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SPECIALTY SECTION

This article was submitted to
Quantitative Sustainability Assessment,
a section of the journal
Frontiers in Sustainability

RECEIVED 03 March 2022

ACCEPTED 29 July 2022

PUBLISHED 15 August 2022

CITATION

Del Baldo M (2022) When innovation
rests on sustainability and food safety:
Some experiences from Italian
agri-food start-ups.
Front. Sustain. 3:889158.
doi: 10.3389/frsus.2022.889158

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When innovation rests on sustainability and food safety: Some experiences from Italian agri-food start-ups

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In the context of the agri-food industry, innovative start-ups have come into the spotlight as key drivers of innovation, sustainability and food safety orientation. Prior studies have produced significant knowledge on these topics but have mainly addressed established enterprises, while little is known about agri-food start-uppers and their contribution to social and eco-innovation. To fill this gap, this paper explores new entrepreneurial initiatives in the agri-food industry to understand how and why food safety, as well as environmental and social sustainability issues, are incorporated into their business models. The empirical analysis—based on four Italian start-ups—points out start-uppers' awareness of the importance of protecting the environment and promoting sustainability and health. In this vein, innovation is driven by the start-upper desire to actively contribute to educate the consumer on healthier and more sustainable food and trigger more sustainable lifestyles. Accordingly, their businesses, given their agility and flexible models, are by nature among the first to propose innovative solutions that incorporate the principles of circular economy and sustainability.

KEYWORDS

agri-food, innovation, food safety, start-up, sustainability, Italy, case-studies

The agri-food industry has been defined by the [EU - European Commission \(2007\)](#) as the combination of the primary sector (agriculture, hunting and forestry) and the food industry (manufacture of food products, beverage, and tobacco) ([EU - European Commission, 2007](#); [Tell et al., 2016](#)). It is regarded as an important part of the EU economy in terms of jobs and GDP. However, the agri-food industry has traditionally been considered conservative, mature and with a low level of innovation ([Costa and Jongen, 2006](#); [Sarkar and Costa, 2008](#); [Cuerva et al., 2014](#); [Triguero et al., 2018](#); [Triguero, 2019](#)). Worldwide—including Italy—small and medium-sized enterprises (SMEs) represent the majority of agri-food companies ([Di Vita et al., 2013](#); [Banterle et al., 2016](#); [Bentivoglio and Giampietri, 2016](#); [European Commission, COMSE, 2020](#)). Traditionally, these companies have suffered from the lack of material and immaterial resources ([Karaman et al., 2011](#); [Corallo et al., 2020](#)) i.e., financial resources, qualified staff, R&D activities, collaboration, information sources and public financing ([De Martino and Magnotti, 2018](#)). Nevertheless, global trends for the future of the agri-food system—such as sustainability, climate change, food safety and health—have forced companies to make major transformations and revise their business models ([European Parliament, 2019](#); [FAO, 2019](#)).

In this vein, innovative startups—newly created and innovation-based enterprises—have come into the spotlight as key drivers of innovation within the agri-food system (Graziano, 2020).

Prior studies have produced significant knowledge on innovation in the agri-food sector by investigating how companies deal with different practices and tools aimed at promoting food safety (Karaman et al., 2011; Zhou et al., 2016; Steponavičienė et al., 2017; Rezaei et al., 2018; Da Cunha et al., 2019; Asante et al., 2020; Baur, 2020; Reddy et al., 2020). However, they have mainly focused on established enterprises by analyzing the characteristics of the business and/or the context that can foster innovation, while little is known about the purpose of innovation and entrepreneurs' motivations behind innovation, especially with reference to start-ups. In particular, it is unknown whether agri-food start-ups pursue typical business goals—such as cost reduction and product differentiation—or align with the call for a deep evolution of the agri-food system at the global level by triggering paths of social and eco-innovation (Jové-Llopis and Segarra-Blasco, 2018; Cuerva, 2019). The latter are incorporated in the business model and grounded on entrepreneurial/managerial orientation (Rankin et al., 2011; Tell et al., 2016) driven by a set of values (Schwartz, 1992; Schwartz et al., 2012) that translates into a social and environmental orientation (Tomczyk et al., 2013; Marques et al., 2014). In this regard, prior research addressing the Italian context is still limited (Brunori et al., 2013; Asioli et al., 2014; Bentivoglio and Giampietri, 2016; Malorgio et al., 2016; Corallo et al., 2020; Ghisellini and Ulgiati, 2020; Cesaroni et al., 2021; Palazzi and Sentuti, 2021).

Hence, to fill this gap, this paper explores new entrepreneurial initiatives in the agri-food industry, to understand how and why food safety, environmental and social sustainability issues are incorporated into their business models. Specifically, the study aims to answer the following questions: What are the start-uppers' objectives and personal motivations? What are the drivers of agri-food innovation? How do start-uppers implement food safety in their business models?

To reply to these questions, an empirical analysis has been carried out based on four Italian start-ups operating in the agri-food systems.

The remainder of the chapter is organized as follows: Section Literature review presents the theoretical background, focusing on circular economy and new business models, and directing the attention to the innovation and food safety in the agri-food system. Section Background/context: Agri-food and start-up in Italy introduces the empirical context, the methods and the case studies, and Section Discussion discusses the main findings. Finally, Section Conclusion draws conclusions in terms of implications, limitations and further research steps deriving from the study.

Literature review

Circular economy and the emergence of new business models

For decades, companies have adopted a linear economic model, based on 'take, make, and dispose' (Murray et al., 2017; Hopkinson et al., 2018). However, the awareness that the resources available are not infinite, along with the need to mitigate the effects of climate change (water pollution, rising sea levels and extreme weather events) caused by the industrial processes on the planet are progressively stimulating companies to adopt sustainable production models (Brinkmann et al., 2014; Yu et al., 2021).

The importance of closing material cycles (Aguilar Esteve et al., 2021) as a crucial element in a sustainable system, has shown the need to move to a logic of 'reuse, recycle, and recover' (David et al., 2019), typical of the Circular Economy (CE).

CE is regarded among the main instruments to deliver a sustainable world for future generations (Rodríguez-Anton et al., 2019) and as an effective option to respect the planet, ranging from sustainable production systems to the reduction of waste generated, both at the industrial and the individual levels (Rizos et al., 2016; Zucchella and Previtali, 2019). Although there is no single definition of CE, the most shared one (Ellen MacArthur Foundation, 2012) considers CE restorative and regenerative by design since it aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles. This new economic model enables key policy objectives such as generating economic growth, creating jobs and reducing environmental impacts, including carbon emissions.

The inclusion of the transition to the CE among the objectives set by the EU taxonomy for sustainable activities¹ marks the intention to disseminate circular production practices among European companies (Bassi and Dias, 2020; Lucarelli et al., 2020; Giacomelli, 2022). In the absence of mandatory rules (Schneider et al., 2018), sources of soft law, best practices and guidelines, together with the crosshairs issued by the various international and national organizations (European Commission, 2015, 2017; UN, 2015), highly contribute to CE progression (De Cabo et al., 2019). However, to be operationalised and not limited to only a few responsible companies (Marques et al., 2014; Lombardi et al., 2015; Oncioiu et al., 2018) CE requires a change in current business models (Bocken et al., 2016; Geissdoerfer et al., 2018). Moreover, besides the reconversion of the existing ones (Kulins et al.,

1 The EU taxonomy includes: overarching environmental and climate objectives: the transition to a circular economy, climate change mitigation and adaptation, sustainable use and protection of water and marine resources, restoration of biodiversity and ecosystems, pollution prevention and control (European Commission, 2015).

2016; Ritter and Pedersen, 2020), there is a call for new business models capable of incorporating the CE paradigm (Linder and Williander, 2015; Zucchella and Previtali, 2019), particularly in the agri-food sector (Esposito et al., 2020). The growing attention paid by policy makers, non-governmental organizations and scholars has prompted agri-food companies to incorporate sustainability into their strategies, putting food safety, production traceability, product quality and respect for the environment at the core (Sica et al., 2018).

Business model—one of the theoretical foundations in economics that has gained momentum both in the theoretical and practical fields (Zott et al., 2011; Clauss et al., 2021)—defines how a company provides value to customers and transfers payments to profit (Teece, 2010). It describes the logic of how an organization creates, delivers and controls value (Osterwalder and Pigneur, 2010).

Despite different definitions, there is a general agreement on the interconnected key elements of a BM: value proposition, value creation and value capture (Clauss, 2017). The dynamic dimension is inherent to the concept of business models (Fjeldstad and Snow, 2018). Business model innovation is seen as a key to companies' competitiveness, renewal and growth (Johnson et al., 2008; Santos et al., 2009; Johnson, 2010; Lambert and Davidson, 2013). A flexible business model incorporates innovation through radical changes, such as the one triggered by digital transformation (Breier et al., 2021; Clauss et al., 2021; Vaska et al., 2021), thus eliciting new opportunities to achieve, which are particularly urgent in a relatively mature and slow-growing sector such as the agri-food sector (Franceschelli et al., 2018).

Innovation in the agri-food sector

Several studies have investigated the factors concerning the activities enabling firms to conceive, develop and introduce new products, services and processes (Bossle et al., 2016; Cuerva et al., 2020). Among these, innovation has been proven to be the result of R&D activities and market orientation (Avermaete et al., 2004), qualified staff and enhanced sources of information (Avermaete et al., 2004), and collaboration along the supply chain (Carraresi and Banterle, 2015; Gonzales-Moreno et al., 2019). Moreover, it has been argued that innovation is affected by both internal factors (company size and the firm's age, among others) and external factors, such as regional economic performance (Lefebvre et al., 2015), public policies and the endowment of internal and external resources (Capitanio et al., 2010a; De Martino and Magnotti, 2018). Innovation capability is one of the most important factors in seizing new opportunities and enhancing competitiveness within the agri-food sector (Menrad, 2004; Rama, 2008; Capitanio et al., 2010b; Jové-Llopis and Segarra-Blasco, 2018).

In the past decade empirical research has been predominantly based on European countries and on the sectors of media, information technology and biotechnology, while the agri-food sector has received limited attention (Baregheh et al., 2014; Ulvenblad et al., 2014), except from a few relevant contributions (see Beuchelt and Zeller, 2012; Galli and Brunori, 2013), among others, solicited by the scientific community (i.e., the special issue of *International Journals Entrepreneurship and Innovation*, vol 15, issue 3, 2014).

Over the coming decade, the EU agriculture and agri-food sector are expected to provide higher productivity of healthy, safe and nutritious food, preserving natural resources as well in accordance to European strategy for smart, sustainable and inclusive growth (European Commission, 2010, 2012; EU, 2012) aimed to encourage innovation to meet the growing global demand for food and contrast ecosystem degradation and resources overexploitation (Wang et al., 2022). This objective requires robust investments to strengthen research, development and technological innovation (Giampietri et al., 2015), which can be accomplished through interactive approaches that bring together public and private sectors and involve stakeholders (farmers, businesses, NGOs, advisors, researchers) to create a cross-fertilization of science and practice, sharing knowledge and experiences, and speed up the innovation process that is crucial for many agri-food SMEs (Caiazza et al., 2014; Grosso et al., 2021). Innovation in small firms is associated with entrepreneurial features and internal capabilities as well as networking activities and collaborations useful to grasp information, external resources and other inputs (Romijn and Albaladejo, 2002).

In the agri-food- traditionally regarded as a sector with low research intensity (Minarelli et al., 2015)—companies should not innovate in isolation, but should embed their innovation activities in ecosystem populated by a network of actors and institutional framework conditions (Menrad, 2004; Corcoles, 2019). Indeed, networks and clusters play an important role in innovation processes (Pittaway et al., 2004; Musso and Francioni, 2015), especially when it comes to the competitiveness of a sector populated by SMEs, whose success depends on their flexibility and ability to interact with external partners to overcome internal restrictions (Neven and Droge, 2001; Di Vita et al., 2013; Bresciani, 2017). The agri-food entrepreneurs who have developed a more specialized managerial outlook have usually adopted new business models based on a network approach (Lawson et al., 2008; Brinkmann et al., 2014), or taken the form of hybrid organization in-between the for-profit sector and the non-profit sector (Boyd et al., 2009) to pursue the social and environmental goals.

The agri-food sector requires more and continuous innovation² to improve the productivity of agricultural products

² The Oslo Manual defines innovation as the implementation of a new or significantly improved product (good or service) or process, a new

and to adapt to input/output market developments and changes in resource quality and availability (OECD, 2013; Borychowski et al., 2020). This particularly applies to Italy, which is facing intense competition, especially from emerging countries (Materia, 2012; Maietta, 2014; Giacosa et al., 2017).

Innovation in the food sector can involve the development of new ingredients, new or significantly improved food products, new methods of food preservation, new ways of packaging and new marketing or organizational methods in the workplace or external relations. It represents a strategic factor that allows the reduction of production costs as well as the possibility to fulfill consumer expectations in terms of food quality, safety, ease of use and storability (Capitanio et al., 2010b).

Innovations introduced by agri-food firms are often incremental (Earle, 1997; Zouaghi and Sanchez, 2016), conservative (Costa and Jongen, 2006; Sarkar and Costa, 2008) and oriented to minimize production costs (Bigliardi and Galati, 2016) or improve product quality because of the increased consumers' attention to product quality and food safety (Shukla et al., 2018; Corallo et al., 2020).

In the last decade, the growing awareness of environmental and social issues on the global scale—boosted by the current pandemic (FAO, 2019)—has triggered processes of business model innovation in the agri-food system aimed at incorporating circular economy practices and eco-innovation (Rankin et al., 2011; Rabadán et al., 2021) and has allowed agri-food companies to pursue and combine high financial performance and social and environmental objectives (Tell et al., 2016; Bigliardi and Filippelli, 2021). Agri-food firms have been the focus of attention of governments and NGOs due to the effect that their production has on natural resources and the communities they operate in (Hartmann, 2011; Long et al., 2020). The potential vulnerability of agri-food companies to public opinion has driven them to integrate, within their corporate strategies, measures that incorporate social, environmental and ethical concerns in accordance with stakeholders' expectations, who are more attentive to food safety and food security [Lombardi et al., 2015; World Health Organization (WHO), 2020; Ammirato et al., 2021].

In this regard, eco-efficiency drives the interaction between ecological conditions and socio-economic factors as well as the combination of agricultural economic development and environmental protection (Pang et al., 2016; Deng and Gibson, 2019; Coluccia et al., 2020; Golas et al., 2020; Yanlin et al., 2020). Agricultural eco-efficiency requires less natural resource consumption and environmental pollution within the ecosystem (Deng and Gibson, 2019; Liu et al., 2020). Both intrinsic and extrinsic motivations have gained momentum in driving agri-food firms toward responsible conduct and orienting their policies to pursue sustainability objectives as requested by the

marketing method or a new organisational method in business practices, workplace organization or external relations (OECD/Eurostat, 2005).

2030 Agenda (UN, 2015). At the firm level, organizational moral motives, to act in accordance with ethical norms in society, are crucial in the product innovation processes of agri-food firms when aiming for socially responsible outcomes.

Innovation and food-safety

Food safety is synonymous with health protection and is an integral part of the values and innovative strategy of agri-food companies [Giraud-Héraud et al., 2009; Hammoudi et al., 2009; Pinstrup-Andersen, 2009; Griffith et al., 2010; FAO, 2019; World Health Organization (WHO), 2020; Yadav et al., 2021]. How a company deals with food safety is reflected in its strategies and business model, and, as a result, its processes and activities (Malorgio et al., 2016).

Food safety requires specific managerial, organizational and technical skills (Karaman et al., 2011; Asioli et al., 2014) and implies an orientation toward innovation (De Martino and Magnotti, 2018) that involves significant investments (Mensah and Julien, 2011; Asioli et al., 2014).

Being that a large number of agri-food companies are small, the lack of financial resources may represent an obstacle to the implementation of innovative food safety systems (Avermaete et al., 2004; Tomašević et al., 2013). The costs associated with food safety are often perceived as too high (Karaman et al., 2011; Asioli et al., 2014; Aung and Chang, 2014; Corallo et al., 2020). Indeed, managing food safety entails investing in new plants, new technologies and equipment, staff training and consultancy services (Mensah and Julien, 2011; Tomašević et al., 2013; Cavaliere et al., 2016; Hessing et al., 2020). In this vein, the lack of technical skills, adequate knowledge of quality management systems and trained personnel have been identified as the main barriers to the implementation of HACCP (Karaman et al., 2011), traceability systems in the agri-food industry (Bosona and Gebresenbet, 2013; Corallo et al., 2020), and food safety systems in agriculture (Rezaei et al., 2018).

Several contributions have pointed out the benefits of food security, including the ability to strengthen and protect corporate image and customer relations and ensure the transparency of production processes and the entire supply chain (Asioli et al., 2014; Mattevi et al., 2016). The practices and tools used to develop food safety create consistency with the values of the top management and improve the company's image and reputation, resulting in significant competitive advantages (Palazzi and Sentuti, 2021).

The factors that motivate companies to adopt food safety practices and systems can be traced back to external and internal factors (Mattevi et al., 2016; Corallo et al., 2020).

Among the main external drivers are the obligation to comply with the legislation (Mensah and Julien, 2011; Kirezieva et al., 2015; Mattevi et al., 2016; Corallo et al., 2020), the pressure from the rules and the social issues that are specific to the

context where the company operates (Golini et al., 2017; Baur, 2020), social norms that push the entrepreneurs/managers to engage in food safety practices (Rezaei et al., 2018) and the pressure of the social environment that enhances their awareness and encourages them to engage in more responsible behaviors in the area of product safety (Zhou et al., 2016), growing expectations on the part of consumers who are increasingly attentive not only to the quality and healthiness of products but also to the ethical, social and environmental implications of their production processes along the entire food supply chain (Grimm et al., 2014; Lokunarangodage et al., 2015; Faisal and Talib, 2016). In this sense, the introduction of traceability systems (Asioli et al., 2014) or quality standard certifications (Cavaliere et al., 2016) can be used by companies in the agri-food system as a tool to guarantee consumers a safe and quality product. Indeed, in the last few years the interest of agri-food SMEs and startup companies in the use of certification schemes has grown considerably (Gusmerotti et al., 2019).

Several prior contributions on innovation in the food industry have illustrated theoretical concepts with case studies but they have mainly addressed large firms. By contrast, empirical evidence about innovation patterns in small agri-food firms remains sparse (Avermaete et al., 2004) and calls for further investigation (Franceschelli et al., 2018).

Background/context: Agri-food and start-up in Italy

Agri-food production is a key component of the Made-in-Italy brand. Each year a huge quantity of high-quality products are exported all around the world and contribute to both the economy and the overall image of Italy (Del Giudice et al., 2012).

In 2020, the food and beverage (F&B) industry employed 4.82 million people in Europe with a turnover of 1.2 trillion euros and 366 billion of added value (Food Drink Europe, 2020). The F&B is among the largest manufacturing employer sector and major source of innovation (Kafetzopoulos et al., 2020); 59% of food companies have the necessary skills to tackle digital transformation. In Europe, the highest density of robotics is recorded in Sweden, Denmark, the Netherlands and Italy (ISTAT, 2018/2019). In Italy the sector has recorded positive performances closely linked to products connoted by designation of origin and geographical indication, such as Controlled and Guaranteed Designation of Origin (DOCG), Designation of Controlled Origin (DOC) and Typical Geographical Indication (IGT), Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) or Guaranteed Geographical Specialties (TSG) certifications, which are the driving forces of Italian export, with value representing about 19% of the total Italian agri-food economy (CREA, 2020).

Among the agri-food sector, whose structure is very diversified, SMEs represent a leading player. They generate

40% of the turnover and added value and guarantee over half of the jobs. There are over 63,000 SMEs of which 6,250 have more than 9 employees and 2,550 have more than 19 employees (ISTAT, 2018/2019). SMEs in F&B are showing great resilience (Bentivoglio and Giampietri, 2016). Their strengths are represented by the following elements: a wide range of high-quality products; close ties with the territory and the Italian cultural (tangible and intangible) heritage; high safety standards; and the ability to combine tradition and revitalize it through process and product innovation. The macro-areas of specialization include: nutrition and health consumer promotion; the nutritional enhancement of traditional Italian agri-food products; food safety that authorizes new technologies for food safety and the integrity of the agri-food supply chains in a global scenario; and sustainability of the Italian agri-food chain (Caiazza and Volpe, 2014; Caiazza, 2015).

Currently, agri-food is the second most important manufacturing sector in Italy, and despite the current economic crisis, it boasts a positive performance. However, this requires innovation competence to be enhanced since it represents the main driver of growth productivity and competitiveness. In this context, improving regional networks and agri-food clusters is a way to enhance and/or trigger innovation competence (Bentivoglio and Giampietri, 2016) and achieve long-term sustainability, facing significant challenges such as over-exploitation of agricultural resources, excessive use of inputs and pollution (Poppe, 2014).

On the one hand, the Italian agri-food sector represents an excellence thanks to its quality, food safety, cutting-edge technological innovation, sustainability, biodiversity and respect for tradition (Tiozzo et al., 2019).

On the other hand, the Italian agri-food industry must face several challenges. The process of valorising typical productions involves different dimensions: the nutritional and hedonistic one up to the technological, service, safety, authentication, traceability and certification aspects of the products; implementation of enabling technologies, industrial biotechnologies and nanotechnologies, advanced materials and manufacturing systems. To preserve their competitiveness in digitalisation, internationalization and the improvement of skills, start-ups often rely on external (European Commission, COMSE, 2020) and alternative financing forms such as crowdfunding (Cillo et al., 2019).

Methodology

The empirical study below introduced aims to understand how food safety and sustainability issues are incorporated into the motivations for creating start-ups and how they contribute to shaping the business model. Namely, the analysis addresses the following questions: RQ1: What are the start-uppers' objectives

and personal motivations? RQ2: What are the drivers of agri-food innovation? RQ3: How do start-uppers interpret and implement food safety in their business models?

The empirical analysis was conducted in Italy since the agri-food industry represents a strategic sector for the national and European economies (CREA, 2020).

A qualitative approach based on multiple case studies (Yin, 2003; Eisenhardt and Graebner, 2007) was carried out focusing on four Italian innovative agri-food start-ups. The case study approach is useful to investigate a phenomenon in its real-life context and is widespread in the context of small business research since it favors the in-depth analysis of concrete experiences or new areas of research (Eisenhardt, 1989; Ryan et al., 2007).

With respect to the research objectives the inductive approach, widely used in international management literature (Flick, 2009), allows researchers to understand, through in-depth analysis, complex phenomena characterized by a high level of inhomogeneity or a high degree of novelty and dynamism. This methodology is particularly suited to experimental research strategies (Eisenhardt, 1989; Yin, 1989). According to the explorative nature of the research questions, an interpretive-based methodology based on qualitative techniques was selected (Yin, 2014). The empirical research was based on the following steps: selection of the case studies among Italian agri-food start-ups registered at the end of 2020; collection of information through primary and secondary sources, including the company website, sector magazines, newspapers and direct semi-structured interviews addressed to start-uppers (Eisenhardt et al., 2016). The method of triangulation was applied to counteract the weaknesses of each source of data with the strengths of the others (Denzin, 2017).

The research strategy and the information sources are depicted as follows (Figure 1).

According to Italian Law 221/2012, innovative start-ups must meet at least one of the following three requirements: (1) investments in R&D activities; (2) hiring experienced researchers; and (3) holding a patent. A sample of innovative start-ups was selected within the agri-food industry from the Bureau van Dijk database AIDA, which includes a specific section for innovative start-ups.

By the end of 2020 more than 30,000 companies were included in the Italian agri-food sector belonging to the manufacturing and beverage industries (Ateco Sector codes 10 and 11). A further selection was made of active companies providing a phone number and an email address for a total of 6,159. Among these 104 companies were represented by innovative start-up.

The number of companies was supplemented with those included in the Bravo Innovation Hub Agrifood, the acceleration program promoted by Italian Minister of Economic Development as part of the Project “Enterprises and

Competitiveness including 66 companies” proposing innovative solutions in the agri-food chain.

Fifteen companies located in Northern and Central Italy were extracted from the sample, on the basis of the prevailing geographical distribution pointed out by prior research (Cesaroni et al., 2021; Palazzi and Sentuti, 2021): more than 50% of agri-food businesses active for less than 9 years are in fact located in the Northern Italy and 20% in Central Italy. All 15 companies were contacted by email and 4 of them were willing to cooperate (Table 1).

A key step was to define the method used for data collection and analysis from primary sources through a research protocol aimed to ensure reliability (Yin, 2014) and determine focal elements, including the identification of the key informant people, the length of interviews and the questions to be addressed to the start-uppers through semi-structured interviews (Qu and Dumay, 2011; Waddock, 2021). Specifically, the topics included: personal information; professional training courses; reasons for starting the business; orientation toward sustainability objects; attention to food safety and its implementation within the business model.

Online interviews through zoom and meet platforms were carried out from February to December 2021. In total, 8 recorded interviews lasting about 40 min each were done. The interviewees were invited to introduce themselves and talk about their start-ups and innovation processes. To elicit the discourse on how the decision to launch the start-up was born, the interviewees were allowed to speak freely about their company’s story, focusing on the phases related to its conception and start-up. We then asked questions to understand if and how the issue of food safety affects the company’s choices and behaviors (from the point of view of production, distribution, communication, etc.), and we focused on the most innovative aspect of their startup and what their objectives and personal motivations are.

Magila Aquaponic farms³

Magila is a family business and was founded by Laura (28 years old) who is currently the general director (sole administrator) and her parents. It is a micro enterprise with 3 employees in total. They decided to focus on a new production concept system called aquaponics, which combines environmental sustainability and technological innovation applied to agri-food production. During the interviews, Laura pointed out that: “*Like my parents, I have always put environmental issues and the quality of food at the core*”. Laura obtained a degree in Environmental Sciences from Bicocca University of Milan, and she did several internships related to the environment. The idea of the indoor greenhouse was born to adapt to the family shed and create a more

³ <https://www.magila.it/>

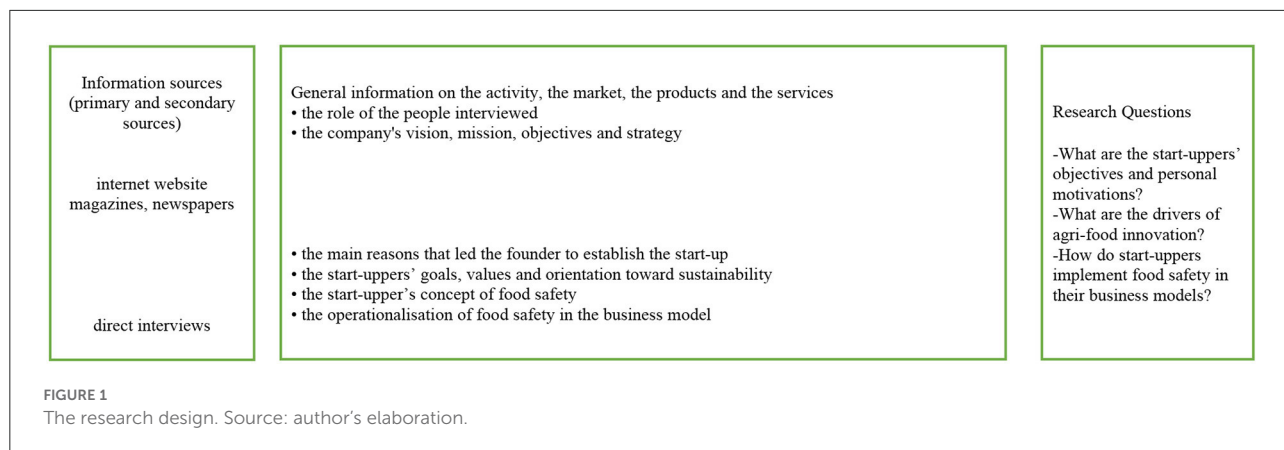


FIGURE 1
The research design. Source: author's elaboration.

TABLE 1 The selected case-studies.

Company's name	Location (IT)	Year of constitution	Activity
Magila Srl Società Agricola	Biassono (MB) Northern Italy	2019	Aquaponic
Future Farm Srl	Cassago Brianza (LC) Northern Italy	2017	Production of bio and dietetic juices
InovaFood Srl	Pordenone (PN) Northern Italy	2019	R&D ice cream, pastries
Smart Farm Srl Società Agricola	Meolo (VE) North-East	2018	Production of photosynthetic microorganisms and their derivatives, R&D microbiology applied to agriculture

protected environment for the plants. Laura has participated in numerous initiatives in which start-ups in the agri-food sector were present. For instance, in July 2019, through the Lombardy Energy Cleantech Cluster, Magila participated in the selection for the presentation of innovative projects within the European project VIDA (Value-added Innovation in food chains for the acquisition of knowledge and skills in support of innovation). Three years ago Laura decided to create a business based on aquaponics and was supported by her family who decided to invest in the project starting to grasp information, and interact with experts in aquaponics. The latter consists of a soilless agricultural technique derived from the integration of the aquaculture system (fish farming) and hydroponic cultivation (the cultivation of plants in aqueous solutions of nutritional salts) with continuous recycling and an integrated ecosystem, without the use of pesticides and fertilizers. The salads and micro-greens cultivated using this technique are healthy products with a low environmental impact (about 90% water savings) and are characterized by a higher nutrient concentrations than products obtained with traditional methods.

Magila sells its products directly to local consumers (both private and businesses).

She is aware of the urgent need to incorporate sustainable innovation in the agri-food business model, as her words testify:

“The average farmer who has been doing agricultural activities for generations lacks an innovative vision. If a plant is sick, it is normal to use medicine. A healthy collaboration between man and technology (for instance, the use of drones in agriculture) is essential to innovate agriculture and to tackle environmental problems. Moreover, the consumer should understand that it is better to choose seasonal products, produced close to the area where they live”.

Future Farm Srl⁴

Massimo Gualerzi is a cardiologist who has been involved in the prevention of cardio-metabolic diseases for many years. He decided to set up a company whose mission is to create quality products that help people diversify their diet to protect their health and that have no impact on the environment. Future Farm Srl was established in 2017 and based in the province of Lecco. It produces single flavor juices, consisting of fruit and vegetables only. The kit “Biodetox Strong Smoothie” is obtained using only organic ingredients, like seasonal fruit and vegetables harvested by hand, recycled paper for packaging and plastic-free packaging.

⁴ <https://www.dr-farmer.com/>

Initially, the company was made up of two partners: Massimo and a colleague, who took care of the operational part of the production. When they conceived the “Dr. Farmer” product line, the company “The Longevity Suite” was established and incorporated into Future Farm Srl. The financial provisions (600,000 the first time and 1,000,000 the second time) were collected through crowdfunding. Dr. Farmer juices are distributed in 18 Italian centers and directly delivered to final consumers attentive to health, weight loss, fitness and detox.

The company has also implemented co-branding strategies and training programs to improve external beauty, physical fitness and mental well-being. According to Massimo, “*the consumer should try to consume seasonal foods and focus on quality. People usually don’t know how to distinguish quality food from unhealthy food and are often misled by the advertising messages. In the Longevity Suite centres, people’s lifestyles are changed*”.

InovaFood Srl natural inventions⁵

Stefano Pillot is 52 years old and has been working in the ice cream sector for years. After getting a degree in agricultural sciences in 2003, he took over the trading company where he worked, transformed it into a production company and founded the Galatea brand, to produce artisanal ice cream. Galatea belongs to the small Gelinova group. He then founded with his wife the start-up Inovafood Srl, based in Pordenone, to carry out research and development in the agri-food sector and generate innovations beneficial to Galatea and Golosa, a company that focuses on confectioneries. Stefano and his wife are start-up partners, and they only have one employee, a food technologist. Currently, InovaFood is carrying out research trying to find a sugar substitute to improve health. Food safety rests on both the use of technology and raw materials.

In this regard Stefano affirmed that: “*Large distribution networks are being more and more attentive to traceability, natural and organic products. To improve food safety and increase the quality of their diet, consumers, who are poorly informed, need more information and knowledge on the labels and must be encouraged to consume better products*”.

Smart Farm Srl Società Agricola

Matteo Fecchio is a 33-year-old agricultural expert who, after graduating, set up a sole proprietorship operating in two production lines: a more traditional one, devoted to cultivating aromatic plants addressed to the fruit and vegetable market, and an innovative one, focused on a micro-algae project known at the University of Padua. After 3 years of experimentation, in 2020 Matteo, with the support of financing partners, set up a production plant of a superfood, a micro-algae called

spirulina, used for its properties in the field of nutraceuticals. Today the Smart farm Srl Società Agricola has been legally constituted as a start-up, to introduce several types of algae and improve the production and efficiency of spirulina, combining the extraction of essential oils from medicinal plants. The start-up is also evaluating the insect breeding project for food use. A further innovative aspect concerns the technologies adopted to obtain new generation foods, making them accessible to all, and the sustainable agricultural model, attentive to both economic and environmental issues through the use of renewable sources. Matteo and his partners collaborate with other agrifood companies and universities (Padua and Pisa) on projects focused on the reuse of organic waste in cultivating algae. The founder affirms: “*We are facing several problems due to bureaucracy to guarantee food safety in accordance with the law and the required controls. As a consequence, we need to lower production costs as much as possible during the cultivation phase and to adopt new sales strategies such as online commerce. Many farmers do not have an innovative mentality and do not understand the importance of online commerce and the use of innovative technologies to increase product quality*”.

A synthesis of the main findings useful to answer the research questions is provided in the table below, which includes some excerpts drawn from the interviews (Table 2).

Discussion

Drawing from the case studies, innovation in agri-food start-ups is mainly guided by objectives such as ensuring better food safety of products, improving organoleptic quality, and implementing a sustainable production process. Behind these objectives, and referring to the first research question, start-uppers’ motivations often have nothing to do with traditional profit orientation and are strongly linked to personal and familial values and beliefs (Schwartz et al., 2012). Environmental sustainability deeply affected their choices to become entrepreneurs and is among the main reasons that led them to decide to start their businesses. Start-uppers are convinced of the importance of protecting the environment, sustainability and health. In this vein, innovation is driven by the desire to leave a healthier environment or educate the consumer on healthier and more sustainable food by triggering more sustainable lifestyles (Lombardi et al., 2015). For instance, InovaFood Srl uses social media and organizes webinars to promote food safety and sustainability issues.

In some cases, such as Magila Aquaponic, they are inspired by the desire to reinterpret traditional products or production processes. They are driven by the desire to ensure food safety beyond legislation compliance because they feel the ethical responsibility of their entrepreneurial actions in the agri-food system (Brunori et al., 2013; Jové-Llopis and Segarra-Blasco, 2018). Start-uppers are also aware that consumers are more concerned with sustainability and food safety due to the Covid

⁵ <https://www.galateagelati.it/azienda/>
<https://www.inovafoodsrl.it/>

TABLE 2 Main findings outline.

Company's name	What are the start-uppers' objectives and personal motivations?	What are the drivers of agri-food innovation?	How do start-uppers implement food safety in their business models?
Magila Srl Società Agricola	<i>"Like my parents, I have always put environmental issues and the quality of food at the core".</i>	The family supported and shared the founder's decision to invest in the project grounded on sustainability production.	Magila Aquaponics continuously recycles and rests on an integrated ecosystem, without the use of pesticides and fertilizers.
Future Farm Srl	<i>"My goal is to prevent cardiometabolic diseases and complement research in the metabolic field as there is ample space to create quality products that help people diversify their diet to protect their health Hence, Longevity Suite is a company that aims to generate programs to improve external beauty, physical fitness and mental well-being".</i>	The skills and knowledge in cardiology and the capability to provide an effective response to people attentive to health, fitness, weight loss and who avoid any form of intoxication to prevent cardio diseases.	The production of bio and dietetic juices is based on fibers that slow down the absorption of sugars, and help to prevent sudden changes in blood sugar, without the use of any pesticide. Product are obtained using only organic ingredients, like seasonal fruit and vegetables harvested by hand, recycled paper and plastic-free packaging.
InovaFood Srl	<i>"Our goal is to create a research and development container to be used not only for selling products, but also to serve as a consultancy and assistance provider for other companies in the sector".</i>	Relationships with universities allow the companies increase knowledge, implement innovation and disseminate the culture of food safety.	The primary company devoted to producing ice cream and pastries has implemented regulatory standards for food safety, as well as ethical and social certifications. Food safety rests on innovation through the use of new technologies, ingredients and raw materials and communicative tools such as the smart label, to offer consumers transparency when it comes to information. Examples include: the methods of replacing classic preservatives with natural methods, to obtain cold pasteurized milk (to preserve the nutrients and make the proteins more digestible), new system to replace emulsifiers and hydrogenated fats, and conventional stabilizing systems with systems deriving from fibers, recovery of natural and not invasive raw materials, the search for a sugar substitute to avoid healthy problems.
Smart Farm Srl Società Agricola	<i>"I have always been attracted to the world of algae, discovered through a biologist from the University of Padua, and to the world of nutraceuticals for the care of the body through a healthy functional diet. My desire is to trigger a new way of growing, using plants, and existing technologies to produce new generation foods and making them accessible to everyone".</i>	Collaborations with other companies in the sector and with universities (Padua and Pisa) to set up plants grounded on the use of renewable energies and circular process based on the reuse of organic waste in the nutrition of algae.	The business model is dynamic and replicable and attentive to both economic and environmental issues. It is based on the production of photosynthetic and the use of renewable sources (biogas, photovoltaic), HACCP protocols. It rests on innovative projects such as the breeding of insects for food use or the use of agricultural waste—which becomes a cost in terms of disposal—in the production cycle, putting it in combustion inside a boiler that feeds and heats the greenhouse environment, like macro algae used to obtain bioplastic destined to make new products.

pandemic, which has led them to be more attentive to health, thus encouraging them to boost innovation that manifests through sustainable products and processes i.e., the use of energy retrieved from renewable sources and recycled materials (Baregheh et al., 2014; Bocken et al., 2016; Bassi and Dias, 2020).

In relation to the second research question—the drivers of food safety for businesses—the results from prior studies have highlighted two main drivers: pressure from stakeholders (Grimm et al., 2014; Lokunarangodage et al., 2015; Faisal and Talib, 2016; Golini et al., 2017; Baur, 2020) and internal factors attributable to the desire of the management to improve the corporate image and reputation (Aung and Chang, 2014). In this vein, results from the case studies mark the relevance of intrinsic reasons that trigger the entrepreneurial orientation and the will to create consistency with basic values, which can help to explain individual decision making, attitudes and behaviors (Schwartz et al., 2012).

With regard to the third research question results drawn from the analysis point out that food safety is integrated in the business model processes. Therefore, it is not only in compliance with legislation and the adoption of *ad hoc* solutions to solve contingent problems through a reactive approach; rather, it is much more since food safety is an integral part of the corporate values and strategy. The barriers pointed out by previous studies in terms of excessive costs (Karaman et al., 2011; Asioli et al., 2014; Aung and Chang, 2014; Corallo et al., 2020; Hessing et al., 2020), the lack of financial resources and public contributions (Tomašević et al., 2013), the lack of partners and suitable technologies, do not seem to hinder innovation. The analyzed companies manifest a tension surrounding food safety that overcomes the lack of skills, experience and information (Mattevi et al., 2016) by accessing external resources and activating partnerships with actors belonging to the entrepreneurial ecosystems (i.e., universities, research centers, etc.) (Giacosa et al., 2017).

Conclusion

High-intensity and rough traditional agricultural production methods have led to structural imbalance and the functional degradation of several ecosystems (Horton et al., 2016). Sustainable agri-food eco-systems share data and information among farmers, businesses and consumers and apply transparent and dynamic decisions. Therefore, contemplating food security and sustainability in the business model is a key challenge for agri-food companies called to embody circular economy processes, especially for small and young agri-food companies that suffer from structural limits, making it more difficult to invest and innovate (Costa and Jongen, 2006; Sarkar and Costa, 2008; Cuerva et al., 2014; Triguero et al., 2018; Triguero, 2019). However, the complexity, fragmentation and barriers of the agri-food system can be

overcome through collaborating with stakeholders both public and private organizations—starting with universities (Menrad, 2004; Corcoles, 2019). Partnerships between agri-food start-ups and universities are essential to foster innovation (in terms of nutrition and health claims, certification and product traceability, development of technologies for high quality and healthy products) and to improve food safety, as well as raise consumer awareness of food safety (Karaman et al., 2011; Mensah and Julien, 2011; Asioli et al., 2014; Caiazza and Volpe, 2014; Malorgio et al., 2016; De Martino and Magnotti, 2018). The whole system must enhance its contribution of small producers, who have innovative ideas, are particularly attentive to food security and offer an important contribution to leverage local economies [World Health Organization (WHO), 2020]. Start-ups, given their agility and flexible models, are by nature among the first to propose innovative solutions. Innovative technologies are fundamental in the start-up world of agri-food, including the agritech sector, the development of technologies for traceability and food safety (Karaman et al., 2011; Zhou et al., 2016; Steponavičienė et al., 2017; Rezaei et al., 2018; Da Cunha et al., 2019; Asante et al., 2020; Baur, 2020; Reddy et al., 2020) and the design of solutions to satisfy new consumption models and the creation of new products.

Value and implications

Studying objectives that guide innovation and start-uppers' motivations behind innovation in the agri-food sector is relevant to understanding whether and how newly created and innovation-based enterprises are sensitive to global trends for the future of the agri-food system and ready to take on the challenge.

This study highlights that even in a traditional sector such as the agri-food, new entrepreneurial figures are emerging, driven by the sensitivity to sustainability, environment, health, and food security [World Health Organization (WHO), 2020]. This study is also valuable for enabling policymakers to identify the levers on which to promote an entrepreneurial culture more oriented toward the agri food industry trends. This is particularly relevant in Italy, which hosts two of the most important international accelerators (Start-up BookCamp, FoodTech and FoodForward), and where food-tech ('from the farm to the fork') leverages innovative digital technologies for the production, storage, processing, packaging, control and distribution of food (Asioli et al., 2014; Malorgio et al., 2016; Corallo et al., 2020). Moreover, Italy covers a strategic positioning on the CE also due to the increasing regulatory focus (e.g., law 221, 28 December 2015; 'Toward a model of Circular economy for Italy' and other legislative decrees) (Ghisellini and Ulgiati, 2020).

Given the results, this study contributes to pointing out the drivers of this orientation grounded on sustainability-oriented

business models and emphasizes the relevance of the start-uppers values.

Limitations and further research

This study has some limitations that can be addressed in further research. First, results cannot be generalized since they are drawn from the analysis of a limited number of cases. Case studies are not based on statistical generalization (Tsang, 2014), while they can provide an analytical generalization that derives from the observation of a specific phenomenon, aiming to determine theory understanding and explanations useful for other cases (Yin, 2013). At the moment, four start-uppers have been interviewed, but data collection relative to additional case studies is still ongoing. Further interviews will be useful to reach a satisfactory level of “theoretical saturation” (Eisenhardt, 1989). Accordingly, future research could investigate both the objective of innovation and the motivations of start-uppers by reiterating the analysis on a more ample sample, including mature agri-food companies, and adopting a comparative perspective. Finally, the methodological approach could be complemented by adopting a quantitative-based analysis perspective to carry out a survey addressed to all companies populating the agri-food system, in Italy and/or in other European countries.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Funding

This work was benefited from the contribution of the University of Urbino for the co-financing of publications by the Department of Economics, Society and Politics (year 2022) and for the University Scientific Research on the theme of the promotion of health and food safety “Food safety: Guidelines, strategies and performance of agrifood companies”.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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