recognizes instead that one of the most difficult activity is to acquire new customers, which necessitates high amounts of time and money.

Key Activities and Resources

For what concerns the activities performed by the two startups they are very similar. In fact, their core activity as service providers is to supply the platform through an

application which enables to connect end users and food businesses. The added value offered by BigZpoon's app is the ability to manage the payments transactions, which is not performed by JustNow yet. On the other side, JustNow leverages its services on the possibilities to offer customized notifications to the single client.

The two startups do not offer any logistics activity, such as the delivery of the food to the user's house, but they are both planning for the future to provide this optional, since they believe it could be a value-added service.

The main contrast for what concerns activities and resources is identified by the concept of the service provider's hub-less model.

In fact, BigZpoon believes that the business model in order to be scalable and efficient must stay far away from any physical characteristic. The startup is based on its invisibility, and does not have to integrate any physical part, neither own any stock. Its main objective is to create a bridge of communication between the parts, which is possible through its physical-free model.

JustNow does not discriminate the possibility to own physical channels, indeed, it affirms that in the future this system could be implemented in the business.

Nevertheless, both startups state that the current hub-less model is definitely more scalable than one with physical characteristics.

Costs and Revenues

Since the activities performed are similar the cost structure is almost the same for both businesses, and it is represented by engineering and app development costs and marketing and sales costs.

For what concerns revenues, the two startups apply a commission fee charged on the food business side on each sale made thanks to the app. It is important to highlight the higher flexibility that is supplied by JustNow. In fact, the startup is able to offer more types of payments to the food businesses. Retailers are able to choose to be charged through a commission applied on each product sold or to subscribe a fixed fee valid for a certain period of time. The latter method is not supplied by BigZpoon since the startup affirms that a small new firm encounters many difficulties in convincing a business to subscribe in advance to a fixed fee without showing immediate benefits.

Drivers and Barriers

For what concerns regulations, Bigzpoon recognizes that laws are both against and in favor of these business models. Regulations do not allow the resell of food already cooked and therefore they contribute to the problem, but this is due to safety and healthy reasons. Concurrently regulations enhance businesses to reduce food waste in order to be greener and more environmental friendly. Eventually, laws are in favor of BigZpoon operations.

JustNow as well believes that European laws are more in favor of these kind of businesses, unfortunately, in South Africa regulations are less developed and is more difficult to encourage firms towards this direction.

Both startups act on the same way for what concerns geographical expansion. Scaling up towards new market is necessary, but it must be done carefully throughout time and the growth must be sustainable in terms of costs. Therefore, it is important to start from one region and try during time to expand towards new markets.

The analysis on customer habits shows that both firms do not consider this barrier as a strong limitation; BigZpoon recognizes the barrier but believes that it will eventually break down itself since sustainable trends are increasing worldwide. JustNow states that it is easy to overcome this constraint since it is sufficient to show the immediate benefit that the customer can gain from this type of businesses.

5.5.2 Cross-analysis within the reuse stage

The analysis aims at evaluating the characteristics of the firms operating at the reuse level of the hierarchy.

The two startups under investigation are Replate, from California, and Olio, from United Kingdom. The reasons why the founders decided to implement a business based on the donation of surplus food are different. Since Replate is operating with cooked meals mostly prepared for catering services, due to regulations this type of food cannot be resold in other markets. Therefore, the startup decided that donation would have been the best option to recover surplus food. On the other hand, Olio decided to offer the food for free through the app only on after the start of the business. In fact, the first concept of the service provider was to supply a platform were the food was sold. Nevertheless, the food uploaded on the app was overpriced and consequently unsold.

Eventually, it does not have to be forgotten that donations have a direct positive impact on food businesses image and employees' satisfaction.

Customer Segment

The customer base of the two firms is quite different. Olio offers the service to end users and retailers, while Replate is focused on canteens and catering services and any charity organization. The main difference is the fact that Olio operates with retailers and food services while Replate is struggling to enter in the restaurants market. In fact, Replate would be interested in the future to enter this market, but at the moment this would not be economically sustainable.

An important factor for both of them is the demand of the network, which is always present; for this reason, Olio decided to enlarge its customer base toward the retailers.

Key Activities and Resources

The activities performed by the two startups are similar. They both provide the platform where the players of the marketplace can have access and upload their surplus food or request it.

Moreover, Replate supplies the logistics activities: it retrieves and delivers the food from the businesses to the nonprofit organizations through its own drivers, who are direct employees.

Olio delivers logistics activities as well but through different means. In fact, the service is provided to retrieve the surplus food produced by retailers. The activity is performed by the so-called Food Waste Heroes, volunteers that pick up the food from retailers, bring it to their own house and upload it on the platform such as any end user. The delivery activity is not performed, in fact, the user that requests some food has to go him/her self to the house where the surplus is and pick it up.

Therefore, the main difference is not on the activity supplied but on the resources used by the two startups. The main reason why Replate does not depend on volunteers is based on their unreliability issue, in fact, since the startup offers an "on demand" service, it could be difficult to be able to manage volunteers. Moreover, Replate aims at acting on a social level as well, and, through its services the startup is able to create new jobs for the community.

On the other hand, Olio strongly believes in the sense of community and bases its business model on it. Volunteers are the core resource of the startup, and since they come from the same community where they serve, there are no other people that can accomplish their role better than themselves. Olio overcomes the unreliability problems through the creation of a very large well-connected network of volunteers, to which it is asked a very limited number of hours to dedicate to their activities.

It is important to highlight that for both the firms the important feature of their model must be the commitment and quality service of the volunteers and drivers. Their role is fundamental to build a strong relationship with the community and people in need, and, for both of them, this element cannot be guaranteed by a third-party provider.

Costs and Revenues

Both startups have to support the development and management of the platform and application. Moreover, since the drivers of Replate are employees, the startup incurs also in this cost.

The revenue stream is covered for both startups by charging the businesses side, therefore caterers and retailers. The reasons why this side of the marketplace is charged is because the food businesses would still be charged if they had to dispose food, therefore, if also their sustainable requirements are taken into consideration they would prefer to donate the food instead of disposing it.

Drivers and Barriers

For both the businesses owning the food and stock it is only a more complex and riskier solution, which could lead to complications and reliability problems. In fact, a hub-less model like theirs is way more scalable and efficient than a hub model. They must remain focus on their core activity, which is to fill the gap on the communication between the actors of the marketplace.

Both startups recognize regulations as a possible barrier for the development of these businesses, the main constraint is represented by the type of food the startups are dealing with and they affirm that laws could increase the range of operations.

Geographic expansion is always necessary and what the firms are looking for. It is important to startup from one place and then grow, it is not possible to expand the business all at once.

For what concerns customer habits towards food waste both startups recognize it as a barrier which must be broken through a long-term process which must have a strong impact on customers.

5.5.3 Cross-analysis between prevention and reuse stages

This paragraph aims at evaluating the different drivers that lead a service provider to implement a sustainable business model and the differences on the structures applied between the two stages of the hierarchy.

The four startups analyzed come from different regions of the world and, indeed, with different backgrounds, nevertheless, the businesses have some common patterns from which it is possible to identify important decisional milestones and drivers of choice.

The main purpose of the four businesses is to reduce food waste through the creation of new value from it, which is enabled by different types of activities. The initial driver that led all the founders to be oriented toward this type of sustainability is the problem of the food waste paradox, already explained in the previous chapters.

The driver that mainly influenced all the startups to develop a concept within the service providers stage of the agri-food supply chain is explained in every interview. The element which was really missing in order to reach their objective was not an "hardware component" but, instead, the lack in the system was present at the "software level", which needed to fill the existing communication gap between different actors of the chain. In fact, the main activity performed by any service provider is to connect the different players of a marketplace in order to allow to share information and food more efficiently.

Now that the higher level of the value proposition is clearly identified, it is necessary to illustrate the different drivers that can enhance the creation of a model oriented towards surplus food prevention or reuse.

The two startups that implemented a prevention structure are driven by the purpose of creating a win-win-win solution, for customers, food businesses and environment, this solution is able to guarantee a sustainable profitable model. The two firms also affirm that

there are some legal and social implications that can constraint the donation model of surplus food. For these two reasons they decided to act at the prevention level.

On the other hand, the other two startups that are implementing a model based on the reuse of surplus food affirm that this structure is driven by the type of food they donate, which is prepared and ready to eat, and cannot be resold easily due to regulations constraints.

Customer Segment

For what concerns the customer base of the four startups it is similar for all of them. In fact, since they are connecting different players of a marketplace the actors present are the following:

- All startups aim at offering the surplus food to end users, such as primary market final customers for the prevention stage; charities, people in need and local communities for the reuse level;
- On the other side of the marketplace the main players are all performing on the lower levels of the agri-food supply chain; the actors here are mainly retailers, small local shops and food services.

The common feature is the willingness of every startup to increase its customer base during time where new opportunities will be presented.

A similar customer segment pattern can be highlighted between the two different levels of the hierarchy. The prevention stage is more oriented towards food businesses such as retailers or restaurants. Retailers have fresh food but with a longer expiration date than prepared meals; restaurants have fresh food, but it is managed when it is not cooked yet. Therefore, the startups are not dealing with leftovers of food but with fresh surplus food which can be still resold to the primary market.

The reuse level is dealing with food which has been already cooked and served such as food coming from canteens and catering services, or food which is donated by the community itself, such as private citizens, therefore, this food cannot be resold, but it is donated instead.

Key Activities and Resources

As already stated, the key activities of the four startups is to create a connection through an online platform and mobile application between the players of the marketplaces. Therefore, the core activity performed is the development and management of the platform.

The main difference between prevention and reuse is the logistics activities management. The trends show that at the prevention stage the startups are less keen to supply these services, in fact, the startups analyzed do not offer any logistics performance, they do not pick up or deliver food from food businesses to end users and neither store food in any physical channel. Nevertheless, both firms stated that they are planning for the future to implement a delivery service from the food businesses to the final consumer's house, since they recognize the activity as a possible value-added to their business.

On the other hand, the startups at the reuse level are offering logistics services that collect the surplus food from the food businesses through their own volunteers or employees. The important aspect for both of them is to use their own personnel to perform this activity, since they believe that a third-party provider would not be able to deliver the same experience and efficiency as their own people. Therefore, at the reuse level the people who retrieve and deliver the food are a fundamental resource for the development of the business.

Costs and Revenues

For all the startups the management and development cost of the platform is the direct consequence of their core activity.

Moreover, since the reuse stage offers some logistics activities, the costs items relative to these performances is added to their cost structure.

Eventually all the startups incur in other operations and marketing costs, which enable to manage the customer base and enlarge it.

For what concerns the revenue stream all four service providers are implementing a model which charges the food business side instead of the end user side. This specific player is charged due to the fact that the surplus food produced would otherwise go into waste if it could not be reused, the disposal of the waste would still be a cost for the businesses, therefore, it is more convenient for them to donate or resell it than to dispose it. The

startups charge the businesses through two main methodologies, the players are able to pay a fixed subscription or pay a fee on each transaction made. There are no trends that emerge between the two levels of the hierarchy, in fact, these methods are applied at the prevention as well as at the reuse level.

Drivers and Barriers

The main reasons why all the startups have not implemented a hub model is explained by some statements given throughout the interviews.

Firstly, a hub-less model is more flexible since it can adapt to any situation and system. Secondly, the presence of physical channels would increase complexity and risks and would not allow the startups to focus on their core activity. Moreover, as already said, their purpose is to fill a communication gap, which has to be done through software services and not physical elements.

Eventually, the main driver that explains this type of business structure is the scalability characteristic given by the absence of a physical part. The models built by the service providers are highly scalable and easier to expand.

For what concerns regulations as a possible barrier or driver to these businesses the startups do not have the same opinion about this topic, but similar patterns can be highlighted. It is important to understand that regulations depend on the country the startup is operating in, and, therefore, it is not possible to evaluate two trends for the two levels of the hierarchy. In any case, the startups recognize that the current regulations can simultaneously incentivize the reduction of food waste through the laws oriented toward the reduction of waste, greenhouse emission, etc. On the other side, they can constraint the businesses due to health and safety reasons, based on the type of perishable products the firms are dealing with.

In conclusion, all the firms believe that there still are possibilities for new laws to incentivize more these sustainability models and act more proactively on the food waste issue.

The last topic addressed by the interviews is the barrier represented by customers habits and cultural heritage. On the reuse level the startups recognize that this factor is a big limitation for their business models, indeed, it is necessary to structure a long-term

mission in order to be able to act on the different levels of the problem and break down this barrier.

On the prevention level the barrier is recognized but it is not considered as a big issue since the food taken into consideration by these businesses is not leftovers of ready meals, but only fresh food which is not sold yet. In any case the barrier is overcome by the enhancement of the benefits given to the end users by these businesses. Moreover, they state that this barrier will break down by itself due to new social trends that incentivize sustainability.

Eventually, these are the main drivers and barriers that can be recognized in the implementation of this sustainable business model.

5.5.4 Conclusions

In the previous paragraphs a deep analysis on the case studies has been performed in order to highlight and rise important aspects concerning the T2 Bocken archetype. It is now important to summarize the results obtained by the research conducted, in order to be able to formulate a clear answer to the second research question of this dissertation.

Therefore, the research question and its correlated answer will be reported here.

RQ2: What are the characteristics of the business model "Create value from waste" implemented by startups operating within the agri-food industry?

- **RQ2a**: What are the drivers and barriers that may affect the startup implementation of a "Create value from waste" business model within the agri-food industry?
- **RQ2b**: What are the different nuances assumed by the implementation of the business model "Create value from waste" in the agri-food industry?
- **RQ2c**: What are the drivers and barriers that may affect the implementation of the different nuances of the "Create value from waste" business model?

In order to answer to these questions, it is possible to illustrate the results obtained by the studies through the construction of new decision trees, based on the answers given by the startups under analysis. Therefore, in the trees, it is possible to observe the characteristics

of the different business models and as well the drivers that lead a startup to choose one element instead of another.

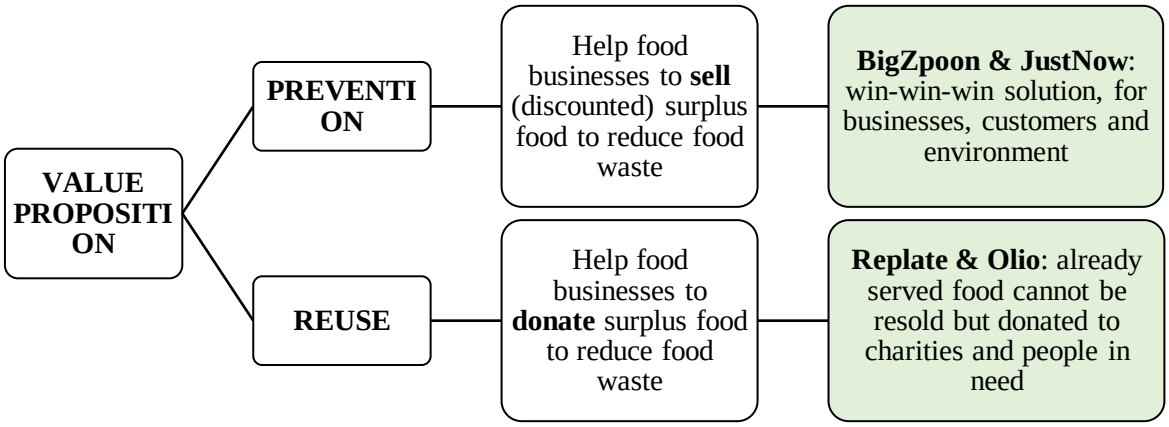


Figure 5.14 Value Proposition: Decision tree and drivers

As stated previously, the main drivers that lead towards a different stage of the food waste hierarchy are the constraints resulting from the regulations acting in the specific country the startup operates in and the type of food waste the startup is dealing with.

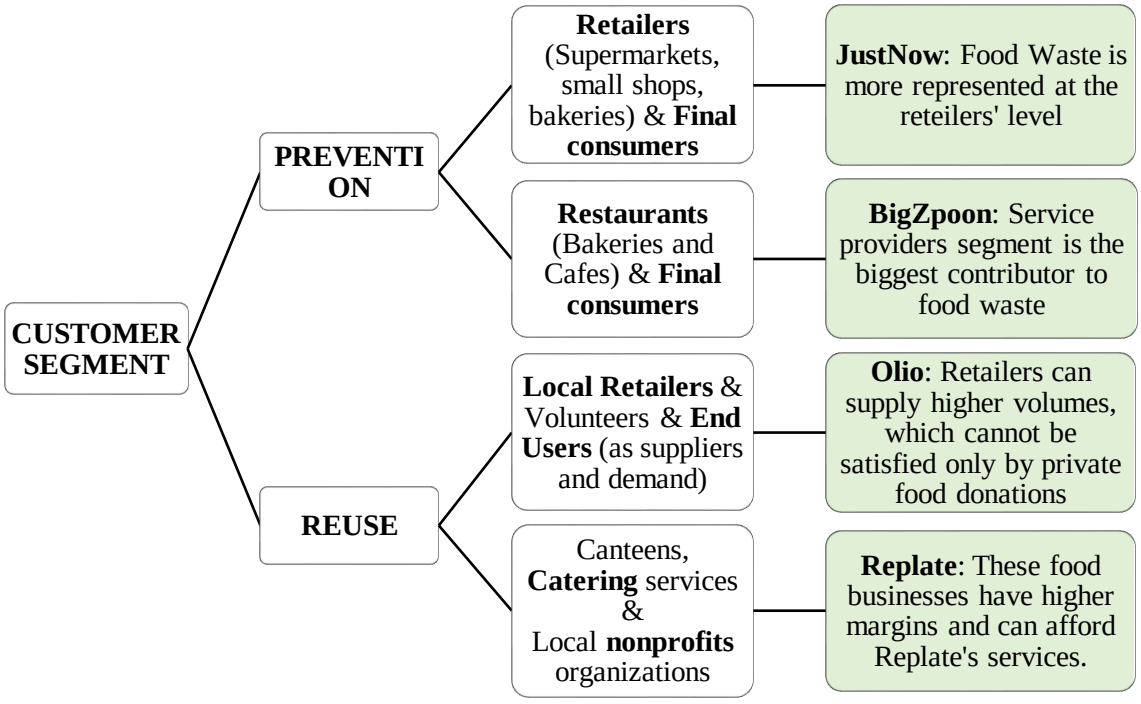


Figure 5.15 Customer Segment: Decision tree and drivers

For what concerns customers, the food business side actor changes for each startup. Nevertheless, the reason why a startup operates with one customer or the other is mainly due to the fact that the business has to start from few costumers, but the most important aspect is that all the startups are willing to expand their customer base in the future within different stages of the supply chain and to different geographical areas.

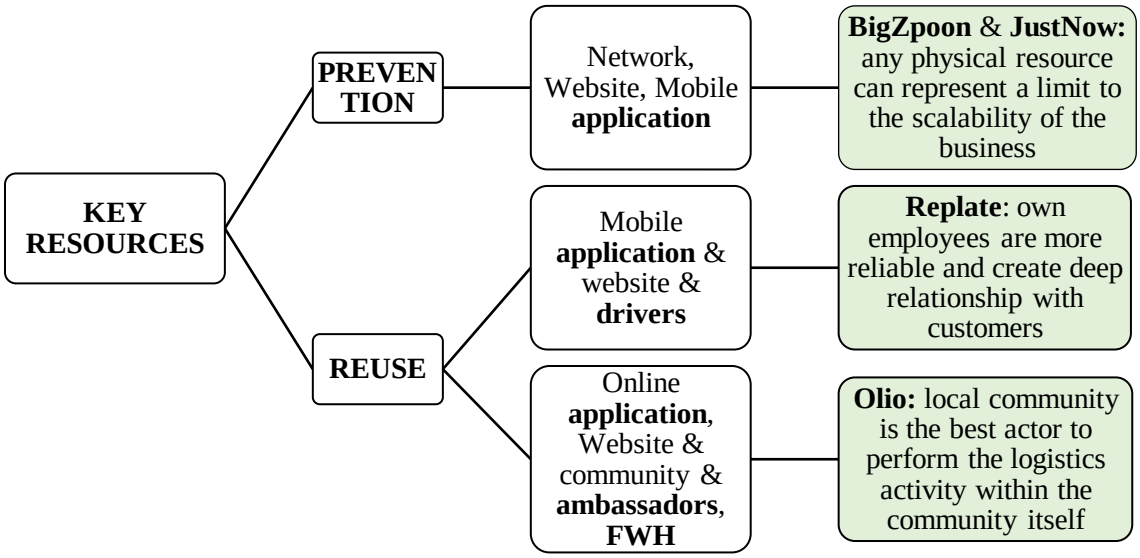


Figure 5.16 Key resources: Decision tree and drivers

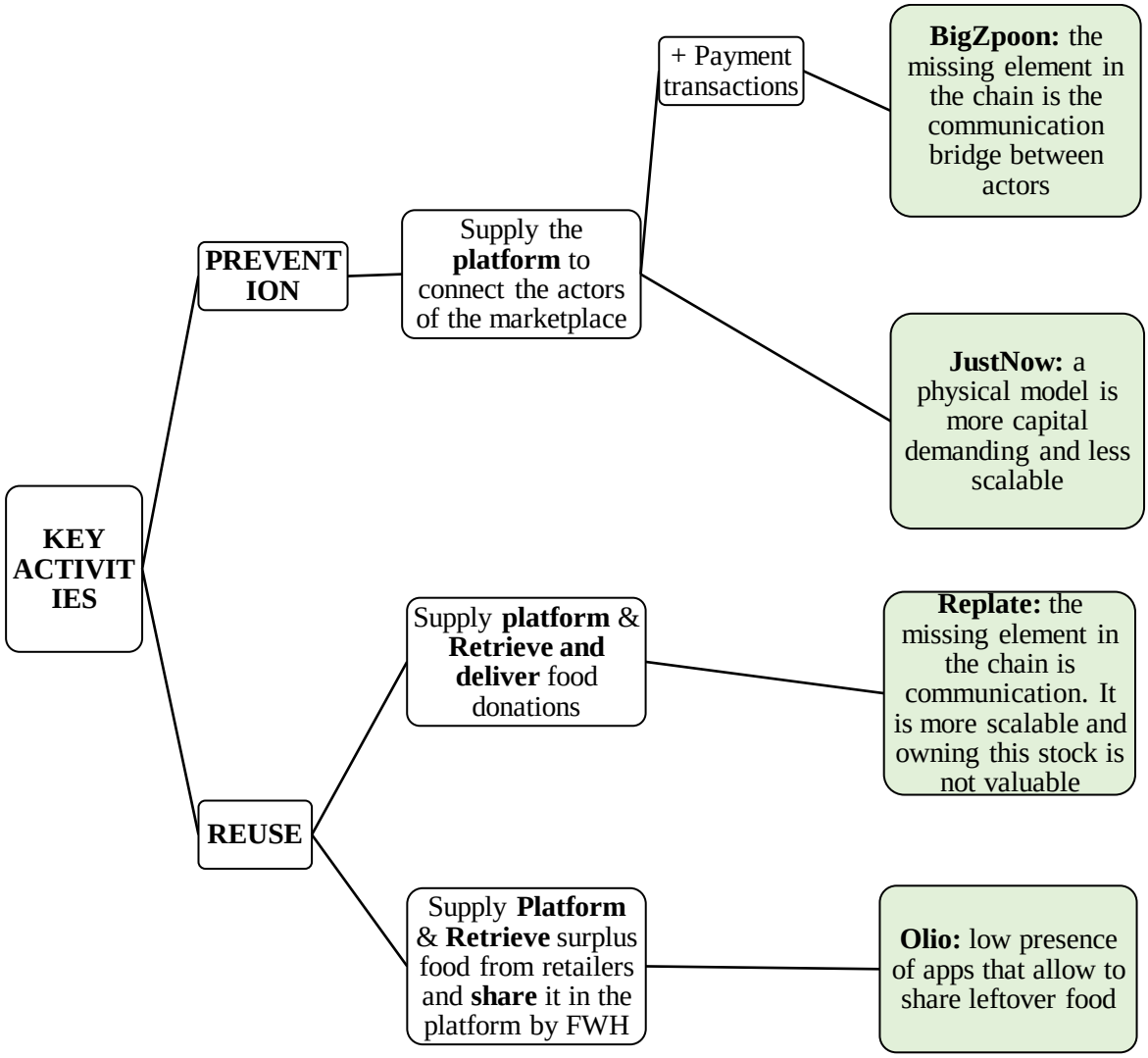


Figure 5.17 Key activities: Decision tree and drivers

The main difference between prevention and reuse level regarding key resources and activities is the fact that at the prevention stage the service provided are only "software-based", without any physical infrastructure or activity. On the other side, at the reuse level, the activities performed are more operational, such as logistics. Therefore, they involve also key resources as chauffeurs or volunteers that can collect surplus food donated by businesses.

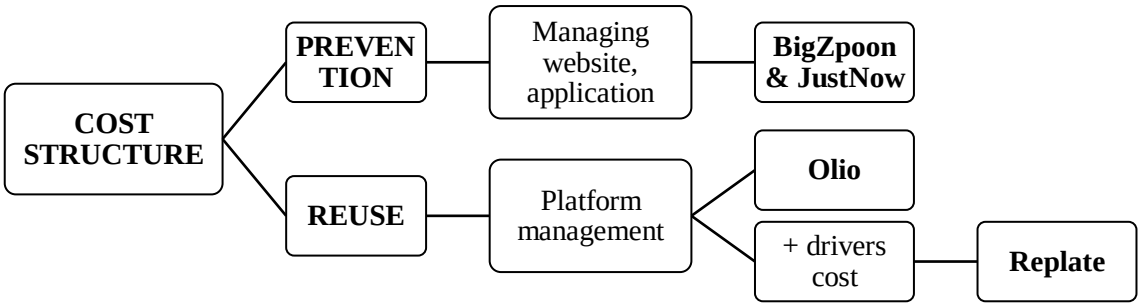


Figure 5.18 Cost Structure: Decision tree and drivers

The cost structure of each business is a direct consequence of the activities performed by the startup itself. Therefore, each cost item is directly linked to the core activities and resources of the startups.

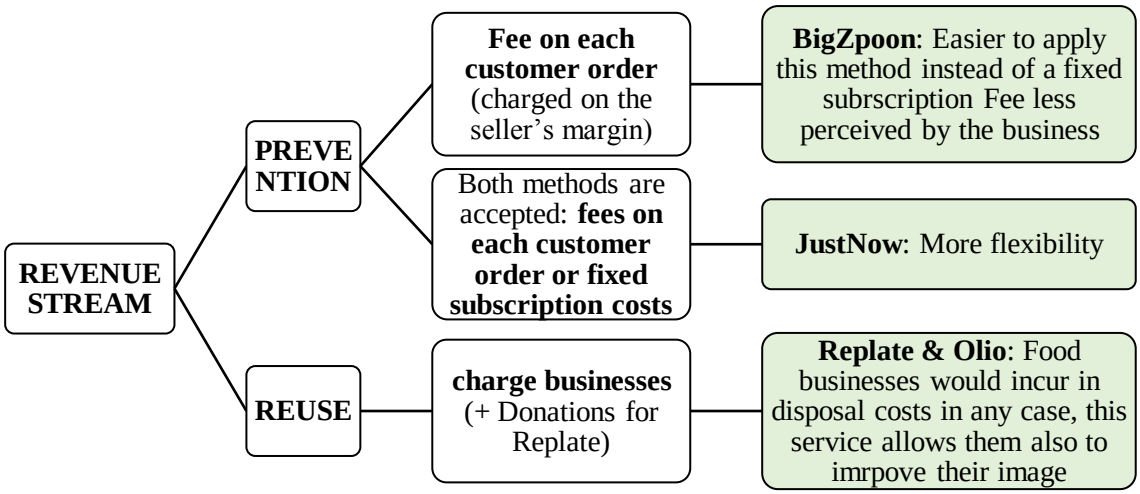


Figure 5.19 Revenue Stream: Decision tree and drivers

The revenue stream is similar for all the business models, the food businesses are charged, through different methods, for the services offered by the startups.

Eventually, through the interviews it has been possible to answer also to the question that aim at addressing the drivers that can lead a startup to focus on this specific archetype.

Firstly, the service provider business model results as a winning solution for the issue present in different marketplaces, which is recognized with the lack of communication between the different actors of the arena. Therefore, the startups have been applying a

service provider model in order to build a communication bridge between the parties. The advantages mentioned by our sample and recognized for this business model are:

1. Higher flexibility
2. Higher scalability
3. Lower risk and complexity

The second aspect concerns regulations. Each business believes that the laws concerning food waste management in the country in which it operates have the possibility to incentivise more food waste reduction and better management. Nevertheless, it appears that in western countries the regulations applied are more in favour of these business models compared with less developed countries.

Eventually, the customer habits aspect is recognized as a possible barrier more from the startups operating at the reuse level of the hierarchy. In fact, these businesses believe that in order to change the end users' culture it is necessary that governments and agri-food actors adopt long term missions to break down this constraint. At the prevention level instead, this barrier is recognized as less dangerous since the food they are dealing with has not been already served and donated but is still addressed to the same primary market.

5.6 Description of those T2 startups operating outside the agri-food industry

In this section of the chapter will be analysed those startups that follow a T2 archetype but do not play in the agri-food industry. In fact, from the database it emerged that there are some startups using as input resources that are considered waste in the agri-food industry. However, through the processes applied, these resources are transformed into products intended for different industries, and do not return inside the agri-food chain. For this reason, since the outputs of these startups do not enter in the agri-food industry, these firms cannot be considered actors of this supply chain.

In the following table (Table 5.3) it is shown the list of all the startups that were found in the database through the retrieving activity explained in chapter 3 "Methodology". These startups are taken into consideration here, since they operate with outputs of the agri-food industry, but they are not present in the final database, since, as already explained, they do not perform any activity pertaining our definition of the agri-food supply chain.

Company Name	Founded Date	Region	Country	Website	# of Employees
Blackwood Technology	2015	Noord-Holland	The Netherlands	http://www.blackwood-technology.com/	1-10
EggPlant Srl	2013	Puglia	Italy	http://www.eggplant.it	1-10
Fraddon Biogas Limited	Mar 10, 2014	United Kingdom	Europe	http://www.fraddonbiogas.com	1-10
Infinity Biofuels	Jan 29, 2016	Ontario	Canada	http://www.infinitybiofuels.com/	1-10
Milk Brick	nov-17	Sardegna	Italy	https://www.milkbrick.com	1-10
Shift	Jan 1, 2017	Ontario	Canada	http://www.shiftwastenow.com	1-10

Table 5.3 List of T2 Non-Agri-Food Startups

As showed in the table, the startups with this characteristic are 6, 3 of them operate at the recovery level of the food waste hierarchy, the remaining 3 at the disposal level of the hierarchy. The food waste hierarchy explains better why these firms cannot be part of the agri-food supply chain. In fact, the last two levels of the pyramid aim at treating waste and recovering energy and dispose food waste into landfill. The food waste hierarchy framework does not take into consideration the possibility to create value in other industries, starting from agri-food outputs. If a resource exits the agri-food value chain, it is considered as "disposed" by the food waste hierarchy. Actually, these materials are going to exploit the "Power of cascaded use and Inbound material/product substitution" (Ellen MacArthur Foundation, 2013a) described in the literature review (chapter 2).

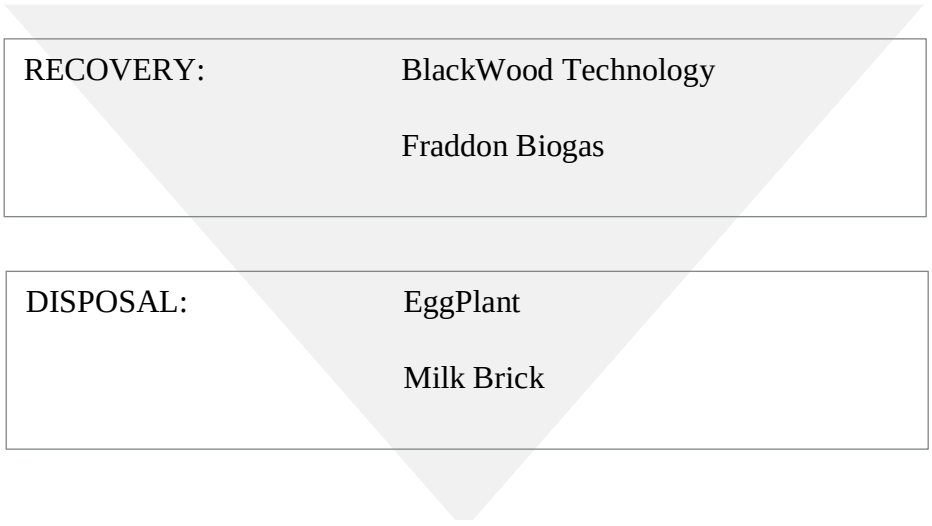


Figure 5.20 T2 Non-Agri-Food Startups assigned to the Food Waste Hierarchy

Hereafter, the 6 startups will be shortly described in order to give a better idea of the activities performed.

1. BlackWood: The startup was founded to manage unavoidable agri-food waste. The startup performs a thermal process on various streams of woody biomass and residues from the agri-food value chain, in order to produce high-grade solid biofuel. The process enhances the energy density and the calorific potential of the input resources. In this way, it improves the efficiency of logistics, handling and storage processes. Moreover, it allows the further use of wastes, opening to a various range of potential applications. The biofuel produced is described as "stable, homogeneous and high-quality" from the startup website.
2. Fraddon Biogas: The startup core activity is the processing, through an anaerobic digestion, of food leftovers and agricultural wastes in order to produce gas and electricity. The startup operates in Cornwall through an anaerobic digestion facility.
3. Infinity Biofuels: The startup is performing efficient processes in order to convert feedstock into "the highest yield of high-octane, renewable, drop-in gasoline", as it is described in their website. The focus is on efficiency and no further refining processes are required. The output of the processes is directly blended with refinery blendstock and additivies in order to have the finished gasoline ready to be used by any engine. It a clean process and carbo-saving. The ultimate objective of the startup is the production of "sustainable biofuel" that they call "infinite gasoline".
4. EggPlant: The startup developed a technology capable to implement, through a zero waste process, the reuse of wastewater as input in order to produce high-performance biofuel. The environmental problems tackled by the startup are two: the first is the reduction of pollution created in the traditional hydrocarbons-based plastics; at the same time, the startup is managing the disposal of wastewater. The value proposition of the company is to "eliminate the concept of easte with the mission to reuse waste as raw material to ger smart and sustainable products".
5. Milk Brick: The startup is operating in the construction industry. It is based in Italy and uses the milk fibers produced by the local milk producers as an input in its innovative process. The result is a biodegradable thermoacoustic insulator fiber

used to produce eco-biological bricks. Their vision encompasses the environmental benefits that their business model is creating through the implementation of a closed-loop business model.

6. Shift: The startups focuses in the transformation of animal waste into energy. Their process is composed by 4 main steps: the first takes into account the storage of waste, then the process of conversion into usable biogas starts; the third step aims at converging the produces biogas into the users' facilities and the last step is the consumption stage. It is very strong the social aspect in the business model, since the startup is devoting its activities to people and communities that cannot afford the traditional sources of energy.

5.7 Conclusions

Through this chapter it has been possible, firstly, to define the sample of startups for the case studies analysis. In fact, from all the startups in the database recognized as performing the Bocken T2 archetype, it has been selected the range of startups from which it would be possible to obtain the most useful insights for the purpose of the thesis.

From the 27 startups operating in the agri-food industry and applying a business model based on the creation of value from waste, only the startups operating at the "Service providers" supply chain stage have been selected. 16 is the number of potential startups that could take part to the case studies analysis.

The final business study analysis has been conducted on 4 startups. Firstly, it has been necessary to study each startup through the information provided online, on websites and Crunchbase. Consequently, it has been possible to build for each startup a customized interview based on the characteristics of its business model, its nine blocks and all the relative information.

The four interviews have been conducted through videocalls to the CEO and/or founders of the startups. The following step has been to study in detail each startup, highlight the important aspects and identify drivers and barriers that lead towards the different decisions taken by each startup.

Eventually, three cross cases analysis have been conducted to merge and confront the information given by the different startups, in order to build common patterns and differences among business models.

From the analysis it appears that the type of "software services" provided by a service provider are the key elements that are missing in the structure of the agri-food industry nowadays. It aims to fill the communication gap between different actors of the agri-food supply chain and the end users.

Moreover, the type of physical-free model offered by a service provider resulted the best solution for what concerns high potential scalability.

For what concerns barriers, it appears that regulations and human habits can limit the growth of these business models, but, through some long-term actions it could be possible to overcome these constraints and increase the strength of this business model.

6. Conclusions

To conclude, the main findings of the research will be described in this final chapter. The line of reasoning which conducted the authors in the development of the two research questions will be briefly summarized, and the mentioned questions will be reported. Theoretical and practical implications of the findings will be analysed, diving the latter into practical implications for managers and for policy makers. Finally, the limitations of the studies will be presented and commented, reporting some ideas as starting point for further researches.

6.1 General overview

The topic of sustainability has gained momentum in the last 30 years. The relevance of the topic has been recognized by organizations, firms and consumers. The process that led to the recognition of the positive impact that sustainable development can have on the environmental, social and economic perspectives has been long and is still not completed. Several companies are still looking at it only as a matter of "regulation compliances", without involving it into their standard operation policies.

The agri-food industry is one of the fields in which the impact of sustainable development is more clearly visible, because of its immediate reflection on both environment and society.

The topic of sustainability has been identified in the last years as strictly related with the innovation topic (Ludeke-Freud, 2009; Upward and Jones, 2016; Schaltegger et al. 2012). Behnam and Cagliano (2017) proved that is statistically true in companies that "The pursuit of sustainability priority leads to the pursuit of innovation priority". This is the reason why it has been decided to adopt startups as unit of analysis for the thesis.

The concept of sustainable business model can be expressed by Upward and Jones 2016 definition as: "We define, if it were to exist, an organization that only enabled strongly sustainable outcomes as one that creates positive environmental, social and economic value throughout its value network, thereby sustaining the possibility that human and other life can flourish on this planet forever".

Despite the extensive literature on the topic, no studies concerning the application of sustainable business models to the agri-food industry startups has been identified. The typologies of business models adopted by startup implementing sustainability in the agri-food and the typology of sustainability pursued by those startups has never been analysed by researchers.

Moreover, the research focused on a specific sustainable implementation, the archetype of business model referred by Bocken et al. (2014) as "Create value from waste". The logic of the mentioned archetype is the one followed by the natural ecosystems: "the energy and/or matter produced by one species is consumed by another" (Gibbs and Deutz, 2007).

Fundamental for the researches about the topic has been proved to be the knowledge spread by the Ellen MacArthur Foundation. Drivers and barriers accompany may encounter in the implementation of the closed loop business model have been analysed. It has been analysed also a study conducted by Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2013a) about the application of the circular economy in the agri-food industry companies.

However, when considering startup as unit of analysis, the only studies present in the literature refers to the clothing and fashion industry (Weissbrod and Bocken, 2017; Bocken et al., 2017; Todeschini et al., 2017).

Referring at the line of reasoning above presented and at the literature gaps individuated during the literature analysis, the research questions addressed by the thesis are the following:

RQ1: What are the most implemented business models by the agri-food Sustainability Oriented startups?

- **RQ1a:** What are their characteristics in terms of supply chain stage in which they operate, geographical distribution, ability to collect funds, and typology of sustainability orientation pursued?

- **RQ1b:** What are differences and similarities that emerge from a comparison with the analysis performed by Caliceti (2017)?

RQ2: What are the characteristics of the business model "Create value from waste" implemented by startups operating within the agri-food industry?

- **RQ2a**: What are the drivers and barriers that may affect the startup implementation of a "Create value from waste" business model within the agri-food industry?
- **RQ2b**: What are the different nuances assumed by the implementation of the business model "Create value from waste" in the agri-food industry?
- **RQ2c**: What are the drivers and barriers that may affect the implementation of the different nuances of the "Create value from waste" business model?

Two main methodologies have been adopted to tackle the research questions. For the first research question, a quantitative approach has been pursued through the analysis of a database containing 7.966 startups. For the second research question have been used both, the insights resulting from the first research question and a more qualitative approach, based on the analysis of the individual startups, as well as startups clusters, through the application of frameworks and interviews with the companies' top management.

The specific processes followed to apply each methodology have been described in Chapter 3.

6.2 Theoretical implications

RQ1: What are the most implemented business models by the agri-food Sustainability Oriented startups?

- **RQ1a:** What are their characteristics in terms of supply chain stage in which they operate, geographical distribution, ability to collect funds, and typology of sustainability orientation pursued?
- **RQ1b:** What are differences and similarities that emerge from a comparison with the analysis performed by Caliceti (2017)?

As mentioned above, the first research question arises from a gap in the literature. To the best of our knowledge, no research analysed the business models adopted by sustainable oriented agri-food startups. A previous dissertation work by Caliceti (2017) analysed the sustainable business models implemented in the agri-food industry. Therefore, similarities and differences with the mentioned dissertation have been highlighted. The authors decided to adopt the classification framework developed by Bocken et al. (2014) and industry-specific knowledge in order to suit the framework to the research purpose. The 8 archetypes of the framework have been used to classify the startups of the sample, as explained in Chapter 3 section 3.1.5. Moreover, additional information has been collected and analysed, such as the supply chain stage in which the startups operate, their geographical distribution, their ability to collect funding and the typologies of sustainability that they are pursuing, according to the Sustainable Development Goals and targets described in the "2030 Agenda of sustainable development".

The archetype T1-"Maximize energy and material efficiency" resulted the most implemented sustainable business model in the sample, coherently with Caliceti (2017)'s findings. The popularity of the business model is mainly driven by startups selling data analysis tools in order to increase the efficiency of the agri-food businesses, and by startups selling structures and technologies for the implementation of aquaponics and aeroponics systems. Accordingly, the supply chain stages more represented in the T1 archetype are Service providers (76 SOs) and Technology suppliers (72 SOs). The archetype is described by Bocken et al. (2014) as **"**Do more with fewer resources, generating less waste, emissions and pollution". The results of the thesis show that an increase in efficiency is the main objective of Sustainable Oriented startups. The final aim of the new technologies adoption is efficiency improvements, which can lead companies in obtaining the same, or even greater results, despite a decrease in the use of resources. The exploitation of data analysis is in line with the trends that emerged and are emerging with the fourth industrial revolution (McKinsey Digital, 2015).

The typologies of businesses implementing the T1 archetype as a business model is recognizable also in the typologies of sustainability pursued. Using the Sustainable Development Targets as unit of analysis, the most pursued by the T1 archetype resulted 2.4 and 9.4, described in the "2030 Agenda for sustainable development" respectively as

"By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality" and "By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities".

It is interesting to notice that if the archetype distribution is analyzed separately for developed and developing countries, the results are different. Using the macro-group archetypes, the startups whose business model has been assigned to the group "Technological oriented innovation" in developed countries are the 65% of the sub-sample, making it more than the average. On the other hand, the most diffused macro-group of archetypes in developing countries is "Organizational oriented innovation" (46.1%). Once again, the results show coherence with the finding of Caliceti (2017)'s dissertation. However, being different the indicator adopted by this research and the one adopted in the mentioned dissertation, it is not possible a numerical comparison.

Concerning the ability to collect funds, the archetype O2-"Deveop scale up solutions" resulted the one with the best performance in terms of "Average funding (US$)". The funded startups implementing this business model resulted able to collect an average value of 23,654,400 US$. The results are coherent with what has been discovered by Caliceti (2017), however, it has to be said that both the results are biased by the presence of one startup in the archetype O2 which has been able to collect 100,000,000 US$ (Sundrop Farms).

The least implemented archetypes in the sample resulted to belong to the same macro-group of archetypes: "Social oriented innovation". In particular, S3-"Encourage sufficiency" and S1-"Promote functionality rather than ownership" have been encountered only as implemented by respectively three and four startups. The results are coherent with the findings of the previous dissertation. As it has been previously mentioned, the motivations for the low implementation of the S1 archetype might be the nature of the product. Being food products perishable, the "pay per use" customer's

approach is not suitable. However, the few presences of business models devoted to "Encourage sufficiency" is an interesting insight, since sufficiency is key for the implementation of a sustainable business model, and it is intrinsic in the definition of sustainability itself.

Interesting insights arose from the analysis of the SOs geographical dispersion. The startups sustainability specialization has been analysed for every country present in the database with at least 10 agri-food startups. The results encountered in this part of the analysis diverge from what has been observed by Caliceti (2017). In particular, Finland and South Africa resulted as the second and third most specialized countries, while they have not been reported in the previous dissertation. Moreover, the countries specialization in the agri-food industry has been analysed through a new adaptation of the Balassa Index, for which a comparison with the previous dissertation is not possible. A cross-analysis of the two indexes resulted in the construction of a matrix (Graph 4.3 - Chapter 4) with the purpose to graphically highlight the specialization of the startups of the country in the agri-food industry and in sustainability. The countries lying in the top-right quadrant of the matrix, resulting from the analysis as specialized in both the fields, are South Africa, The Netherland, Nigeria, Italy, India, Ireland, Brazil, Australia and Portugal.

RQ2: What are the characteristics of the business model "Create value from waste" implemented by startups operating within the agri-food industry?

- **RQ2a:** What are the drivers and barriers that may affect the startup implementation of a closed loop business model within the agri-food industry?
- **RQ2b:** What are the different nuances assumed by the implementation of the business model "Create value from waste" in the agri-food industry?
- **RQ2c:** What are the drivers and barriers that may affect the implementation of the different nuances of the "create value from waste" business model?

From the results given by the updated database, it has been possible to focus the attention of the research on those business models that are implementing a technological sustainability oriented towards the creation of value from waste.

From the 27 startups of the database that are operating within this archetype, it has been chosen to focus on a sample of 16 startups. From this sample, 4 startups have been selected in order to perform a case study analysis. In fact, a descriptive case study has been identified as the best tool to perform this qualitative research.

The startups taken into consideration are all operating within the service providers stage of the agri-food supply chain. The four startups, BigZpoon, JustNow, Replate, Olio, are acting on the first two stages of the food waste hierarchy, prevention and reuse.

The analysis has been conducted through interviews to the founders or CEO of the startups. The interviews have been performed through videocall, and the questions were focused on the business model canvas blocks and on the main trends emerged by the literature review.

Each startup has been analysed individually and then compared with the others through different cross-analysis.

From the interviews it emerged that the main drivers for the decision between performing at the reuse or prevention stage of the hierarchy are the type of food and process the startup is dealing with, the regulations of the country the startups is operating in, and the impact which the startup is aiming for.

For what concerns the business model characteristics it has been possible to observe that every startup is willing to increase its customer base and enlarge the players of its marketplace in the future, with no limitations on type of actors or level of the supply chain.

All the startups are performing similar activities, in fact, the main purpose of these service providers is to fill the communication gap present between different actors of the supply chain. The main difference on the activities performed appears between the prevention and reuse models, in fact, at the reuse level, startups perform also logistics activities such as retrieving and delivering the surplus food from the donors to the receivers.

Key resources and cost structure are a direct consequence of the key activities performed by the startups. The revenue stream is also similar for every startup, the startup charges

the food business for the service provided, through a fee on each transaction or through a fixed subscription.

Eventually, it is important to highlight why the startups are operating on a hubless-physical-free model. The reason, as explained before, is the fact that the missing part element between the actors of the supply chain operating within the marketplaces taken into consideration, is the bridge that can allow the communication between parties.

In addition, a model which supplies services is more scalable and can expand more easily, as well it is less risky and less complex to apply.

Concerning possible barriers that can limit the implementation of a T2 archetype, the startups believe that both local regulations and customer habits could result as a possible constraint. Nevertheless, they also recognize that these barriers can be destroyed through the elaboration of long term missions that can incentivize the model of creation of value from waste.

Eventually, considering Bocken et al. 2014, the results given by this dissertation can enlarge the former research, in fact, Bocken et al. 2014 evaluates different types of archetypes of sustainable business models but does not evaluate the different characteristics and shades that the archetypes may assume. Moreover, the former research does not focus in any specific industry. Therefore, through this research it has been possible to evaluate the characteristics of each archetype within the agri-food industry and, moreover, to increase the focus on the archetype "Create value from waste" within the agri-food industry.

6.3 Practical implications

6.3.1 Managerial implications

The importance given by companies to sustainable development is increasing. Relevant players in the industry (e.g. Carlsberg group, Danone and Keurig) are fostering sustainability overall their entire supply chain. However, this is still an approach to sustainability driven by the necessity of being compliant with external policies and regulations. The thesis has shown that sustainability can be pursued with the aim of

gaining competitive advantage. Founders of new ventures should keep in mind that the implementation of sustainability goes beyond the mere adaptation to rules and regulations, it can rather be considered as a strategic objective.

Several examples of startups able to create competitive advantage have been discovered during this research, thanks to the implementation of sustainability in their business model. A clear example are those startups falling in the business model category T1-"Maximize energy and material efficiency". Clearly, the exploitation of energy and material efficiency leads to an immediate cost reduction, creating competitive advantage for the sustainable company. Another example is the implementation of a T2-"Create value from waste" business model. It has been deeply analysed that the implementation of this archetype can lead not only the new ventures in gaining competitive advantage but can also improve the situation of companies already present in the industry. In most of the analysed cases, the startups are able to extract value form the wastes of incumbents, therefore without any raw material cost for those elements. On the other hand, the incumbent who is participating to this process, is going to save the costs for the disposal of its waste. It is a win-win solution. Actually, as pointed out during the interview by the CEO of the new venture BigZpoon, Sanjeev Ukhalkar, the implementation of this archetype leads to a win-win-win solution, in which the last "win" is the positive environmental impact arising from the reuse of wastes.

The theory has shown interesting insights on the cross-industry application of this archetype, even if it goes beyond the scope of thesis.

Moreover, the database analysis illustrated the presence of several startups which are devoting their activities to foster sustainability in the industry. More precisely, 103 out of 412 startups in the sample have been classified as O1-"Repurpose for society/environment". Nowadays the creation of a sustainable new venture can be supported by external entities too.

Moreover, the drivers identified as explanatory reasons for the different ramifications that each part of the business model can assume, should be considered by entrepreneurs in the process of opening a new venture. As example, the type of product managed by the marketplaces resulted critical for the positioning within the Food Waste Hierarchy.

Manager should approach coherently supply and demand: if the startup aim is to resell products, managers should be aware that it is very difficult to perform this activity with leftover food, and consequently, they must select the appropriate supply source.

Some interesting insights for managers arose also regarding the revenue stream. Despite difference nuances it seems to exist, from the case studies emerged that it is difficult to persuade customers in approaching the business with a fixed cost subscription, like a monthly fee. For new ventures, it easier to approach customers offering variable costs, i.e. a fee on each transaction, in order to increase the transparency with the customer about the value the startups is actually creating.

6.3.2 Policy makers implications

As it emerged from the literature review, governments are the entities that are leading sustainable development along its evolution. The 2030 Agenda and all the governments' plan of actions are an opportunity for the implementation of sustainable business model. Governments organizations, such as the United Nations, must continue to guide the radical change towards a sustainable world. They are the most powerful actor in the process of leading companies and consumers towards sustainability.

The role of governments is fundamental and has immediate effects in the startups businesses. Representative is the case study performed on the startup Justnow. The startup is currently operating in both, South Africa and Romania. It clearly emerged from the interview that the actions of the European governments are facilitating the establishment of the startups in Romania. On the other hand, sustainability policies in South Africa government are not common practice and the startup is experiencing more difficulties in establishing its business model.

To conclude, the role of policy makers is making the difference in the spread of sustainable common practices. Governments have to pursue the implementation of sustainability involving companies in their plan towards this change, increasing the importance the topic has gained in the last few years.

6.4 Limitations and future research

The main source of information used in the thesis has been the described database. The information inside the database, obtained from Crunchbase, company's websites and the internet in general has been extracted by the two authors. The process of information extraction has been previously validated from Caliceti (2017) and leaves little space at the subjectivity of the authors. However, missing information from both, Crunchbase and internet might have limited the results of thesis. In fact, not all the startups fully disclosed their information, the funding amount and the location of the headquarters remain unknown for some startups in the sample. However, despite the mentioned limitations, it has been possible to extract interesting insights and to formulate answers to the two research questions. The contribution of the information collected online and of the interviews carried out has been fundamental to retrieve additional data and increase the level of detail of the analysis. However, the participation at the interviews has been limited to only four startups. Consequently, it has not been possible to analyse all the ramifications pointed out in the described decisional trees.

Moreover, the specific focus on the startups operating within the agri-food supply chain has been an additional limitation. It limited the possibility to further analyse all the startups that are able to create value outside the agri-food industry from waste produced within the food value chain. Further analysis in this direction may lead to interesting insights. These business models are also supported by some theoretical background. They exploit the "Power of cascaded use and Inbound material/product substitution", described by the Ellen MacArthur Foundation (2013a) as the most powerful application of the circular economy.

Finally, the next steps could involve the application of the described methodology to other stages of the supply chain. Due to the considered sample, only the application of the archetype "Create value from waste" to the stage "Service providers" has been deeply analysed. The role of the business model in different level of the supply chain remain an open question.

7. Appendix

7.1 Appendix A: List of activities allocated to agri-food actors

1. Primary activities: Input suppliers

01.30 Plant propagation

01.64 Seed processing for propagation

10.91 Manufacture of prepared feeds for farm animals

20.15 Manufacture of fertilisers and nitrogen compounds

20.20 Manufacture of pesticides and other agrochemical products

46.12 Agents involved in the sale of fuels, ores, metals and industrial chemicals

2. Primary activities: Farmers, breeders and fishers

NACE's activities allocated to **FARMERS**

01.1 Growth of non-perennial crops

Class	Title
01.11	Growing of cereals (except rice), leguminous crops and oil seeds
01.12	Growing of rice
01.13	Growing of vegetables and melons, roots and tubers
01.14	Growing of sugar cane
01.19	Growing of other non-perennial crops

Table 7.1 Activities represented in class 01.1.
Source: Eurostat, 2008.

01.2 Growing of perennial crops

Class	Title
01.21	Growing of grapes
01.22	Growing of tropical and subtropical fruits
01.23	Growing of citrus fruits
01.24	Growing of pome fruits and stone fruits
01.25	Growing of other tree and bush fruits and nuts
01.26	Growing of oleaginous fruits
01.27	Growing of beverage crops
01.28	Growing of spices, aromatic, drug and pharmaceutical crops

Table 7.2 Activities represented in class 01.2.
Source: Eurostat, 2008.

01.61 Support activities for crop production

01.63 Post harvest activities

02.30 Gathering of wild growing non-wood products

NACE's activities allocated to **BREEDERS**

01.4 Animal production

Class	Title
01.41	Raising of dairy cattle
01.42	Raising of other cattle and buffaloes
01.43	Raising of horses and other equines
01.44	Raising of camels and camelids
01.45	Raising of sheep and goats
01.46	Raising of swine/pigs
01.47	Raising of poultry
01.49	Raising of other animals

Table 7.3 Activities represented in class 01.4.
Source: Eurostat, 2008.

01.62 Support activities for animal production

01.70 Hunting trapping and related service activities

NACE's activities allocated to **FISHERS**

03.1 Fishing

Class	Title
03.11	Marine fishing
03.12	Freshwater fishing

Table 7.4 Activities represented in class 03.1.
Source: Eurostat, 2008.

03.2 Aquaculture

Class	Title
03.21	Marine aquaculture
03.22	Freshwater aquaculture

Table 7.5 Activities represented in class 03.2.
Source: Eurostat, 2008.

3. Primary activities: Food processors

10.1 Processing and preserving of meat and production of meat products

Class	Title
10.11	Processing and preserving of meat
10.12	Processing and preserving of poultry meat
10.13	Production of meat and poultry meat products

Table 7.6 Activities represented in class 10.1.
Source: Eurostat, 2008.

10.20 Processing and preserving of fish, crustaceans and molluscs

10.3 Processing and preserving of fruit and vegetables

Class	Title
10.31	Processing and preserving of potatoes
10.32	Manufacture of fruit and vegetable juice
10.39	Other processing and preserving of fruit and vegetables

Table 7.7 Activities represented in class 10.3.
Source: Eurostat, 2008.

10.4 Manufacture of vegetable and animal oils and fats

Class	Title
10.41	Manufacture of oils and fats
10.42	Manufacture of margarine and similar edible fats

Table 7.8 Activities represented in class 10.4.
Source: Eurostat, 2008.

10.5 Manufacture of dairy products

Class	Title
10.51	Operation of dairies and cheese making
10.52	Manufacture of ice cream

Table 7.9 Activities represented in class 10.5.
Source: Eurostat, 2008.

10.6 Manufacture of grain mill products, starches and starch products

Class	Title
10.61	Manufacture of grain mill products
10.62	Manufacture of starches and starch products

Table 7.10 Activities represented in class 10.6.
Source: Eurostat, 2008.

10.7 Manufacture of bakery and farinaceous products

Class	Title
10.71	Manufacture of bread; manufacture of fresh pastry goods and cakes
10.72	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes
10.73	Manufacture of macaroni, noodles, couscous and similar farinaceous products

Table 7.11 Activities represented in class 10.7.
Source: Eurostat, 2008.

10.8 Manufacture of other food products

Class	Title
10.81	Manufacture of sugar
10.82	Manufacture of cocoa, chocolate and sugar confectionery
10.83	Processing of tea and coffee
10.84	Manufacture of condiments and seasonings
10.85	Manufacture of prepared meals and dishes
10.86	Manufacture of homogenised food preparations and dietetic food
10.89	Manufacture of other food products n.e.c.

Table 7.12 Activities represented in class 10.8.
Source: Eurostat, 2008.

11.0 Manufacture of beverages

Class	Title
11.01	Distilling, rectifying and blending of spirits
11.02	Manufacture of wine from grape
11.03	Manufacture of cider and other fruit wines
11.04	Manufacture of other non-distilled fermented beverages
11.05	Manufacture of beer
11.06	Manufacture of malt
11.07	Manufacture of soft drinks; production of mineral waters and other bottled waters

Table 7.13 Activities represented in class 11.0.
Source: Eurostat, 2008.

20.59 Manufacture of other chemical products n.e.c.

4. Primary activities: Retailers

47.2 Retail sale of food, beverages and tobacco in specialised stores

Class	Title
47.21	Retail sale of fruit and vegetables in specialised stores
47.22	Retail sale of meat and meat products in specialised stores
47.23	Retail sale of fish, crustaceans and molluscs in specialised stores
47.24	Retail sale of bread, cakes, flour confectionery and sugar confectionery in specialised stores
47.25	Retail sale of beverages in specialised stores
47.29	Other retail sale of food in specialised stores

Table 7.14 Activities represented in class 47.2.
Source: Eurostat, 2008.

47.76 Retail sale of flowers, plants, seeds, fertilisers, pet animals and pet food in specialised stores

47.81 Retail sale via stalls and markets of food beverages and tobacco products

47.9 Retail trade not in stores, stalls or markets

Class	Title
47.91	Retail sale via mail order houses or via Internet
47.99	Other retail sale not in stores, stalls or markets

Table 7.15 Activities represented in class 47.9.
Source: Eurostat, 2008.

5. Primary activities: Food service

55.1 Hotels and similar accommodations

56.10 Restaurants and mobile food service activities

56.2 Event catering and other food service activities

Class	Title
56.21	Event catering activities
56.29	Other food service activities

Table 7.16 Activities represented in class 56.2.
Source: Eurostat, 2008.

56.30 Beverage serving activities

6. Secondary activities: Wholesalers

46.1 Wholesale on a fee or contract basis

Class	Title
46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods
46.19	Agents involved in the sale of a variety of goods

Table 7.17 Activities represented in class 46.1.
Source: Eurostat, 2008.

46.2 Wholesale of agricultural raw materials and live animals

Class	Title
46.21	Wholesale of grain unmanufactured tobacco, seeds and animal feed
46.23	Wholesale of live animals

Table 7.18 Activities represented in class 46.2.
Source: Eurostat, 2008.

46.3 Wholesale of food, beverages and tobacco

Class	Title
46.31	**Wholesale of fruit and vegetables**
46.32	**Wholesale of meat and meat products**
46.33	**Wholesale of dairy products, eggs and edible oils and fats**
46.34	**Wholesale of beverages**
46.36	**Wholesale of sugar and chocolate and sugar confectionery**
46.37	**Wholesale of coffee, tea, cocoa and spices**
46.38	**Wholesale of other food, including fish, crustaceans and molluscs**
46.39	**Non-specialised wholesale of food, beverages and tobacco**

Table 7.19 Activities represented in class 46.3.
Source: Eurostat, 2008.

7. Secondary activities: Technology suppliers

28.30 Manufacture of agricultural and forestry machinery

28.93 Manufacture of machinery for food beverages and tobacco processing

46.61 Wholesale of agricultural machinery, equipment and supplies

77.31 Renting and leasing of agricultural machinery and equipment

8. Secondary activities: Support activities

Support activities which enable **TRANSPORTATION**:

49.2 Freight rail transport

49.41 Freight transport by road

50.2 Sea and costal freight water transport

50.40 Inland freight water transport

51.21 Freight air transport

52.1 Warehousing

52.2 Support activities for transportation

Class	Title
52.21	Service activities incidental to land transportation
52.22	Service activities incidental to water transportation
52.23	Service activities incidental to air transportation

Table 7.20 Activities represented in class 52.2.
Source: Eurostat, 2008.

52.24 Cargo landing

52.29 Other transportation support activities

53.2 Other postal and courier activities

Support activities which enable the **CONSERVATION OF FOOD PRODUCTS**:

17.21 Manufacture of corrugated paper and paperboard and of containers of paper and paperboard

22.22 Manufacture of plastic packaging goods

23.13 Manufacture of hollow glass

25.91 Manufacture of steel drums and similar containers

25.92 facture of light metal packaging

9. Secondary activities: Service providers

58.19 Other publishing activities

62.01 Computer programming activities

63.1 Data processing, hosting and related activities; web portals

Class	Title
63.11	Data processing hosting and related activities
63.12	Web portals

Table 7.21 Activities represented in class 63.1Source: Eurostat, 2008

66.11 Administration of financial markets

72.1 Research and experimental development on natural sciences and engineering

Class	Title
72.11	Research and experimental development on natural sciences
72.19	Other research and experimental development on natural sciences and engineering

Table 7.22 Activities represented in class 63.1.
Source: Eurostat, 2008.

73.11 Advertising agencies

73.20 Market research and public opinion polling

74.90 Other professional, scientific and technical activities

75.00 Veterinary activities

79.90 Other reservation service and related activities

62.01-63.11 The two codes have been used concurrently to identify companies developing software to improve efficiency

7.2 Appendix B: List of keywords used for database construction

KEYWORDS: INPUT COMPANIES	
Plant	Insecticide
Seed	Rodoenticides
Animal	Fungicides
Supplement	Herbicides
Feed	Acaricides
Fertilizer	Molluscicides
Compound	Biobides
Pesticide	Antisprouting
Agrochemical	

Table 7.23 List of keywords related to input companies.

KEYWORDS: FARMERS	
Tuber	Crop
Grape	Cereal
Fruit	Oil
Citrus	Vegetables
Pome	Root
Spice	Rice
Farming	Sugar cane
Harvest	Leguminous

Table 7.24 List of keywords related to farmers.

KEYWORDS: BREEDERS	
Pig	Cattle
Poultry	Buffalo
Chicken	Cow
Tourkey	Horse
Duck	Mule
Geese	Hinny
Guinea Fowl	Ass
Rabbit	Equinoes
Ostriche	Camel
Snail	Sheep
Bee	Goat
Honey	Swine

Table 7.25 List of keywords related to breeders.

KEYWORDS: FISHERS	
Shrimp	Fish
Oyster	Crustacean
Mussel	Mullusc
Fingerling	Whale
Seaweed	Turtle
Worm	(Sea) Urchin
Frog	Algae
Lobster	Acquaculture

Table 7.26 List of keywords related to fishers.

KEYWORDS: FOOD PROCESSING INDUSTRY	
Grain	Food
Flour	Meat
Wheat	Pork
Rye	Lamb
Oat	Mutton
Maize	Beef
Starch	Slaughterhouse
Glucose	Caviar
Gluten	Roes
Maltose	Potato
Tapioca	Juice
Bread	Vinegard
Cake	Jam
Bakery	Marmelade
Pastry	Jelly
Pie	Nut
Tart	Tofu
Pancake	Salad
Waffle	Pastes
Biscuit	Oil
Noodle	Margarine
Pasta	Dairy
Couscous	Milk
Cocoa	Cheese
Syrup	Butter
Chocolate	Yoghurt
Confectionery	Curd

KEYWORDS: FOOD PROCESSING INDUSTRY	
Chewing gum	Caseine
Tea	Lactose
Coffee	Ice Cream
Condiments	Soup
Herb	Broth
Sauces	Sandwich
Salt	Egg
Pepper	Yeast
Pizza	Beverage
Homogenised	Alcohol
Cider	Water
Perry	Beer
Vermouth	Wine
Whiskey	Spirit
Gin	Sake
Brandy	Liquor
Liqueur	Drink
Vodka	Lemonade
Malt	Orangeade
Cola	Tonic

Table 7.27 List of keywords related to food processing industry.

KEYWORDS: FOOD SERVICE	
Restaurant	Catering
Hotel	Canteens
Refuges	Tavern
Cafeterias	Cocktail
Fast food	Lounge
Bar	

Table 7.28 List of keywords related to food service.

KEYWORDS: RETAILER	
Stall	Market
Vending Machine	

Table 7.29 List of keywords related to retailers.

7.3 Appendix C: List of selected Category Groups

Category Group	Selected
Administrative services	Yes
Advertising	Yes
Apps	Yes
Biotechnology	Yes
Clothing and apparel	No
Commerce and Shopping	Yes
Community and Lifestyle	No
Consumer Electronics	No
Consumer Goods	No
Content and Publishing	No
Dana and Analytics	Yes
Design	No
Education	No
Energy	No
Event	No
Financial Services	No
Gaming	No
Government	No
Hardware	Yes
Health Care	Yes
Information Technology	Yes
Internet Services	Yes
Manufacturing	Yes
Media and Entertainment	No
Mobile	No
Natural Resources	Yes
Navigation and Mapping	No
Payments	No
Platforms	No
Privacy and Security	No
Professional Services	No
Real Estate	No
Sales and Marketing	Yes
Science and Engineering	Yes
Software	Yes
Sports	No
Sustainability	Yes
Transportation	Yes
Travel and Tourism	Yes

Table 7.30 List of selected category groups.

7.4 Appendix D: Canvas Business Model of the analysed Service providers startups

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Key partners are both, buyers and sellers.
Suppliers to deliver products have to be considered too, since Bon Harvest is taking care of the delivery</td>
<td>KEY ACTIVITIES

Promote farmers’ discounts, manage buyers’ orders, manage transactions, manage deliveries</td>
<td rowspan="2">VALUE PROPOSITION

Bon Harvest empowers farmers and other providers of fresh food to sell all excess, expiring food while reducing food waste</td>
<td>CUSTOMER RELATIONSHIP

The relationship with farmers and consumers is built is strengthened by the sustainability aspect</td>
<td rowspan="2">CUSTOMER SEGMENTS

Farmers and customers (consumers and local businesses i.e. food services).</td>
</tr>
<tr>
<td>KEY RESOURCES

Website and
Network drivers</td>
<td>CHANNEL

Retailers’ offer is passively proposed to the costumer through a website.
The delivery is managed by Bon Harvest</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

Bon Harvest faces advertise costs and the costs of managing website (maintenance, updating, …), transportation costs and fees to allow debit card transactions
Drivers</td>
<td colspan="2">REVENUE STREAMS

The source of revenue is the final consumer. To join the app from the customer side is free of charge. Bon Harvest revenues are created through a fee on each customer order (usually 5%) and a fee that the seller pay to be included in Bon Harvest’s marketplace</td>
</tr>
</table>

Figure 7.1 Bon Harvest - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Key partners are both, buyers and sellers.
Key partners are also entities creating connections between buyers, sellers and Takestock</td>
<td>KEY ACTIVITIES
Promote discounts, manage buyers' orders, manage transactions. Reduce food waste</td>
<td rowspan="2">VALUE PROPOSITION
Takestock.com is an online trading platform to make it easy for owners of stock to sell their unwanted items and to find a buyer efficiently rather than turning to scrap as an option.
Partners can act as mediators creating contacts between buyers, sellers and the platform</td>
<td>CUSTOMER RELATIONSHIP
The relationship with sellers and consumers is built on the economic advantage the two can achieve. Moreover, it is strengthened by the sustainability aspect</td>
<td rowspan="2">CUSTOMER SEGMENTS
Food manufacturer, Farmers and customers (consumers and local businesses)</td>
</tr>
<tr>
<td>KEY RESOURCES
Website and Network</td>
<td>CHANNELS
Food offer is passively proposed to the costumer through a website.
The delivery is managed by the sellers</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Takestock faces advertise costs and the costs of managing website (maintenance, updating, …) and fees to allow debit card transactions.
Moreover, the fees to the partners who are creating the connection between Takestock and buyers and sellers are an additional cost</td>
<td colspan="2">REVENUE STREAMS
The source of revenue is the final consumer. To join the application form both, seller and buyer's sides is free of charge.
Takestock's revenues are created through a fee on each customer order (15%), deducted from the restaurants' margin</td>
</tr>
</table>

Figure 7.2 Takestock - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Key partners are both, consumers and food services. Consumers provide the demand and food services provide the offer</td>
<td>KEY ACTIVITIES

Promote food services menu and discounts, manage consumers’ orders, manage transactions</td>
<td rowspan="2">VALUE PROPOSITION

Allow consumers to enjoy delicious food, while saving money and helping the environment, reducing the amount of food that is thrown away</td>
<td>CUSTOMER RELATIONSHIP

Sales effort for restaurants; Marketing efforts and a Loyalty Program for</td>
<td rowspan="2">CUSTOMER SEGMENTS

End-Customers and food services (restaurants, cafes, bakeries, small shops, etc.)</td>
</tr>
<tr>
<td>KEY RESOURCES

Mobile application, website and Network</td>
<td>CHANNELS

Platform, website, mobile application, social media, phone calls, emails, representatives</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

4 areas of costs: marketing, sales, engineering, operations</td>
<td colspan="2">REVENUE STREAMS

The join of the application is free of charge. A fee is applied to each payment transaction made from the customer to BigZpoon</td>
</tr>
</table>

Figure 7.3 BigZpoon - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Key partners are both, consumers and retailers. Consumers provide the demand and retailers provide the offer.
The partnership with retailers is really strong</td>
<td>KEY ACTIVITIES

Promote retailers discounts, manage consumers’ orders</td>
<td rowspan="2">VALUE PROPOSITION

Allow consumers to purchase surplus food from retailers with a discount.
It aims at reducing the amount of food that is thrown away</td>
<td>CUSTOMER RELATIONSHIP

The relationship with retailers and consumers is strengthened by the sustainability aspect</td>
<td rowspan="2">CUSTOMER SEGMENTS

Retailers and consumers</td>
</tr>
<tr>
<td>KEY RESOURCES

Mobile application, website and Network</td>
<td>CHANNELS

Retailers’ offer is passively proposed to the consumers through a website/mobile application.
The delivery is up to the consumer</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

Foodhero faces advertise costs and the costs of managing website and application (maintenance, updating)</td>
<td colspan="2">REVENUE STREAMS

NA</td>
</tr>
</table>

Figure 7.4 – FoodHero - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Key partners are both, consumers and retailers. Consumers provide the demand and food businesses provide the offer</td>
<td>KEY ACTIVITIES

Connect retailers and end users</td>
<td rowspan="2">VALUE PROPOSITION

Allows consumers to enjoy food while saving money and helping the environment, and helps retailers to reduce the amount of food waste</td>
<td>CUSTOMER RELATIONSHIP

Customers are engaged through on-site marketing performed by promoters and by social media advertising</td>
<td rowspan="2">CUSTOMER SEGMENTS

End-Customers and Retailers (supermarkets, cafes, bakeries, small shops, etc.)</td>
</tr>
<tr>
<td>KEY RESOURCES

Mobile application, website</td>
<td>CHANNELS

Platform, website, mobile application, social media, flayers, posters, representatives</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

Management and Development of the application

Customer acquisition</td>
<td colspan="2">REVENUE STREAMS

The food businesses are charged, they can choose to pay a fixed monthly fee or to pay a commission for each product sold</td>
</tr>
</table>

Figure 7.5 Justnow - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Key partners are both, consumers and retailers. Consumers provide the demand and retailers provide the offer.</td>
<td>KEY ACTIVITIES

Promote retailers discounts, manage consumers’ orders. reward system</td>
<td rowspan="2">VALUE PROPOSITION

Allow consumers to purchase surplus food from retailers with a discount.
It aims at reducing the amount of food that is thrown away.
Based around Finland.</td>
<td>CUSTOMER RELATIONSHIP

The relationship with retailers and consumers is strengthened by the sustainability aspect.
+ consumers involvement trough reward system.</td>
<td rowspan="2">CUSTOMER SEGMENTS

Retailers and consumers</td>
</tr>
<tr>
<td>KEY RESOURCES

Mobile application, website and Network</td>
<td>CHANNELS

Retailers’ offer is passively proposed to the consumers through a website/mobile application</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

Froodly faces advertise costs and the costs of managing website and application (maintenance, updating)</td>
<td colspan="2">REVENUE STREAMS

NA</td>
</tr>
</table>

Figure 7.6 Froodly - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Key partners are both, consumers and restaurant. Consumers provide the demand and restaurants provide the offer.</td>
<td>KEY ACTIVITIES
Promote restaurants’ menu and discounts, manage consumers’ orders</td>
<td rowspan="2">VALUE PROPOSITION
Allow consumers to purchase takeaway food from restaurants with a discount.
It aims at reducing the amount of food that is thrown away.
Peculiarity: Sales are time based, not only to avoid waste but also to increase demand in low periods (e.g. afternoon)</td>
<td>CUSTOMER RELATIONSHIP
The relationship with restaurants and consumers is strengthened by the sustainability aspect.</td>
<td rowspan="2">CUSTOMER SEGMENTS
Restaurants and consumers.</td>
</tr>
<tr>
<td>KEY RESOURCES
Mobile application, website and Network.</td>
<td>CHANNELS
Restaurant offer is passively proposed to the consumers through a website/mobile application.
The delivery is up to the consumer.</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Grablr faces advertise costs and the costs of managing website and application (maintenance, updating, …) ?and fees to allow debit card transactions.?</td>
<td colspan="2">REVENUE STREAMS
NA</td>
</tr>
</table>

Figure 7.7 Grablr - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Key partners are both, consumers and restaurant. Consumers provide the demand and restaurants provide the offer.</td>
<td>KEY ACTIVITIES
Promote restaurants’ menu and discounts, manage consumers’ orders, manage transactions</td>
<td rowspan="2">VALUE PROPOSITION
Allow consumers to purchase takeaway food from restaurants with a discount. It aims at reducing the amount of food that is thrown away.</td>
<td>CUSTOMER RELATIONSHIP
The relationship with restaurants and consumers is strengthened by the sustainability aspect.</td>
<td rowspan="2">CUSTOMER SEGMENTS
Restaurants and consumers.</td>
</tr>
<tr>
<td>KEY RESOURCES
Mobile application, website and Network.</td>
<td>CHANNELS
Restaurant offer is passively proposed to the consumers through a website/mobile application. The delivery is up to the consumer.</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
RESQ CLUB faces advertise costs and the costs of managing website and application (maintenance, updating, …) and fees to allow debit card transactions.</td>
<td colspan="2">REVENUE STREAMS
NA</td>
</tr>
</table>

Figure 7.8 ResqClub - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Key partners are both, consumers and restaurant. Consumers provide the demand and restaurants provide the offer.</td>
<td>KEY ACTIVITIES

Connect customers and restaurants through the app where surplus food is listed for promotions.
Manages deliveries</td>
<td rowspan="2">VALUE PROPOSITION

Reduce surplus food through promotion.</td>
<td>CUSTOMER RELATIONSHIP

The relationship with restaurants and consumers is strengthened by the sustainability aspect.</td>
<td rowspan="2">CUSTOMER SEGMENTS

Food service businesses and consumers.</td>
</tr>
<tr>
<td>KEY

Mobile app.
Ambassadors for the delivery of the food.</td>
<td>CHANNELS

Restaurant offer is passively proposed to the consumers through a website/mobile application.
Delivery.</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

Optimiam Ambassadors

App Costs</td>
<td colspan="2">REVENUE STREAM

NA</td>
</tr>
</table>

Figure 7.9 Optimiam - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Key partners are both, consumers and restaurant. Consumers provide the demand and restaurants provide the offer. Moreover, partnership with newspapers and online website is key in order to gain visibility</td>
<td>KEY ACTIVITIES
Promote restaurants’ menu and discounts, manage consumers’ orders, manage transactions. Reduce food waste.</td>
<td rowspan="2">VALUE PROPOSITION
Allow consumers to purchase takeaway food from restaurants with a discount of up to 90% off.
It aims at reducing the amount of food that is thrown away.</td>
<td>CUSTOMER RELATIONSHIP
The relationship with restaurants and consumers is strengthened by the sustainability aspect.</td>
<td rowspan="2">CUSTOMER SEGMENTS
Restaurants and consumers.</td>
</tr>
<tr>
<td>KEY RESOURCES
Mobile application, website and Network.</td>
<td>CHANNELS
Restaurant offer is passively proposed to the consumers through a website/mobile application.
The delivery is up to the consumer</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
BuffetGO faces advertise costs and the costs of managing website and application (maintenance, updating, …) and fees to allow debit card transactions.</td>
<td colspan="2">REVENUE STREAMS
The source of revenue is the final consumer. To join the application form both, restaurant and consumer sides is free of charge. BuffetGo revenues are created through a fee on each customer order, deducted from the restaurants’ margin.</td>
</tr>
</table>

Figure 7.10 BuffetGo - Business Model Canvas.

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIP	CUSTOMER SEGMENTS
Key partners are both, consumers and farmers. Consumers provide both the demand and the supply; and farmers provide the offer.	Connect farmers, local businesses and local community to trade surplus food.	Reduce food waste through sharing surplus food for free or promotion	The relationship with customers is strengthened by the sustainability aspect.	Local farmers and neighbours
	KEY RESOURCES Mobile application, website and Network.		**CHANNELS** Offer is passively proposed to the consumers through a mobile application.	

COST STRUCTURE	REVENUE STREAMS
Mobile App cost.	Registration and use is for free

Figure 7.11 Ripelist - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Grocery retailers and wholesale distributors farmers</td>
<td>KEY ACTIVITIES
Realization of a software which enables a better management of unsold inventory of food
Online Marketplace for surplus food.</td>
<td rowspan="2">VALUE PROPOSITION

Build technology to improve the management of unsold inventory and enable real time data visibility.</td>
<td>CUSTOMER RELATIONSHIP
Strengthened by the transparency of the service</td>
<td rowspan="2">CUSTOMER SEGMENTS

Food manufacturers, wholesale distributors, grocery retailers</td>
</tr>
<tr>
<td>KEY RESOURCES
Software for management of unsold inventory
Controlled relationship management portal that facilitate donations/discounts/etc.</td>
<td>CHANNELS
Website.</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Cost of the software.</td>
<td colspan="2">REVENUE STREAMS
A “starter pack” is provided for free, but companies have to pay Spoiler Alert in order to be able to use its software.</td>
</tr>
</table>

Figure 7.12 SpoilerAlert - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Charity organizations (demand)
Restaurants and businesses (offer)</td>
<td>KEY ACTIVITIES
Packaging and pick up the surplus food from corporations and restaurants
App provides reporting analytics to track food</td>
<td rowspan="2">VALUE PROPOSITION
Reduce the surplus food generated by businesses through donation.</td>
<td>CUSTOMER RELATIONSHIP
The relationship with customers is strengthened by the sustainability aspect.</td>
<td rowspan="2">CUSTOMER SEGMENTS
Food businesses and restaurants
Local nonprofits organizations</td>
</tr>
<tr>
<td>KEY RESOURCES
Mobile and web app technology (Blockchain)
Drivers</td>
<td>CHANNELS
Marketing to promote companies dedication;
Website and application;
Activities around the city;
Pick up and delivery;</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Drivers costs
Management of app and blockchain technology.</td>
<td colspan="2">REVENUE STREAMS
NA</td>
</tr>
</table>

Figure 7.13 Goodr - Business Model Canvas.

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIP	CUSTOMER SEGMENTS
Charity organizations, food businesses	Through the platform businesses can donate food. Drivers package, retrieve and deliver the food donation	Reduce food waste and feed people in need through the donation of surplus food by food businesses	Transparency between donors, drivers and charities	Businesses, Charities and people in need
	KEY RESOURCES Platform Drivers (food rescuers)		**CHANNELS** Platform Blog Pickup and delivery	

COST STRUCTURE	REVENUE STREAMS
Food rescuers Platform management	Replate is 100% non-profit. All donations are 100% tax deductible. Replate charges the businesses for the service of picking up and handling the food. (offer different plans for the businesses). Private donations

Figure 7.14 Replate - Business Model Canvas.

<table>
<tr>
<td rowspan="2">KEY PARTNERS

Local businesses and community.
13.000 Volunteers ambassadors.
1.500 food waste heroes (volunteers) that collect surplus food and share it on OLIO</td>
<td>KEY ACTIVITIES
Connect people and businesses through the app where surplus food is uploaded from users;
FWH collect surplus food and share it with the community</td>
<td rowspan="2">VALUE PROPOSITION

Connect people with each other and with stores to reduce food waste.
Makes people more aware through OLIO ambassadors</td>
<td>CUSTOMER RELATIONSHIP
OLIO built a strong community where customers and volunteers can share food, meet, connect to each other under the common interest of not wasting food</td>
<td rowspan="2">CUSTOMER SEGMENTS

Local shops/retailers, customers and neighbours</td>
</tr>
<tr>
<td>KEY RESOURCES

Online application
Community and volunteers</td>
<td>CHANNELS

Network of ambassadors to promote OLIO and aware customers
Website where to register
Social media</td>
</tr>
<tr>
<td colspan="2">COST STRUCTURE

Cost of the app management</td>
<td colspan="3">REVENUE STREAMS

OLIO generates revenues by charging businesses for the service it provides via the FWHeroes to enable them to have zero edible food waste stores</td>
</tr>
</table>

Figure 7.15 Olio - Business Model Canvas.

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIP	CUSTOMER SEGMENTS
100 food industry partners. i.e. Retail partners: TESCO, LIDL, ALDI, Waitrose. 120 charities (in Ireland). Volunteers to deliver and collect food.	Connect food business and local charities through its platform. It stores the surplus food in its own hubs. Pickup and delivery **KEY RESOURCES** Platform and mobile application. Hubs to receive and store food and vans to collect food from the businesses	Deliver fresh food to charities. Business can contribute to the health of the community and reduce food waste.	Strong relationship with businesses based on food waste reduction. **CHANNELS** Online platform Website where partners can sign up. Direct calls to charities to inform them on the stock and receive orders.	Food Businesses with surplus food (such as farms, manufacturers, distributors). Local charities (such as breakfast clubs, homeless hostels, family support services).

COST STRUCTURE	REVENUE STREAMS
Manage the application and platform. Physical assets: 3 hubs and a fleet of vans. Stock costs.	Charity partners pay a nominal contribution towards the storage and transport of the food.

Figure 7.16 FoodCloud - Business Model Canvas.

7.5 Appendix E: Interviews

Bigzpoon Interview

Business model analysis

1. Value proposition:

Bigzpoon aims at connecting through its platform food services and consumers to reduce food waste.

(1) Why did you choose to focus your business on food? Especially on food waste reduction and on the creation of value from waste? What moved you towards this direction? (Introduction on the history of the firm)
(2) What are the drivers that explain the reason why Bigzpoon decided to prevent food waste through the activity of selling surplus food at lower price?
Why did you choose this model instead of redistributing surplus food to charities/people in need through free donations?

2. Customer Segment:

The customers of your business are both food services (mainly restaurants) and final consumers.

(1) How do you build a network with both end users and food service? How do you reach new restaurants?
What type of marketing campaign do you perform to reach new customers and restaurants?
How does the loyalty program work?

(2) What type of food businesses can apply to be part of the platform? (e.g. restaurants, café, local shops, bakeries, small food businesses)
(3) Why Bigzpoon focuses its business on this segment and does not operate with other actors of the supply chain such as food manufacturers, farmers, distributors? What are the drivers of this choice?

a. How can this specialization affect the scalability of the business?
b. What are the impacts (advantages/disadvantages) of this specialization?
c. Would you be interested in expanding your customer base to other actors?

(4) How is it possible to have such a reactive marketplace, in order to have supply-demand concurrently?

3. Key Activities & Resources:

Bigzpoon supply to its customers the services of the platform and does not perform any logistics service.

(1) What are the advantages of managing a platform and mobile application?
(2) Bigzpoon does not supply any logistics activity. Why for example you did not implement a service of deliverying of the food from the restaurants to the consumers houses?

a. Is it due to resources/costs constraint? Or due to the fact that delivering is a business already widely spread? Or is it just too far away from your value proposition?

4. Costs & Revenues:

(1) How is the cost structure of the business built?

Signing up in the app is free of charge for both sides of the marketplace.

(2) Revenues are created through a small fee assigned to each customer order, which is deducted from the restaurant's margin. Why did you choose to adopt this type of revenue stream?
a. Why you did not choose to adopt a fixed monthly/annual fee paid by restaurants? Or a small fee required during the registration?

b. Why didn't you choose to charge the final customer instead of the food services?

Drivers & barriers

1. Why did you choose the concept of a platform and of service provider business model?

    a. Why instead not choosing a more traditional physical channel/stock owning business?

2. Do you think that in today's regulations (concerning food) there are more reasons in favor or against these types of business that enhance the reduction of food waste?
   What are the main constraints and difficulties (in dealing with this type of products)? (i.e. regulations on food expiration, preservation, management, etc.)

3. Do you think that geographic dispersion can represent a barrier for your business? Is this due to the type of product you are dealing with? What are the possible impacts on scalability?
4. Do you think that customers habits/cultural heritage represents a big barrier for food waste reduction? How do you think this could be changed and what actions do you take to change this social aspect?

JustNow Interview

Business model analysis

1. Value proposition:

JustNow aims at connecting through its application retailers and food services with final customers to reduce food waste.

(3) Why did you choose to focus your business on food? Especially on food waste reduction and on the creation of value from waste? What moved you towards this direction? (Introduction on the history of the firm)

(4) What are the drivers that explain the reason why JustNow decided to prevent food waste through the activity of promoting surplus food at lower price?
Why did you choose this model instead of redistributing retailers surplus food to charities/people in need through free donations?

2. Customer Segment:

The customers of your business are both retailers (and food services) and final consumers.

(1) How did you build a network with these actors?
How do you reach new retailers/food businesses?
What type of marketing campaign do you perform to reach new food businesses?
Do you perform any marketing for end consumers?

(2) What type of food business can apply to be part of the network within your app? (e.g. retailers, small local shops, distributors, bakeries, café, restaurants)
   a. What are the advantages for a food business in signing up in the app instead of performing promotions and special offers itself? (e.g. retailers in different countries can promote food close to its expiration date)

(3) Why JustNow focuses its business on this segment and does not operate with other actors on upper levels of the supply chain such as food manufacturers, farmers, distributors? What are the drivers of this choice?

   a. How can this specialization affect the scalability of the business?
   b. What are the impacts (advantages/disadvantages) of this specialization?
   c. Would you be interested in expanding your customer base to other actors?

(4) How is it possible to have such a reactive marketplace, in order to have supply-demand concurrently?

3. Key Activities & Resources:

JustNow supplies the marketplace service through its mobile app.

(1) Why you do not offer any logistics service such as delivery (for example from a restaurant/café to a consumer's house)?

(2) Why did you choose an hubless concept for your business model? What are the drivers that led you towards a platform concept instead of supplying a physical channel for the reselling of surplus food?

   a. What are the advantages of the model? What in terms of flexibility?
   b. What are the impacts of this choice in terms of scalability?

4. Costs & Revenues:

(1) How is the cost structure of your business built? (Main cost items)

(2) Since the signing up of the app is free of charge, how are revenues created?

   a. Which actor is charged during the transactions and how?
   b. Do the food services pay a monthly/yearly fee? Why/why not?

Drivers & barriers

5. Do you think that in today's regulations (concerning food) there are more reasons in favor or against these types of business that enhance the reduction of food waste?

What are the main constraints and difficulties (in dealing with this type of products)? (i.e. regulations on food expiration, preservation, management, etc.)

6. Do you think that geographic dispersion can represent a barrier for your business? Is this due to the type of product you are dealing with? What are the possible impacts on scalability?
7. Do you think that customers habits/cultural heritage represents a big barrier for food waste reduction? How do you think this could be changed and what actions do you take to change this social aspect?

Replate Interview

Business model analysis

1. **Value proposition:**

Replate aims at delivering surplus food to local charities and people in need, that would otherwise go into waste.

History:

(1) Why did you choose to focus your business on food? Especially on food waste reduction and on the creation of value from waste? What moved you towards this direction? (Introduction on the history of the firm)

(2) What are the drivers that explain the reason why Replate operates with charities and performs donations to people in need instead of performing for example other activities such as the resell of the surplus food (for example to other markets)?

2. **Customer Segment:**

The customers of your services are both food businesses and local charities.

(1) The platform connects food businesses with local charities, what is the role of the charities? what are the difficulties in the coordination and collaboration with them? What type of charities can apply for being part of the platform?
(2) Food businesses that are part of the platform are mostly food services (restaurants, bars, etc.). Why did you choose to focus your platform around these businesses? Why you did not choose other actors to be part of it such as farmers, food manufacturers, distributors? What are the drivers of this choice? How can this affect the scalability of the business?
    a) What are the impacts (advantages and disadvantages) of this specialization?

b) Would you be interested in expanding your customer base to other actors such as farmers, manufacturers, distributors?

(3) What are the benefit for a food business to work with you instead of reselling the food to secondary markets or dispose it?

(4) How is it possible to have a reactive marketplace, in order to have supply-demand concurrently? How is the network structure built?

3. Key Activities & Resources:

Replate provides different activities, such as connecting through its platform customers and suppliers; retrieve/deliver surplus food from food businesses to charities.

(1) How is it managed the pick-up and delivery system done by Replate? What are the advantages of delivering also these services (in terms of vertical integration) instead of supplying only the platform?

a. Why Replate requires a minimum volume of food in order to be able to pick it up? Is this due to resources or costs constraints?

b. What are the advantages of managing a mobile application/website where it is possible to organize the pickup (instead of for example of using direct calls, or other means)?

c. What are the impacts of pickup/delivery activities in the business cost structure?

The cars used to collect and deliver the food by the food rescuers are owned by Replate or each driver drives his/her own car to perform these logistics activities?

Replate does not own the stock of surplus food. But directly delivers it to charities.

(2) What are the reasons to do not own the stock but act only as a marketplace through the online platform? What are the barriers in which you would incur if you wanted to own the stock? Does Replate do not own the stock for reasons of: resources/costs/perishable product?

4. Costs & Revenues:

The activities of delivery and pick up are done by food rescuers (drivers).

(1) What is the impact of this cost item in the costs structure of the business?Why the business decided to pay the drivers instead of creating a network of volunteers to perform this activity?

a. Is it due to resources availability or for safety reasons (or other causes)? how is it managed the payment of the drivers? (i.e. per hour, per delivery, etc.)

The revenue stream of Replate charges food businesses for the logistics services.

1) Why are the businesses charged? Why businesses would agree with this charging method instead of disposing the food?
   Why not consider charging the charities for the service offered?
2) Replate aims also at collecting private donations, how is that feasible? What are the income of these donations?

Drivers & barriers

8. Did you choose the concept of a platform and of service provider business model due to the fact that customers nowadays have moved their preferences on access rather than ownership?
9. Do you think that in today's regulations (concerning food) there are more reasons in favor or against these types of business that enhance the reduction of food waste? What are the main constraints and difficulties (in dealing with this type of products)? (i.e. regulations on food expiration, preservation, management, etc.)
10. Replate operates not only locally but in a vast area. Do you think that geographic dispersion represents a barrier for your business? Is this due to the type of product you are dealing with? What are the possible impacts on scalability?

11. Do you think that customers habits/cultural heritage represents a big barrier for food waste reduction? How do you think this could be changed and what actions do you take to change this social aspect?

OLIO Interview

Business model analysis

1. **Value proposition:**

OLIO aims at delivering surplus food to local charities and people in need, that would otherwise go into waste.

(3) Why did you choose to focus your business on food? Especially on food waste reduction and on the creation of value from waste? What moved you towards this direction? (Introduction on the history of the firm)

(4) What are the drivers that explain the reason why OLIO enables only donations instead of performing for example other activities such as the resell of the surplus food?

2. **Customer Segment:**

The final consumers can be both, the suppliers and the customers.

(5) Your partners are mainly private citizens and local shops. For these segments, regulation is stricter or softer?
   a) What is the relevance of private citizens donations and food businesses donations in the business?
   b) What are the impacts (advantages and disadvantages) of this specialization?
   c) Do you redistribute food also to charities, why not? (There are restrictions/limitations for charities to apply for the service?)

(6) How is it possible to have a reactive marketplace, in order to have supply-demand concurrently? How is the network structure built?

3. Key Activities & Resources:

OLIO provides different activities, such as connecting the community through its platform, managing and coordinating “Food Waste Heroes” and “Ambassadors”.

(3) Olio is based on a strong sense of community, with a local scope. What are the benefits of working with local communities? Could this be an advantage or a disadvantage for the scalability of the business?

a. Being the pickers volunteers (food waste heros), have you ever experienced availability problems? How do you manage the unpredictability of workforce driven by this choice?
b. It has been difficult to build a network of reliable volunteers?

Is the geographical factor affecting the reliability of the community, because of cultural characteristics?

(4) How is it managed the pick-up and delivery of the “Food Waste Heroes”? Does OLIO take part in the planning or operational phase of these activities?

Why did they choose to use the FWH service to pickup the food?

a. How is the food stored by the “Food Waste Heroes”? How is food safety ensured? Do they follow any guideline/policies in preforming their activities?

“Volunteer hub”, how do they work? How is food safety ensured?

(5) What is the role of the “Ambassadors” in promotion and marketing?

(6) What are the advantages of managing a mobile application/website and food waste heroes chats where it is possible to organize the pickup (instead of for example of using direct calls, or other means)?

4. Costs & Revenues:

(1) How is the cost structure of the business built?

The revenue stream of OLIO charges food businesses.

(2) Why are the businesses charged? Why businesses would agree with this charging method instead of disposing the food? Why not consider charging the consumers?

(3) OLIO aims also at collecting private donations, how is that feasible? OLIO collects a 10% fee on every donation, is it possible to donate directly to OLIO or the above mentioned is the only way used to collect founds?

Drivers & barriers

12. Did you choose the concept of a platform and of service provider business model due to the fact that customers nowadays have moved their preferences on access rather than ownership? (why did you choose the concept of a platform, therefore an hubless model, instead of owning the stock and selling it in a physical channel?)
13. Do you think that in today's regulations (concerning food) there are more reasons in favor or against these types of business that enhance the reduction of food waste? What are the main constraints and difficulties (in dealing with this type of products)? (i.e. regulations on food expiration, preservation, management, etc.)
14. Do you think that geographic dispersion represents a barrier for your business, given the local focus of your initial project? Is this due to the type of product you are dealing with? What are the possible impacts on scalability?
15. Do you think that customers habits/cultural heritage represents a big barrier for food waste reduction? How do you think this could be changed and what actions do you take to change this social aspect?

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