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THE TRIPLE LAYERED BUSINESS MODEL CANVAS IN SMART AGRICULTURE: THE CASE OF EVJA STARTUP

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Abstract

In recent years, the studies of Business Model Innovation (BMI) and Circular Economy (CE) have been issues much debated in the literature. Moreover, the sustainable development enhanced by the Green Economy (GE) and by smart technologies represents a huge opportunity for generating profit in new and environmentally way. Actually, was not widely investigated in academic literature, what is the impact of the Sustainable Business Model (SBM) in terms of competitive advantage for the firms, especially for small and medium-sized enterprises (SMEs) beyond big companies. The main research question was: "There's a sustainable or circular business model in the literature that can be used in the smart agriculture industry?" Moreover: "How the emerged managerial model can be applied to the case of an Italian firm?" The research design is based on the following phases. Firstly, give a literature review of significant and emerging studies on BMI and SBM. In a second step, access to a conceptual and managerial model, in order to compare it in the scientific community and expand the debate on sustainable development also in managerial perspective. The proposed conceptual model has been tested on EVJA company, a leading Italian innovative start-up operating in the smart agri-food industry. The methodology adopted was a qualitative analysis. Earlier, starting with a deep literature review in order to identify and classify the main contributions on the topic of sustainable and circular business models. Later, by in-depth interviews and focus group to a firm's key informants (namely the CEO and Co-Founder and Chief Technology Officer and Co-Founder of the firm) and on experts and practitioners deriving from the academic and managerial community including the smart agriculture industry. Lastly, the desk research on the case study was enriched by the recurs to primary and secondary sources on the topic of smart technologies and sustainable agriculture. The final aim is to suggest a managerial tool, namely the Triple-Layered Business Model Canvas (TLBMC), in the reference framework of the circular economy, to support the farm manager to figure out an appropriate course of action to promote energy-saving and reuse practice for fighting climate changes. In a managerial way, this could provide better services and products in terms of value for money to the customers. The TLBMC tool in agri-food industries can foster the SMEs to captures value by evaluating the potentials of SBM and producing in a more economical and responsible manner. In a holistic vision, that would involve its customers, suppliers, employees, and communities, as well as its shareholders.

1. Introduction

Has become very current, at the beginning of the XXI century, what Albert Einstein said: *"Serious natural disasters demand a change of mentality that forces us to abandon the logic of pure consumerism and promote respect for creation."* Surely the COVID-19 pandemic has changed existing Business Models (BM). Finding new normality means reviewing the current paradigm in respect of the environment and in a social dimension of the entrepreneur (eco-sustainable products, better working conditions). These effects will accelerate the digitization process of SMEs responding to the new purchasing habits. There are many quick solutions and incremental innovations fostering by the new technologies that will have a strong impact on new products and services. Therefore, firms need new business models to grasp the opportunities offered by the Circular Economy (CE). This paper investigates to what extent existing frameworks, methods, and tools for Business Model Innovation (BMI) are useful to cope with the challenges of designing and implementing Circular Business Models (CBM). The continuing growth of global resource consumption is a challenge in today's resource-intensive economies and for the level of competition. Firms are confronted with an uncertain supply of resources, due to scarcities on the market, increased government intervention and geopolitical tension to secure resources, and increased damage to global ecosystems. CE is an economic system aimed at eliminating waste and the continual use of resources. Circular systems employ reuse, sharing, repair, refurbishment, remanufacturing, and recycling to create a closed-loop system, minimizing the use of resource inputs and the creation of waste, pollution, and carbon emissions (Geissdoerfer et al., 2017). The CE tries to set the products, equipment, and infrastructure in use for longer, in order to improve resource productivity. All wastage should become useful for further processes: either a by-product or recovered resource for another industrial process or as regenerative resources for nature (Invernizzi et al., 2020). This regenerative approach is in contrast to the traditional linear economy, which has a "*take, make dispose*" of production model (MacArthur, 2013). CE Scholars (Andersen, 2007; Stahel, 2016; Lacy and Rutqvist, 2016; Bocken et al., 2016; Lieder and Rashid, 2016; Kirchherr et al., 2017) suggest that a sustainable world does not mean a drop in the quality of life for consumers and can be achieved without loss of revenue or extra costs by firms. Then, the CBM can be as profitable as linear models, allowing us to keep enjoying similar products and services. The intermediate step between circular and linear (horizontal) models is represented by the Triple Layer Business Model Canvas (TLBMC). According to Joyce and Paquin (2016), the TLBMC provides an integrative approach to support those seeking to understand existing BM and creatively explore potential sustainability-oriented BMI.

Integrating the economic, environmental, and social layers supports (vertical coherence) a more robust and holistic view of an organization's business model through its actions and relationships, which can support a more systems-level perspective of sustainability-oriented innovation (Zott and Amit, 2009). The 2030 sustainable agenda is pushing the industry to develop new solutions, transforming and re-designing our infrastructures by focusing on innovative technologies that enable doubling food production, infrastructure growth, and urban development in a sustainable way. At the same time, the demand for smart agriculture technology is increasing and new CBM is emerging. A trend becomes stronger by the increasingly stringent regulatory requirements, and by a growing interest from producers and consumers. In the wider context of the shared-value, the business and social goals could be realized better and at the same time, the impact on the environment minimized (Michelini, 2012). In this scenario, the evolution of agriculture 4.0, also called smart farming (Walter et al., 2017) is linked to the industry 4.0 topic. The rising of big data, drones, and the Internet of Things (IoT) are spreading development processes and connections between products and production, territory and environment, logistics, and commercial networks (Gubbi et al., 2013). Smart agriculture (Campbell et al., 2014), precision farming (Auernhammer, 2001), and precision agriculture (Stafford, 2000) are increasingly common terminologies in the field of technologies applied to the world of agriculture. Following the guidelines suggested by FAO, become more and more significant develops new cultivation ways and smart agriculture offers innovations methods of production. A novel approach to agriculture to satisfying the growing demand of the nine billion people who will populate the planet by 2050. The new logic founded on data-based decision-making structures becomes the frontier for the development of predictive solutions that can provide indications on where, when, and how to operate in an increasingly efficient and effective manner. As a result, smart farming surrounds itself with technologies such as software applications, IoT sensors, data analytics, and end-user services that open up new technological scenarios and BM. On the other side, farmers do not receive a different view of their cultures than they do today, but they do have more precise, real-time-generated sets of information that can be compared, via the cloud and open data, to historical elements, as well as cross-fertilized environmental factors. Collecting data is, however, only the first step towards smart farming: it is necessary to start processing these datasets using machine learning algorithms that can, if properly trained, generate future predictions and, consequently, provide feedback to make data-driven decisions for agriculture. This paper aims to provide conceptual insight on CBM by exploring the concept and potential approaches to pursue. The CE can be a successful driver for change by focusing efforts on economic and environmental issues while also addressing socioeconomic challenges such as (un)employment. The business model of firms is viewed as a systematic driver for change in a company, bringing together the various elements of the way of doing business: the value proposition (what value is proposed and to whom); value creation and delivery (how this value is provided) and value capture (how money is made and other forms of value are captured). To develop and validate new business models, experimentation is needed. The technological evolution increasingly at the service of agricultural businesses is evaluated by the case of an innovative start-up that has devised a system to support precision and sustainable agriculture. According to World Bank figures, in 2016, more than 700 million hectares (1.7 billion acres) were devoted to growing corn, wheat, rice, and other staple cereal grains nearly half of all cultivated land on the planet. In the coming decades, however, meeting the demand for accelerated agricultural productivity is likely to be far more difficult than it has been so far. The need to reduce chemical inputs to aim for "zero residues" is pushing the agricultural industry to look for increasingly innovative solutions capable, at the same time, of ensuring economic sustainability mainly for the SMEs. Moreover, the environmental impact of agriculture involves a variety of factors (Van der Werf and Petit, 2002) from the soil, to water, the air, animal and soil variety, people, plants, and the food itself. Some of the environmental issues that are related to agriculture are climate change, deforestation, dead zones, genetic engineering, irrigation problems, pollutants, soil degradation, and waste. Sustainable agriculture means farming in sustainable ways, which means meeting society's present food needs, without compromising the ability of current or future generations to meet their needs (Reganold et al., 1990).

2. Business model in smart agriculture

Technological innovations will play a prominent role in the transition to smart agriculture. However, technological innovation diffusion is subject to socio-economic barriers. The success of innovations is partly dependent on the business models that are used to diffuse them. Within the context of innovations for smart agriculture, the role that innovation providers' business models play in the successful adoption and diffusion has received limited attention (Long et al., 2016). The concepts of Business Models (BM) and, more recently, Business Model Innovation (BMI) have become influential in management research in recent years (Zott et al., 2011; Ricart, 2014; Geissdoerfer et al., 2016; Foss et al., 2017). BM literature has highlighted the usefulness of the BM construct in research on e-commerce, strategy, and technology management. Teece (2010) offers a notion of BM as the *"design or architecture of the value creation, delivery, and capture mechani-*

sms" of a firm. BMI is a mainstream in the study on business models, Schallmo (2013) and Foss and Saebi (2017) provided an extensive literature review on the topic, which was updated and complimented for this research. A summary overview of the main contributions on the Business Model (BM) and Business Model Innovation (BMI) are shown in table 1 (see appendix). The concept of BMI is deeply enquired by Schallmo (2013) to understand the analysis and planning of transition from one BM to another. The capability to realize a successful BMI can increase an organization's resilience to changes in its environment and create a sustainable competitive advantage (Mitchell and Coles, 2003). These definitions refer to BMI as a mutation in some elements of BM, both as a reaction to opportunities or challenges in the organization's environment or as a way to diversification and innovation. Accordingly, to that, the topic's fields of application have been in corporate diversification (Ansoff, 1957), business venturing (Shane, 1993), and start-up contexts (Kuivalainen et al., 2021). In a holistic vision, the BMI is related to the conceptualization and implementation of new business models. This latter can comprise the development of entirely new BMs, the diversification into additional BMs, the acquisition of new BMs, or the transformation from one BM to another (Geissdoerfer et al., 2018). The conversion can affect the full BM or a combination of its blocks: value proposition, revenue or cost model, delivery and value capture elements, and further the interrelations between the elements, of the value network (Fjeldstad and Snow, 2018). The need for greater sustainability, in terms of social and environmental impacts, can be considered a major antecedent of BMI. The popularity of the sharing economy or collaborative consumption has given to innovative forms of BMs that facilitate the exchange of underutilized assets among individuals (e.g., Airbnb, Zipcar, Rent the Runway). Similarly, the need to facilitate inclusive growth (Spiess-Knafl et al., 2015; Yunus et al., 2010) or target low-income consumers (Anderson and Kupp, 2008; Sánchez and Ricart, 2010) can result in significant BMIs. The need for sustainability pushes the creation of sustainable BMs, and the question of: *"How managers can innovate their BMs toward greater sustainability"* has not been addressed sufficiently to date. Thus, a more explicit and systematic investigation of the BMI construct is warranted to further this research field.

2.1 Sustainable business model innovation

Italian agricultural companies, especially small farms, are struggling to be profitable in difficult economic times. It is a challenge for Italian farmers to compete with imported products on prices. The agricultural industry, however, supports the view that through business model innovation, farms can increase their competitive advantage. Moreover, Sustainable development is an increasingly important concern for business managers. If current population and consumption trends continue, by the 2030s we will need the equivalent of two Earths (Global Footprint Network, 2014). Empirical studies have shown that CEOs see sustainability as more important than ever for long-term success, and believe sustainability issues should be fully integrated into the strategy and operations of a company (Lacy et al., 2012). To address this, radical and systemic innovations are needed (Boons et al., 2013). Sustainable Business Model Innovation (SBMI) is an approach for firms to re-conceptualize the purpose of the firm and its value-creation logic to improve its environmental and social sustainability (Bocken et al., 2014). Existing research on Sustainable Business Models (SBM) has identified several archetypes of strategies firms can pursue SBMI, such as promoting eco-efficiency, creating value from waste, or delivering functionality rather than ownership. Although the question: *"How companies can transform their business models to become more sustainable"* is highly relevant for society and management, it is yet poorly understood (Sommer, 2012), and the harmonization by firms to the sustainable mainstream has been slow. More research is needed on the wider social and political changes required to make these archetypes mainstream (Bocken et al., 2014). Recently, research on sustainable innovation has become more focused on the coevolutionary process in which technologies, social practices, and institutions change towards sustainability (Boons et al., 2013). Organizations can only be sustainable when the whole societal system is sustainable. Both structural and cultural changes are required to facilitate firm- and system-level sustainability (Stubbs and Cocklin, 2008). Business model innovation is conventionally focused on the firm's internal strategic activities, but these activities are greatly affected by the institutional environment in which the firms operate (Zott and Amit, 2007). It is thus important to take a step beyond the business model of the individual firm and identify and analyses the structural and cultural driving forces and barriers that have an impact on SBMI. Bocken et al. (2014) has introduced a more comprehensive view of how firms should approach embedding sustainability in their business models by introducing SBM archetypes that are groupings of mechanisms and solutions that may contribute to BMI for sustainability. These archetypes are introduced to develop a common language that can be used to accelerate the development of SBMs in research and practice. We have adapted the SBM archetypes by Bocken et al. (2014) as follows. The archetypes are (1) Pollution control, (2) Maximize material and energy efficiency; (3) Create value from 'waste'; (4) Substitute with renewables and natural processes; (5) Deliver functionality rather than ownership; (6) Adopt a stewardship role; (7) Encourage sufficiency; (8) Re-purpose the business for society/environment, and (9) Develop scale-up solutions. Further, the archetypes are classified in higher-order groupings, which describe the main type of business model innovation: Technological, Social, and Organizational oriented innovations (Boons and Lüdeke-Freund, 2013). Different archetypes lead to divergent sustainability benefits, and firms can use one or a selection of SBM archetypes for shaping their own transformation. Real sustainability almost certainly demands the combined use of different archetypes. (Bocken et al., 2014). Lately, following this new perspective, takes greater attention to the above-mentioned Triple-Layered Business Model Canvas (TLBMC). A model is a practical tool for coherently integrating economic, environmental, and social concerns into a holistic view of an organization's BM (Joyce and Paquin, 2016). The TLBMC builds on Osterwalder and Pigneur's (2010) original BMC by explicitly integrating environmental and social impacts through additional business model layers that align directly with the original economic-oriented canvas. Actually, the TLBMC is an easy-to-use tool that supports creatively developing, visualizing, and communicating SBMI (Stubbs and Cocklin, 2008). The TLBMC ensues a triple-bottom-line approach to organizational sustainability (Elkington, 1994), explicitly addressing and integrating economic, environmental, and social value creation as core to an organization's BM. According to Joyce and Paquin (2016), the TLBMC leverages life-cycle analysis and stakeholder management perspectives within newly created environmental and social canvases to conceptualize and link multiple types of value creation within a BM perspective. A summary overview of the main contributions to the Sustainable and Circular Business Model is represented in table 2 below.

2.2 Circular business model

Sustainability is interpreted in this research as *"the balanced integration of economic performance, social inclusiveness, and environmental resilience, to the benefit of current and future generations"* (Geissdoerfer et al., 2017). According to Blomsma and Brennan (2017), Circular Economy is understood as an umbrella concept (a phenomenon that creates a relation between pre-existing independent concepts) that aims to develop a regenerative economic system by intentionally slowing, closing, and narrowing material and energy loops. The relationship of sustainability and the circular economy is not quite clear in literature and still calls for theoretical consensus (De Pádua Pieroni et al., 2018). Since the industrial revolution the economic system was mainly based on "linear production" outputs, basically operating in a one-way manner (Coman and Ronen, 2000). Nowadays, is very tricky to go back to the old source of firm's value to ensure long-term sustainability. Following this mindset, the Circular Economy (CE), fully accepts that sustainable economic growth must be based on the model "resource outputs and regenerated resource", that is the logic of efficient resource use and waste reduction (Murray et al., 2017). The CE is a concept already existing in the natural eco-systems therefore we should be inspired by the idea of circularity in production by imitating natural cycling. The reduction of resource, energy, and waste loops in the product's lifecycle and the increasing of efficiency and efficacy can be achieved simultaneously by improving resource productivity. The CE business model pillars are: a) *Product life extension*. Lowering of the need to replace products by their improved quality and extended usability (Sauerwein et al., 2019); b) *Recovery of end-of-life products*. Restoration of products that are no longer usable into the manufacturing loops (Gregson et al., 2015); c) *Circular supplies*. Supply of fully renewable or biodegradable materials/products (Govindan and Hasanagic, 2018); d) *Sharing platforms*. Use of shared resources such as logistics, equipment, and knowledge (Sposato et al., 2017); e) *Reduction of energy consumption*. Promotion of energy conservation and improved efficiency (Hara et al., 2011). The literature on CBMs is growing rapidly and contains a variety of different typologies. There are considerable differences in the level of granularity, as well as the classification approach that is taken. Some authors take a value chain perspective that structures BMs into the circular design, optimal use, and value recovery types (Achterberg et al., 2016). Others distinguish BMs according to the material flows they address. Van Renswoude et al. (2015) focuses on short loops, long loops, cascades, and pure cycles while Lewandowski (2016) focuses on regeneration, sharing, optimization, or looping. The activities implicit in all of these typologies overlap significantly but are often given different names.

Tab. 2: The main existing literature on Sustainable and Circular Business Model

Authors	Focus	Main empirical evidences
Svensson et al., (2011)	A corporate effort towards a sustainable business model	*«The company's efforts towards a more sustainable business model can broadly be divided into factors within the company and factors outside the company. The case study demonstrates how the carbon footprint on the Earth can be reduced by focusing and influencing factors outside the company 'sown production facilities»*
Boons et al., (2013)	Business models for sustainable innovation: state-of-the-art and steps towards a research agenda.	*«As the current literature does not offer a general conceptual definition of sustainable business models, we propose examples of normative requirements that business models should meet in order to support sustainable innovations. Finally, we sketch the outline of a research agenda by formulating a number of guiding questions»*
Laukkanen et al., (2014)	Analysing barriers to sustainable business model innovations: Innovation systems approach	*«The central idea of this paper is to examine how the societal transition towards sustainable business models can be achieved. Through a qualitative Delphi study, we assess and categorize the key structural and cultural barriers to sustainable business model innovation. By applying innovation system approach, we explain how to overcome existing barriers by strengthening the functions of innovation system»*

Planing, (2015)	Business model innovation in a circular economy reasons for non-acceptance of circular business models	*«For practitioners working on new innovative business models in the realm of the circular economy this paper provides a basic framework for clustering their concepts. By learning about consumer motives leading to non-adoption, this paper also provides support for designing better and more successful business models»*
Joyce et al., (2016)	The triple layered business model canvas: A tool to design more sustainable business models.	*«The Triple Layered Business Model Canvas is a tool for exploring sustainability-oriented business model innovation. It extends the original business model canvas by adding two layers: an environmental layer based on a lifecycle perspective and a social layer based on a stakeholder perspective. When taken together, the three layers of the business model make more explicit how an organization generates multiple types of value economic, environmental and social»*
Antikainen et al., (2016)	A framework for sustainable circular business model innovation	*«Currently, there is a lack of frameworks for supporting business model innovation in companies in the context of a circular economy. The current tools do not offer the needed understanding in the changing business environment and breaking up of current value chains. Furthermore, the impact of the circular economy models and sustainability should be understood through value creation for all stakeholders. The challenge of redesigning business ecosystems is to find the "win-win-win setting" that balances the self-interests of involved actors and sustainability impacts»*
Linder et al., (2017)	Circular Business Model Innovation: Inherent Uncertainties	*«Circular business models based on remanufacturing and reuse promise significant cost savings as well as radical reductions in environmental impact. Variants of such business models have been suggested for decades, and there are notable success stories such as the Xerox product–service offering based on photocopiers that are remanufactured. Still, we are not seeing widespread adoption in industry. This paper examines causes for reluctance. Drawing on a hypothesis-testing framework of business model innovation, we show that circular business models imply significant challenges to proactive uncertainty reduction for the entrepreneur. Moreover, we show that many product–service system variants that facilitate return flow control in circular business models further aggravate the potential negative effects of failed uncertainty reduction because of increased capital commitments»*
Yang et al., (2017)	Value uncaptured perspective for sustainable business model innovation	*«This paper contributes to theory by proposing the concept of value uncaptured and offers a framework for using it as a novel perspective for sustainable business model innovation. Four forms of value uncaptured are used to trigger innovation: value surplus, value absence, value missed and value destroyed. In the context of sustainability, each value is considered not only from the perspective of economic value, but also from the perspectives of environmental and social value»*

Evans et al., (2017)	Business model innovation for sustainability: Towards a unified perspective for creation of sustainable business models	*«The paper examines bodies of literature on business model innovation, sustainability innovation, networks theory, stakeholder theory and product service systems. We develop five propositions that support the creation of SBMs in a unified perspective, which lays a foundation to support organizations in investigating and experimenting with alternative new business models. This article contributes to the emerging field of SBMs, which embed economic, environmental and social flows of value that are created, delivered and captured in a value network»*
Baldassarre et al., (2017)	Bridging sustainable business model innovation and user-driven innovation: A process for sustainable value proposition design	*«This research aims at combining principles from both sustainable business model innovation and user-driven innovation to develop more successful, radical and user-centered sustainable value propositions. Sustainable business model innovation entails developing value propositions that create value for multiple stakeholders at the same time, including customers, shareholders, suppliers and partners as well as the environment and society. User-driven innovation allows developing solutions that are meaningful for people and profitable for business by involving potential customers, users and/or other stakeholders in an experimental and iterative design process»*
Lüdeke-Freund et al., (2017)	Sustainable business model research and practice: Emerging field or passing fancy?	*"We argue that the sub-field and the stand-alone positioning may hamper the unfolding of the field's full potential. Instead, we propose that the SBM field needs to assume the role of an integrative field to break existing academic niches and silos and maximize practical impact ("integration hypothesis"). Our observations indicate that the SBM field is indeed developing into an integrative field and force. But we need to better understand and strengthen this development, for example by crafting a dedicated SBM research program. A series of critical reviews could be a starting point for such an endeavor."*
Bocken et al., (2018)	Experimenting with a circular business model: Lessons from eight cases	*«Experimentation is an important capability in the transition to a sustainable business. We focused on 'circular economy as a driver for sustainability. The process and role of business model experimentation were analyzed. A circular business experimentation framework was developed and applied. We found that 1) experimentation creates internal and external engagement to start business sustainability transitions 2) experiments can help test assumptions in every building block of the business model 3) collaboration with external partners can ease experimentation, and 4) experimentation processes are iterative and require regular learning and sustainability checks»*

Breuer et al., (2018)	Sustainability-oriented business model development: Principles, criteria and tools	*"The theoretical discussion feeds into a comparative analysis of the six currently available practitioner tools supporting the exploration and elaboration of sustainability-oriented business models. By synthesizing findings from theory and available tools, we define four guiding principles (sustainability-orientation, extended value creation, systemic thinking and stakeholder integration) and four process-related criteria (reframing business model components, context-sensitive modelling, collaborative modelling, managing impacts and outcomes) for the development of sustainability-oriented business models."*
Guldmann et al., (2019)	A Design Thinking Framework for Circular Business Model Innovation	*«Circular business model innovation (CBMI) can support sustainable business transitions, but the process is poorly understood and there is a lack of tools to assist companies in CBMI. This article aims to contribute to closing this gap by developing a framework for CBMI based on a design thinking approach, which can support the CBMI process. A design thinking process typically consists of three innovation spaces, an exploratory, an ideation, and a prototyping and testing space. (...) this paper identifies two additional spaces, an introductory and an alignment space, for CBMI. The results derived from the six case companies indicate that the developed framework including its tools and techniques are useful for CBMI»*
Furqon et al., (2019)	Business Development of Coffee Farmers Group Using Triple Layered Business Model Canvas	*"The results show that the business conditions of the coffee farmers group were in a position of growth. Therefore, the right strategy for this condition is the harvest strategy or divestiture strategy. The TLBMC design carried out supports the development of sustainable businesses for the coffee farmers group. Novelty –Business development for coffee farmer group using triple layered business model canvas is expected to help increase business on a broader scale. This study is important for business owners and other related parties who seek to develop the business in various aspects including social and environmental aspects."*
Guldmann et al., (2020)	Barriers to circular business model innovation: A multiple-case study	*«The purpose of this article is to provide an overview of the barriers that hinder adoption of circular business models to facilitate circumvention of the barriers and a faster uptake. The research shows that barriers to circular business model innovation are found at all socio-technical levels and, overall, most barriers are encountered by companies at the organizational level, followed by the value chain level, the employee level and, finally, the market and institutional level»*

You et al., (2020)	The business model of Do-It-Yourself (DIY) laboratories–A triple-layered perspective.	*"We have applied the triple-layered business model canvas (TLBMC) to explore and understand DIY laboratories from the economic, environmental, and social value creation aspects. Based on our comprehensive literature review and exploratory case studies, our research findings reveal that DIY laboratories are essentially technology hubs offering technology enthusiasts and entrepreneurs physical and social spaces and business incubation to help them survive and thrive. Engaged with all the Triple Helix stakeholders, DIY laboratories offer a platform of science innovation and technology incubation at the grassroots level for technology entrepreneurs to grow economically, socially, and sustainably."*
Diana, (2020)	The Triple Layered Business Model Canvas Meets The Beekeeping Sector. General And Particular Considerations From The Romanian Industry	*"Beekeeping, as an agricultural branch, has indispensable contributions at societal and environmental level through a number of activities related to food and medicinal product supply and pollination. Sector's dynamic, however, demonstrates that businesses are facing a series of challenges, and therefore, they need to showcase a proactive managerial approach in order to respond to risks and opportunities given by sustainability. Consequently, this paper looks to obtain a better understanding of sustainability management in the beekeeping sector by applying the triple layered business model canvas and featuring a series of facts from the Romanian industry."*

Source: own elaboration.

3. Research methodology

The research methodology adopted in this study had a qualitative analysis and descriptive approach (Nassaji, 2015). Firstly, was carried out an analysis of the relevant academic literature (for the number of citations on Google Scholar, Scopus, and the Web of Science and for the quality of the academic Journals publishing the articles) on the sustainable and circular business models. The in-depth review (Rowley and Slack, 2004) mentioned above was useful in selecting the managerial tool that is the Triple-Layered Business Model Canvas (TLBMC). Among the various conceptual models proposed in the literature on BMs, the TLBMC was the one that best fits with the proposed case study. In the next step, it has been conducted in-depth interviews (Legard et al., 2003) with key informants of EVJA company following a pre-established framework structured on 27 questions to investigate and validate the building blocks of the TLBMC model (9 questions for each layer). In addition, it was made broad desk research on the EVJA case study both with original sources of information[1] than by the recurs of secondary sources[2]. EVJA is an innovative start-up company working in an agro-tech industry that better represents the new challenge of Italian SMEs for competing in international markets. In the initial phase, main data was collected thanks to multiple semi-structured interviews (Schmidt, 2004) with the Founder and CEO of EVJA, Dr. Davide Parisi, and Dr. Antonio Affinito. The individual interviews, one-hour for each, have been organized in the time starting from March to July 2010. Furthermore, have been made several focus groups (Corrao, 2005), more than an hour each, in order to more comprehensive elicitation of individuals' views and to expand the information already emerged from the interviews with other informants. Therefore, were involved experts who have worked directly or indirectly with the company as well as with practitioners deriving from the academic and managerial community (Bertrand et al., 1992). The focus groups' members were the following: 1) Dr. Domenico Giuseppe Crispo - Agronomist and Fellow Researcher at CNR - IPSP[3](plants sustainable production and seedlings protection); 2) Ph.D. Niccolò Loret - Theoretical Physics and Modelist (EVJA R&D activities and climate models); 3) Dr. Marco Matascioli - Engineer and EVJA Technical Advisor (IT infrastructure, product development, process control and, budgeting); 4) Dr. Loet Rammelsberg – Entrepreneur and Program Director at StartLife (hands-on coaching in the early-stage phase, design and, implementation of EVJA acceleration program). The focus group research conducted within a social constructionist epistemological framework does not utilize the notion of pre-existing ideas, opinions, and understandings, located inside the heads of individuals, but, rather, presupposes that sense-making is produced collectively, during social interactions between people (Wilkinson, 1998). Within this framework, then, the particular advantage of focus groups is the opportunity they offer for researchers to observe how people engage in the process of collective sense-making: how views are constructed, expressed, defended and, (sometimes) modified within the context of discussion and debate with others (Kitzinger, 1994). Later, other information was collected from the company's leaflets, official presentation material, and company institutional website[4]. Furthermore, by analysing the posts on the company's social pages (Facebook and LinkedIn) it was possible to collect information on the community and on the customers, who use EVJA's products and services. This allowed investigating the issues related to the social and environmental impacts limited to the business model canvas,

[1] In journalism, a primary source can be a person with direct knowledge of a situation, or a document written by such a person ("Journalism: Primary Sources". Pepperdine University. Retrieved 17 January 2018).

[2] A secondary source is a document or recording that relates or discusses information originally presented elsewhere ("*Secondary sources*". James Cook University.).

[3] National Research Council (CNR) - Institute for Sustainable Plant Protection (IPSP).

which had already emerged in the focus groups. Starting from the consideration that today's linear economic model (Gale, 1989) is increasingly problematic. Creating a closed-loop model in production and consumption is a preferred alternative to address environmental and social damages associated with the linear economy. This case study proposes the TLBMC as a tool backed by a methodology for enabling SMEs to coherently formulate unique circular value propositions based on a lifecycle perspective. The tool is valuable for rethinking and personalizing sustainability and circular economy by more practically tackling the three dimensions of sustainable development while being adaptable to the organization's context (Joyce and Paquin, 2016). To a better understanding of the TLBMC blocks, this application wants to describe the tool's key features and elements through a detailed analysis of EVJA firm.

3.1 The EVJA case study

According to FAO[5], agriculture remains central to the world economy, 60% of the population depends on agriculture for survival. Designing a Decision Support System (DSS) for crop cultivation enables the farmers to make effective decisions for higher yield. The parameters that are considered for the enhancement of seasonal crop growth are a type of soil and season, insect-pests management, irrigation methodologies. The main objective of EVJA start-up[6] is to develop a system that can provide information about the expected yield in each season with better accuracy. The decisions available to them currently are only a shallow guide for farmers due to them being unaware of various methodologies. Inefficiency in a farmers' decision results in the low production rate of the leaf (salads and vegetables fourth range organic) than the expected rate. The growth of seasonal crops is decided basically by two factors, namely the soil type and the season. Also based on the crop type the farmer must adaptively use the insecticides and fertilizers. According to Dr. Davide Parisi (CEO & CO-Founder) and Dr. Antonio Affinito (CTO & Co-Founder): *"The OPI system (Observe, Prevent, Improve) represents an excellent decision support for farmers who want a healthy and high-quality harvest"*. Thus, the parameters to be considered are identified and the simulation is tested using a proprietary patented tool called "OPI". Based on the performance the Intelligent-DSS

[4] www.evja.eu/it

[5] Food and Agricultural Organization, 2013 Statistical Yearbook.

[6] EVJA start-up born in Acerra (Na) in 2015, has taken part in several international accelerator programs, like Startupbootcamp FoodTech Rome in Rome (IT), Agro-Innovation Lab in Vienna (AT), Deutsche Telekom Hubraum IoT in Bonn (DE), Star Life Wageningen University & Research in Wageningen (NL) and it is participated by BayWa (DE) and RWA (AT), major players of the German and Austrian agricultural markets.

guides the farmers to improve the crop growth. The simulated results can be extended for real-time usage in mobile applications. OPI is based on the Internet of Things, artificial intelligence, and advanced agronomic models, and provides real-time monitoring of the crops, both from desktop and mobile devices, everywhere the farmer is. OPI allows to cut the farm management costs and forecast the quantity of yield, giving farmers an edge in their relationships with mass distribution channels and other commercial partners. The result is a more abundant, healthier produce, grown with a minimum environmental impact. OPI-EVJA is among the best agri-tech systems in the world and was a finalist in the FoodTech Challenge[7], the competition managed by the United Arab Emirates Food and Water Safety Office and by Tamkeen which received 437 proposals from companies, research institutes, and entrepreneurs from 68 countries. The EVJA CMO Paolo Iasevoli said: *"Our company was born in 2015 and we immediately realized the need to develop a system technologically advanced that would support agri-food companies to optimize production, with the aim of making them more efficient from an economic and environmental point of view"*. Protection, nutrition, and irrigation are the cornerstones around which OPI develops, which is a constantly evolving system, with great experience in sectors such as engineering, physics, agronomy, precision farming, artificial intelligence, and business development. *"Through the analysis of data and the use of the most advanced sensors for agriculture, it helps make the best decisions, prevents plant diseases and the effects of climate change. OPI is the most advanced decision support system for farms, thanks to sensors and agronomic models enhanced by artificial intelligence"*, explained Davide Parisi, CEO of EVJA.

4. Results

The analysis of EVJA through Osterwalder and Pigneur's (2010) original Business Model Canvas (see figure 1 in appendix), forms the economic layer of the Triple Layer Business Model Canvas (BMC). Osterwalder's BMC does not cover aspects such as environmental impact and stakeholder management (Joyce and Paquin, 2016). As known, the BMC disaggregates an organization's business model into nine interconnected components: customer value proposition, segments, customer relationships, channels, key resources, key activities, partners, costs, and revenues. Although using it may help managers align profit and goals to support more sustainability-oriented value creation on its own (Osterwalder and Pigneur, 2011), practically, environmental and social value is implicitly de-emphasized behind the canvas's more explicit 'profit first' or economic value orienta-

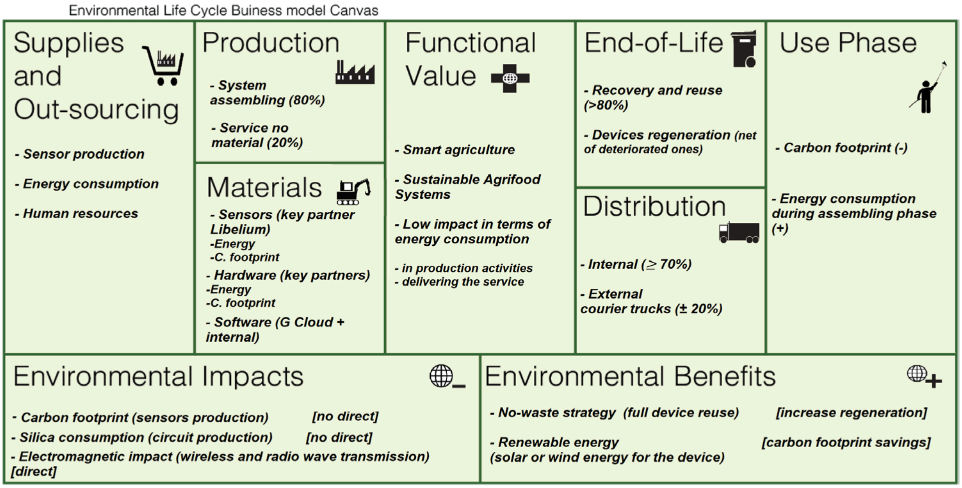
[7] https://foodtechchallenge.com.

tion (Coes, 2014; Upward and Jones, 2016). This has led to the criticism (Marrewijk and Werre, 2003; Bocken et al., 2013) that implementing more sustainability-oriented business models likely either requires an expert or practitioners to support this orientation. The Triple Layered Business Model Canvas (TLBMC) application on EVJA, represents the new tool that would need to integrate economic, environmental, and social value more explicitly into a holistic view of corporate sustainability. The TLBMC may offer the opportunity for managers to explicitly address a triple bottom line where each canvas layer is dedicated to a single dimension and together, they provide a means to integrate the relationships and impacts across layers. In the same way, that original BMC is used to understand how revenues overpass costs, the main objective of the environmental layer of the TLBMC is to appraise how the organization generates more environmental benefits than environmental impacts. That allows users to better understand where the organization's biggest environmental impacts lie within the business model; and provide insights into where the firms may focus their attention when creating environmentally-oriented innovations. The EVJA Environmental Life Cycle Layer (ELCL) consists of 9 blocks (see figure 2), as follows: 1) **Functional value**. The functional value describes the focal outputs of a service (or product) by the organization under examination. It emulates the functional unit in a life cycle assessment, which is a quantitative description of either the service performance or the needs fulfilled in the investigated product system (Rebitzer et al., 2004). For example, the functional unit of EVJA is the smart agriculture approach; 2) **Materials**. The materials component is the environmental extension of the key resource's component from the original BMC. Materials refer to the bio-physical stocks used to render the functional value. For EVJA, materials are first and foremost the sensors which represent the biggest part of its carbon footprint (key partner *Libelium*[8]). 3) **Production**. The production component extends the key activities component from the original BMC to the environmental layer and captures the actions that the organization undertakes to create value. Production for a manufacturer may involve transforming raw or unfinished materials into higher-value outputs. For EVJA, 80% of industrial processes refer to assembling system to make the sensors. 4) **Supplies and Outsourcing**. Supplies and out-sourcing represent all the other various material and production activities that are necessary for the functional value but not considered core to the organization. Like to the original BMC, the distinction here is between is considered core versus non-core to support the organization's value creation. In the available car-

[8] *Libelium* designs and manufactures wireless sensor network devices so that system integrators, engineering, and consultancy companies can deliver reliable Internet of Things (IoT), M2M and Smart Cities solutions with minimum time to market.

bon footprint data of the sensor's manufacturer, most of the supplies and outsourcing impacts such as silica components and energy are involved in the use phase. **5) Distribution**. As with the original Business Model (BM), distribution involves the transportation of goods. In the case of a service provider or a product manufacturer, the distribution represents the physical means by which the organization ensures access to its functional value. Thus, within the environmental layer, it is the combination of the transportation modes, the distances traveled, and the weights of what is shipped which is to be considered. As well, issues of packaging and delivery logistics may become important here. For EVJA, the distribution is for 70% internal via service providing and for physique devices external by trucks or express couriers, its impact more or less 20%. 6) **Use Phase**. The use phase focuses on the impact of the client's partaking in the organization's functional value, or core service and/or product. This would include maintenance and repair of products when relevant and should include some consideration of the client's material resource and energy requirements through use. Many electronic products incur use phase impacts when charging a device and using an infrastructure needed to support the network of users. For EVJA, the use phase consists of two elements. First, a client's carbon footprint has less impact. Second, the energy consumption is concentrated in the assembling phase. 7) **End-Of-Life**. End-of-life is when the client chooses to end the consumption of the functional value and often entails issues of material reuse such as remanufacturing, repurposing, recycling, disassembly, incineration, or disposal of a product. From an environmental perspective, this component supports the organization exploring ways to manage its impact through extending its responsibility beyond the initially conceived value of its products. For EVJA, end-of-life means addressing the impacts of its obsolescent devices consisting of silica sensors. The alternatives are the recovery and reuse of used devices (by replacing some components) and the regeneration (net of deteriorated ones).

Fig. 2: The EVJA Environmental Life Cycle Layer (ELCL)

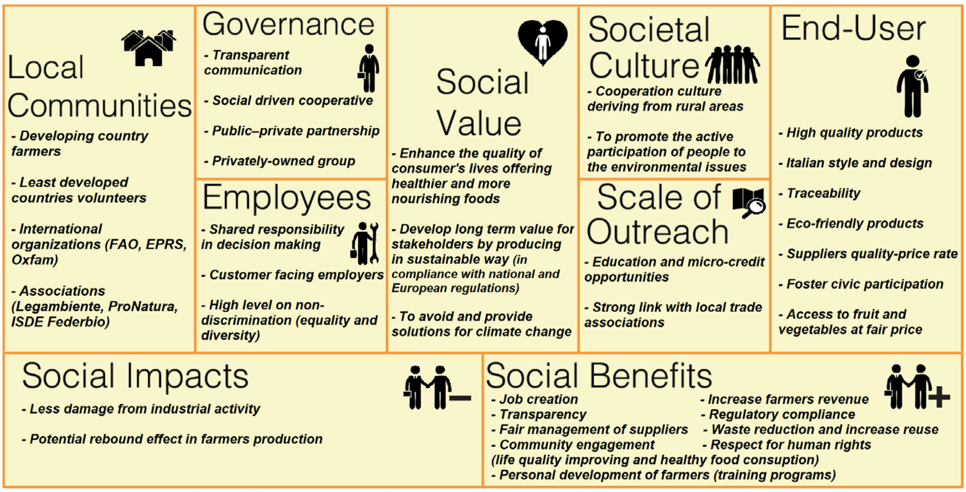


Source: own elaboration based on Joyce and Paquin's (2016) canvas.

8) **Environmental impacts**. The environmental impacts component addresses the ecological costs of the organization's actions. While a traditional BM often summarizes organizational impacts primarily as financial costs, the environmental impacts components extend that to include the organization's ecological costs. For EVJA, its environmental impacts are indirect for carbon footprint sensor production and silica consumption. Otherwise, are direct for the electromagnetic impact caused by wireless and radio wave transmission. 9) **Environmental benefits**. Similar to the relationship between environmental impacts and costs, environmental benefits extend the concept of value creation beyond purely financial value. It encompasses the ecological value the organization creates through environmental impact reductions and even regenerative positive ecological value. For EVJA, an example of this would be the no waste strategy (full device reuse). By evaluating environmental impacts with a life cycle based on renewable energy with carbon footprint savings (solar or wind energy for devices). A crucial facet of using the social layer of the TLBMC is to extend the original BMC through a stakeholder approach to captures the mutual influences between stakeholders and the organization. Also, this layer seeks to capture the key social impacts of the organization that derives from those relationships. Doing so provides a better understanding of where are an organization's primary social impacts and provides insight for exploring ways to innovate the organization's actions and business model to improve its social value creation potential. The practical application of EVJA Social Layer (SL) canvas is represented in figure 3 below. Leveraging the stakeholder approach discussed above, the nine components

of the social layer make up the third layer of the TLBMC and are as follows: 1) **Social value**. Social value regards the aspect of an organization's mission that focuses on creating benefits for its stakeholders and society more broadly. For sustainability-oriented firms, creating social value is likely a clear part of their mission. However, even the most profit-oriented organizations likely consider their value-creating potential beyond simply financial gain (Collins and Porras, 1996). For EVJA, the social value can be arguing through the roadmap for sustainable growth, enhancing the quality of consumer's life offering healthier and more nourishing food. A broader understanding of the company's social value can be extrapolated from its corporate business principles to develop a long-term value for stakeholders producing in a sustainable way and in compliance with national and European regulations. Lastly, to avoid and provide solutions for climate change. 2) **Employees**. The employees 'component provides a space to consider the employee's role as a core organizational stakeholder. Several elements may be included here such as amounts and types of employees, salient demographics such as variations in pay, gender, ethnicity, and education within the organization. As well, it provides a space for discussing how an organization's employee-oriented programs (e.g., training, professional development, additional support programs) contribute to the organization's long-term viability and success. EVJA's goals are to shared responsibility inside the firm in decision making and towards customer-facing employers.

Fig. 3: The EVJA Social Layer (SL)



Source: own elaboration based on Joyce and Paquin's (2016) canvas.

Thanks to EVJA's global reach and rapid growth, maintaining a positive workplace and strong customer relationships likely need to be considered a core part of its business. That is a high level of non-discrimination in terms of equality and diversity. 3) **Governance**. The governance component captures the organizational structure and decision-making policies of an organization. In many ways, governance defines which stakeholders an organization is likely to identify and engage with and how the organization is likely to do so (Mitchell et al., 1997). As a start-up business, EVJA has transparent communication as a social-driven cooperative. The governance is mixed by public and private partnerships although at the beginning the company started out as a privately owned initiative of an entrepreneurs' group. 4) **Communities**. While economic relationships are built with business partners, there are social relationships built with suppliers and their local communities. These two stakeholders come together as communities when aligning the three layers of the TBLMC. EVJA aims to help the developing country farmers and promote the volunteer cause in the least developed countries. Therefore, the EVJA actions affect both the international Organizations (FAO, EPRS, Oxfam) than national Associations (Legambiente, FAI, Isde Federbio, ProNatura). 5) **Societal culture**. The societal culture component recognizes the potential impact of an organization on society as a whole[9]. The culture of your company always determines success regardless of how effective your strategy may be. Torben (2014) pointed out the importance of the human factor in any company. No matter how detailed and solid your strategy is, if the people executing it don't nurture the appropriate culture, your projects will fail. EVJA, spreads the cooperation culture typical of rural areas and promotes the active participation of people in environmental issues. 6) **Scale of outreach**. The scale of the outreach describes the depth and breadth of the relationships an organization builds with its stakeholders through its actions over time. For EVJA, the scale of outreach is represented by growth in education for farmers operating with smart agriculture over the world. Its outreach also encompasses micro-credit programs for SMEs to encourage new sustainable business models. Therefore, it's crucial to a strong link with the local trade associations. 7) **End-users**. The end-user is the person who takes advantage of the value proposition. This block concern how the value proposition addresses the needs of the end-user, contributing to its life quality. For EVJA, the end-user often happens to be the customer who seeks high-quality products with Italian style and design. In the social canvas, EVJA tries to provide value by offering eco-friendly and traceable products with a high level of supplier's quality-price rate. Moreover, the company fosters

[9] *"Culture eats strategy for breakfast"*, a quote originated by Peter Drucker and made famous by Mark Fields, President at Ford, in this sense is exhaustive!

civic participation allowing access to fruit and vegetables at a fair price. 8) **Social impacts**. The social impacts component addresses the social costs of an organization. It complements and extends the financial costs of the economic layer and the biophysical impacts of the environmental layer. For EVJA, the social impacts could stem from the less damage rate of industrial activity but not considering the key partner (*Libelium*). Furthermore, could be considered, the potential of a rebound effect in farmers' productions, regarding conservation and energy economics (Grubb, 1990). 9) **Social benefits**. Social benefits are the positive social value-creating aspects of the organization's activities. This component is for explicitly considering the social benefits which come from an organization's actions. For EVJA, social benefits may include job creation, transparency, fair supplier management, community engagement, that is the improvement of life quality and promoting healthy food consumption. Moreover, the increasing revenues for farmers, the regulatory compliance, the waste reduction (raising the reuse), respect for human rights, and the personal development of farmers through the training programs.

5. Discussions

The main benefits of EVJA ELCL (Environmental Life Cycle Layer) derive from a vast set of data (temperature, relative humidity, deficit of vapor pressure, leaf wetness, solar radiation, carbon dioxide concentration, and soil moisture) that are continuously collected, submitted to a local control unit, and processed through algorithms specifically developed for different crops. On the other hand, farmers can access EVJA from their PC and mobile devices, and they may monitor complex agronomic data analysis presented in a user-friendly interface. The ELCL consists of sensors managed by software that is aimed at making the farmers' jobs more efficient and in an ecological way. Some smart farming products focus on robotics, machine automation, location technology, or data analysis. ELCL is based on IoT systems and assure precision farming. This latter follows a four-step cycle that starts with the plants monitoring via sensors, followed by the diagnostics of the collected data, and ending either with the decision-making of the farmer or with the activation of another system. For example, in automatic irrigation systems connected to the precision farming platform. The result is a more controlled crop cycle, with plant and weather conditions monitored meter by meter, and a more accurate intervention by the farmers, with action undertaken only when it is really needed. The advantages are significant: 1) fewer pesticides and fertilizers are used; 2) irrigation is more efficient, and 3) the final product is healthier and more abundant. This goal is achieved with minimum impact on the environment, leading to a win-win situation for the farmers, consumers, and the environment. The EVJA sensors help farmers to optimize the usage of chemical products and water in this way facilitate reuse and waste reduction. By using IoT and artificial intelligence (Jha, 2019), EVJA allows farmers to monitor their fields in real-time, wherever they are. EVJA gathers data from a network of customizable sensor nodes connected to servers, which can fully operate with radio frequencies. The EVJA system is based on a Software as a Service (SaaS) model, which offers an array of features, including real-time monitoring, forecasting, management, business intelligence, and social features like chat and media sharing (Loret et al., 2020). Farmers can monitor and manage everything, in each field, directly from their desktop, tablet, or smartphones. They can mark every event, like an above-average harvest, and go through the history to see trends and correlations between such events and the key factors registered by the sensors. If a field worker identifies a plant (or leaf) affected by a parasite, they can take a picture and share it with the agronomist (through OPI proprietary patented device) in order to check the disease type and take immediate action. IoT has the potential to monitor irrigation and productivity, and the data gathered by IoT sensors can to provide information about the overall performance of the crops. The EVJA impact on the environment is very strong, the main innovation counts as the first predictive algorithm for horticultural products in the European Union, while the direct competitors commercialize solutions that address generally all types of crops, without focus and verticalization on specific crops and weak results. On the other hand, greenhouse monitoring systems are often designed for fully climate-controlled environments, closer in concept to a scientific laboratory than a farmhouse, while EVJA's "rugged" sensor nodes are designed to be handled roughly, in any kind of working conditions. The main features characterizing the EVJA (ELCL) system are a) *technological*: the integration with advanced predictive models; b) *product*: the bundling of hardware and software in a single solution, which allows for a seamless user experience; and c) *business*: the high scalability of EVJA, which allows for targeting agricultural businesses anywhere in the world. In addition, also the EVJA social impacts are very important and they are represented in the EVJA Social Layer (SL) Canvas. EVJA gives training slots to better explain how the system works and how farmers can use it to rationalize their activities and spearhead resources. The basic EVJA functions to works need just temperature, humidity, leaf wetness, and solar radiation sensors. However, the entire system is easily customizable, and new sensors can be added depending on the user's requests. EVJA is equipped with several generic functions that are useful for defining plant status and needs, keep parasites under control and improve the leaf well-being. Consequently, this also causes positive impacts on the consumer by improving the life quality and promoting a citizen commitment towards more sustainable agriculture. Therefore, using the EVJA interface, the local communities can check the conditions of a crop in real-time. The system allows fixing thresholds for temperature, humidity, leaf wetness, solar radiation, and other customizable observables (depending on the kind of sensors mounted on the device). For the end-users offers high-quality products (e.g., in case of safety thresholds are exceeded, the system sends a warning email to the farmer). The EVJA system processes data in order to calculate the functions that are fundamental for depicting a clear picture of the plants' health status, such as dew point, Vapour Pressure Deficit (VPD), Growing Degree Days (GDDs), and evapotranspiration (Loret et al. 2019). Moreover, water wastage in agriculture and excessive fertilization are two important issues in present-day agriculture. Problems related to the excessive and non-rational use of nitrogen fertilizers are related both to the accumulation of nitrates and nitrites in soil and plants as well as to the leaching of these nutrients to ground and surface water. While nitrates and nitrites in food are precursors of carcinogenic substances to humans, from an environmental point of view, a high concentration of these ions in water sources favours the phenomenon of eutrophication. Management of water and nitrogen fertilizers in agriculture are strongly interconnected practices: the optimal absorption of fertilizers by plants depends mainly on temperature and soil moisture. EVJA is being upgraded with a dynamic forecasting model that simulates the mineral nitrogen content in the soil within an integrated sensor-based irrigation system that provides data on atmospheric climatic conditions, integrated with soil moisture, soil temperature data, and weather forecasts. This will potentially be a key tool for high-tech agriculture aiming to reduce the adverse environmental impacts thereof. The system eliminates the difficulties in reading and interpreting data, facilitating the involvement of farmers in the field, who will receive real-time updates on soil water content and crop water needs directly on their mobile device, allowing for effective and efficient interventions. The system will acquire data from wireless soil moisture sensors to run computer simulations, which are validated through chemical analysis of the soil to determine the actual nitrogen content in its different forms (total, organic, nitrate, and ammonium, which may be quantified through more advanced sensors).

6. Research limitations

The major limitations of this contribution are related to the theoretical nature of the study and the qualitative enquire. Moreover, it is associated with a case study approach (Eisenhardt and Graebner, 1989; Feagin et al., 2001; Yin 2017) and qualitative methods during the first explorative step.

A case study approach is the most suitable in situations where the main research questions are depicted (Yin, 2011), and is also known as a method where data triangulation is often used to increase the quality of the study. Instead of using sampling methods, the case selection maximizes what can be learned in the period of time available for the study. Yin (2013) claims multiple case studies may be better than a single case study. In this study, only one case is analysed for gaining in-depth knowledge on sustainable business model innovation. The other limitation is the exploratory nature of this research. Exploring a relatively new research field on strengths and limitations based on theoretical and practical investigation leads to a broad view of the topic. The wide aim of the research gives a lot of information but statements about relationships and causalities cannot be made. To investigate the topic in higher detail, empirical research should be conducted to find the effects of the Triple-Layered Business Model Canvas (TLBMC) on specific topics or other industries. In addition, while the TLBMC offers a novel approach for analysing and conceptualizing sustainability-oriented innovation and sustainable business models, there are also some clear limitations to consider. One, the TLBMC is simply a tool. It does not do the work of exploring and assessing potential innovations. Furthermore, a limitation could be the small sample size of four interviews and four focus groups. This leads to a low external validity of the results. To cope with this limitation, future research is recommended to investigate different strengths and limitations on a larger scale directed at specific strengths and limitations.

7. Conclusions and managerial implications

Today, more than ever, it is necessary to rethink our habits in daily life so that virtuous behaviours prevail, both towards ourselves and others and towards the environment. This paper wants to contribute to the existing research on sustainable business models by providing a framework in the form of the TLBMC to enable a triple bottom line perspective to sustainability that of economic, environmental, and social impact applied to a business model. Therefore, the TLBMC expands the economic BM's approach to developing environmental and social canvas layers based on lifecycle and integrating stakeholder perspectives into an extended BMC. This expanded canvas moves towards more engaging and holistic perspectives on sustainability-oriented BMI. The TLBMC could have the capacity to help those searching for ways to change firms and organizations for sustainability (Joyce et al., 2015). The patented EVJA system (OPI) is currently working with top Italian farmers and monitoring more than 600 hectares.

Using EVJA devices, farmers have been able to substantially reduce the number of chemical treatments required to hold off parasites and to save a large amount of water. Moreover, such intelligent management of chemicals and water saves important economic resources. Everyone becomes an active part of a new process aimed at achieving more sustainable economic, social and environmental development. First of all, implementing policy actions to support the business in terms of demand and consumption are needed immediately, to trigger a virtuous circular path. But implementation policy actions are also needed to incentivize companies to adopt new business models with an approach to sustainability and social responsibility in their commercial operations and in their relationships with stakeholders. With an increasing population, a growing middle class, and intensive resource use, our current ways of living and doing business are unsustainable. BMI can allow SMEs to change radically processes, products, and organizational forms in order to assimilate sustainability into their core business more successfully. Next to the implementation of innovative technology, sustainable development based on innovative business models, better understating of customer needs and behavioural change are crucial.

8. Directions for future research

The spreading of agriculture 4.0, also called smart farming, is linked to what was happened with industry 4.0. The rising of big data, drones and the Internet of Things (IoT)[10] will activate increasingly processes of innovation and connection between products and production, territory and environment, logistics and retailing network. Smart agriculture and precision farming (or precision agriculture) are technologies that increasingly shaping the agriculture industry. Following slavishly the guidelines suggested by FAO, became necessary to experiment with new cultivation methods and implement a sustainable approach to agriculture in order to meet the growing food demand by consumers. Furthermore, the new perspective based on data science (and its relationship to big data) and data driven decision making (Provost and Fawcett, 2013) offers predictive solutions that could ensure indications on where, when, and how to operate in a more efficient and effective manner. Therefore, smart farming based on novel technologies (software applications, IoT sensors, data analytics, and end-user services) inspires new scenarios and the generation of sustainable business models. In addition, farmers have more accurate and real-time-generated sets of information to compare with old data, as well as cross information, 's on environmental factors and benefits from fertilizing process

[10] We can refer to IoT devices and drones for data collection in agriculture.

or products. Collecting data via the cloud and open-access platform isn't the only step towards smart farming. It's necessary to elaborate and processing datasets by machine learning and algorithms that can, if properly trained, generate future predictions and, consequently, provide precision feedbacks to make data-driven decisions for the agriculture industry. In the near future, EVJA plan to add many useful functions and algorithms in order to improve the service quality provided to the users: multi-spectral and hyper-spectral analysis to directly monitor plants' health; intelligent insect traps to keep track of many dangerous species; and a novel predictive model for the *Fusarium graminearum* fungus for adapting the EVJA system to work on outdoor crops (specifical cereals). Future research should be aimed at optimizing business model tools that maximize the strengths and adapt to the limitations of the BMC. To acquire an improved tool should be done a dept case research of different successful TLBMC. This research should be focused on the elements in the TLBMC which are seen as essential and as important for a company's success and which considers the strengths and limitations of this research. A research question could be: *"What are the essential elements of a sustainable business model and what kind of impacts in terms of environmental and social facets have on the success of business model?"*. Another suggestion for future research could be to achieve a sustainable business model integrating diagnostic indicators for each block (e.g., KPI) and by recurs to the accounting standards (Akisik and Gal, 2011) to measure some positive and negative aspects of TLBMC. The factors volatility outside and inside an organization can push to change a business model, without a system monitoring (TLBMC dashboard reporting) could be difficult to prevent potential risks (Gaug and Pascarelli, 2008). A further research question could be: *"What can be improved in the TLBMC blocks to adapt to internal and external changes over time?*

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Appendix

Tab. 1: The main existing literature on Business Model and Business Model Innovation

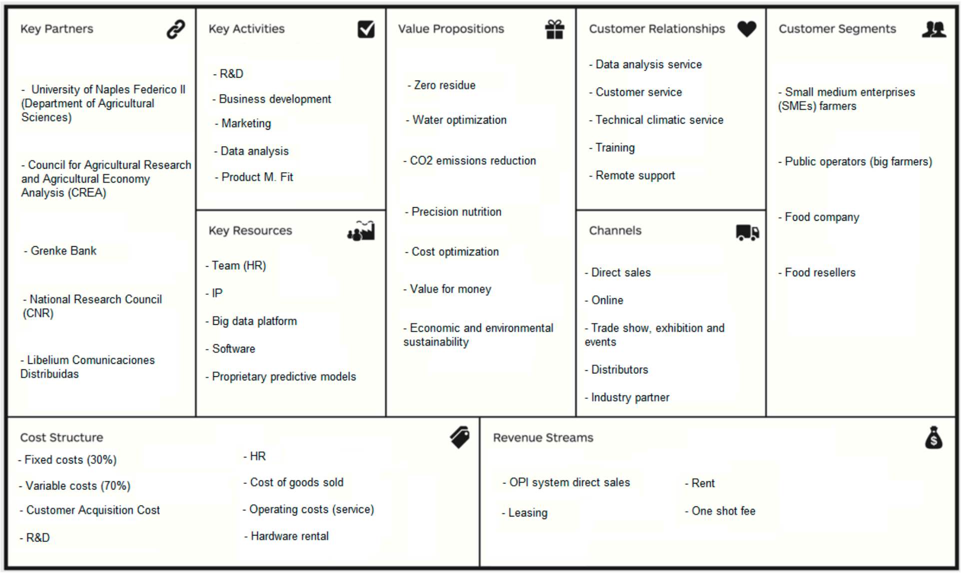
Authors	Focus	Main empirical evidences
Chesbrough et al., (2002)	The role of the business model in capturing value from innovation	*«This paper explores the role of the business model in capturing value from early-stage technology. A successful business model creates a heuristic logic that connects technical potential with the realization of economic value. The business model unlocks latent value from a technology, but its logic constrains the subsequent search for new, alternative models for other technologies later an implicit cognitive dimension overlooked in most discourse on the topic»*
Chesbrough, (2007)	Business model innovation: it's not just about technology anymore	*«… shortening product lives mean that even great technologies no longer can be relied upon to earn a satisfactory profit before they become commoditized. Today, innovation must include business models, rather than just technology and R&D. Business models matter. A better business model often will beat a better idea or technology. Consider Wal-Mart in retailing, Dell in PCs, or Southwest Airlines. But business models are not all the same. To innovate your business model, you must first understand what it is, and then examine what paths exist for you to improve upon it.»*
Johnson et al., (2008)	Reinventing your business model	*«A successful model has these components: customer value proposition, profit formula and key resources and processes. To determine whether your firm should alter its business model, Johnson, Christensen, and Kagermann advise these steps: 1. Articulate what makes your existing model successful; 2. Watch for signals that your model needs changing, such as tough new competitors on the horizon and 3. Decide whether reinventing your model is worth the effort. The answer's yes only if the new model changes the industry or market»*
Lindgardt, et al., (2009)	Business model innovation. When the Game Gets Tough, Change the Game	*«Business model innovation is especially valuable in times of instability. BMI can provide companies a way to break out of intense competition, under which product or process innovations are easily imitated, competitors' strategies have converged, and sustained advantage is elusive. It can help address disruptions such as regulatory or technological shifts that demand fundamentally new competitive approaches. BMI can also help address downturn-specific opportunities, enabling companies, for example, to lower prices or reduce the risks and costs of ownership for customers. In our experience, the companies that flourish in downturns frequently do so by leveraging the crisis to reinvent themselves rather than by simply deploying defensive financial and operational tactics. Moreover, during times of crisis, companies often find it easier to gain consensus around the bold moves required to reconfigure an existing business. BMI may be more challenging than product or process innovation, but it also delivers superior returns»*
Casadesus-Masanell et al., (2010)	Competitiveness: business model reconfiguration for innovation and internationalization	*«The paper reflects on competitiveness by using the business model concept and to understand the need to adapt business models to changes in the environment»*

Chesbrough, (2010)	Business Model Innovation: Opportunities and Barriers	*«Business model innovation is vitally important, and yet very difficult to achieve. The barriers to changing the business model are real, and tools such as maps are helpful, but not enough. Organizational processes must also change. Companies must adopt an effectual attitude toward business model experimentation. Some experiments will fail, but so long as failure informs new approaches and understanding within the constraints of affordable loss, this is to be expected-even encouraged. With discovery driven planning, companies can model the uncertainties, and update their financial projections as their experiments create new data. Effectuation creates actions based on the initial results of experiments, generating new data which may point towards previously latent opportunity»*
Osterwalder et al., (2010)	Business Model Generation: A Handbook for visionaries, game changers and challengers	*«Formal descriptions of the business become the building blocks for its activities: infrastructure (key activities and resources, partner network); offering (value propositions); customer segments, channels; customer relationships; finances (cost Structure and its characteristics); revenue streams. Many different business conceptualizations exist; Osterwalder's work and thesis propose a single reference model based on the similarities of a wide range of business model conceptualizations. With his business model design template, an enterprise can easily describe their business model»*
Zott et al., (2010)	Business Model Design: An Activity System Perspective	*«The authors conceptualize a firm's business model as a system of interdependent activities that transcends the focal firm and spans its boundaries. The activity system enables the firm, in concert with its partners, to create value and also to appropriate a share of that value. They suggest two sets of parameters that activity systems designers need to consider: design elements content, structure and governance that describe the architecture of an activity system; and design themes novelty, lock-in, complementarities and efficiency that describe the sources of the activity system's value creation»*
Markides, (2013)	Business model innovation	*«Redefine the business. Redefine the who. Who is our customer? A company should think of new customers or new customer segments and develop a game plan that serves them better. Redefine the what. What products or services are we offering these customers? A company should think of new customer needs or wants and develop a game plan that better satisfies these needs. Redefine the how. Companies should leverage existing core competencies to build new products or a better way of doing business and then find the right customers. Start the thinking process at different points. For example, instead of thinking, "This is our customer, this is what he or she wants, and this is how we can offer it," start by asking: "What are our unique capabilities? What specific needs can we satisfy? Who will be the right customer to approach? »*

Björkdahl et al., (2013)	Business model innovation the challenges ahead	*«A business model innovation can include a process innovation, a new revenue model or other types of innovation. Therefore, we argue that a business model innovation is a new integrated logic of how the firm creates value for its customers (and users) and how it captures value. In this view, a business model innovation is not a 'mere' product or service innovation, nor is it a process innovation. In the general case, a business model innovation may include new ways for the firm to create value and new firm offers, new ways for the customers to view the firm's offers (positioning innovation), changes to how the firm views its activities (paradigm innovation) and operations (process innovation). Thus, a business model innovation is a new integrated logic of value creation and value capture, which can comprise a new combination of new and old products or services, market position, processes and other types of changes»*
Foss et al., (2017)	Fifteen years of research on business model innovation: How far have we come, and where should we go?	*«We argue that the literature faces problems with respect to construct clarity and has gaps with respect to the identification of antecedent conditions, contingencies, and outcomes. We identify important avenues for future research and show how the complexity theory, innovation, and other streams of literature can help overcome many of the gaps in the BMI literature»*
Anwar, (2018)	Business model innovation and SMEs performance does competitive advantage mediate?	*«...this study examines the importance of BMI in SME performance and the mediating role of competitive advantage. Data were collected through structured questionnaires using a sample size of 303 manufacturing SMEs operating in the emerging market of Pakistan. Hypotheses were tested through Structural Equation Modelling (SEM) using AMOS.21. The results indicate that BMI has a significant positive impact on competitive advantage and SME performance. Competitive advantage partially mediates the relationship between BMI and SME performance. Firms are required to create an effective business model to acquire competitive advantage and superior financial performance. Implications for practice have been discussed.»*
Ghezzi et al., (2020)	Agile business model innovation in digital entrepreneurship: Lean startup approaches	*«Digital startups in the early stages of their development frequently undergo innovation to their value architecture and Business Model. A set of pragmatic methods drawing on lean and agile principles has recently been proposed to support digital entrepreneurs facing Business Model Innovation (BMI), known as Lean Startup Approaches (LSAs). (…) our study draws on an exploratory multiple-case study based on three digital multisided platform startups to craft a unified framework that can disclose the relationship between BMI, LSAs, and Agile Development (AD), within the context of Strategic Agility. Our findings,» which emerge from the unified framework, show that LSAs can be employed as agile methods to enable Business Model Innovation in Digital Entrepreneurship.*

Source: own elaboration.

Fig. 1: The EVJA Business Model Canvas



Source: own elaboration based on Osterwalder and Pigneur's (2010) canvas.