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A Step toward Water Use Sustainability: Implementing a Business Model Canvas for Irrigation Advisory Services

Alessandra Santini [1], Antonella Di Fonzo [2], Elisa Giampietri [1,*], Andrea Martelli [2], Orlando Cimino [2], Anna Dalla Marta [3], Maria Carmela Annosi [4], Francisco José Blanco-Velázquez [5], Teresa Del Giudice [6] and Filiberto Altobelli [2,*]

1 Department of Land, Environment, Agriculture and Forestry (TESAF), University of Padova, 35020 Legnaro, Italy
2 CREA Research Centre for Agricultural Policies and Bioeconomy, 00184 Rome, Italy
3 Department of Agriculture, Food, Environment and Forestry, University of Florence, 50144 Florence, Italy
4 Department of Social Sciences, Business Management and Organization Division, Wageningen Universiteit, 6707 KN Wageningen, The Netherlands
5 Evenor-Tech, 41018 Seville, Spain
6 Department of Agricultural Sciences, University of Naples Federico II, 80055 Naples, Italy
* Correspondence: elisa.giampietri@unipd.it (E.G.); filiberto.altobelli@crea.gov.it (F.A.)

Abstract: Some major future global challenges are linked to more efficient use of water for irrigation to respond to the growing water scarcity coupled with the increasing food demand. Although irrigation advisory services (IASs) are considered effective instruments to increase water use efficiency in agriculture, their diffusion remains limited. This is due to several constraints mainly linked to their low accessibility and high costs. To overcome the bottlenecks associated with IASs' adoption, this paper proposes a business model (BM) as a tool for scaling up IASs within a business perspective, with the aim of encouraging the diffusion of this technology while enhancing the associated environmental and social benefits. Drawn from the experience of the OPERA project, we structured the business model taking advantage of the opinion of relevant stakeholders and IASs' potential users to identify specific limitations and understand their needs. It turned out that farmers are willing to adopt IASs but require that the service is easily accessible, with high-quality information that are delivered at an affordable cost. Indeed, here a BM with an innovative way to produce and deliver value is proposed. The value proposition is built upon key features namely, integration, customization, accessibility, and sustainability that reflect users' needs and preferences. Our BM also provides a detailed revenues strategy that guarantees the financial sustainability of IASs. To design and represent our BM, the "Business Model Canvas ©" has been adopted. We concluded that an innovative and well-structured BM has the potential to leave the IASs profitable and capable to ensure environmental and social sustainability.

Keywords: business model; irrigation advisory services; sustainable agriculture; irrigation; water use efficiency

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1. Introduction

Climate change impacts are worsening the scarcity of water resources by negatively affecting precipitation [1], consequently increasing the frequency and intensity of droughts in many areas worldwide [2]. In this context, agriculture is expected to experience the greatest impact since it accounts for 70% of global freshwater withdrawals [3]. Dealing with water scarcity to ensure that agricultural production keeps pace with a growing global demand for food [4] requires more efficient and sustainable irrigation management, from field to watershed, based on accurate knowledge and information [2]. Indeed, improving water use efficiency through minimizing water losses aims at increasing yields through water-management optimization [5], in line with the current priority of producing more with less [6].

Irrigation advisory services (IASs) (i.e., achieving efficiency in irrigation water use) represent a potential response to this emerging need [7,8]. IASs can optimize water management in agriculture thanks to tools and techniques ranging from traditional irrigation scheduling that advises farmers on when and how to irrigate, to Earth-observation (EO), satellite-based technologies, the internet of things (IoT) and unmanned aerial vehicles (UAVs). These latter are able to estimate different variables regarding different components of the water cycle, from the atmosphere to water bodies, land, soil, and vegetation [9]. IASs can be seen as a sustainable innovation, due to the fact that both environmental and social considerations are taken into account in their development and use [10].

Although IASs are considered effective to increase water use efficiency and productivity and improve the decision-making process with regard to irrigation practices [11], their diffusion remains limited [12]. Accordingly, several constraints tied to the functioning and organization of IASs contributed to slowing down their adoption.

Business models (BMs)—namely the firms' strategies to create, capture, and share value—are often employed to spread the diffusion of new technologies [13]. Innovations in the business model are required to generate a change in the ways a firm creates and delivers value, resulting in a significant improvement in the value proposition [14]. Adopting an innovative business potentially allows for the transformation of the characteristics of sustainable and innovative technologies into economic value [15]. Additionally, a different BM may overcome the market barrier linked with technologies diffusion [16]. Lastly, a BM clearly outlines a revenue strategy to guarantee the economic sustainability of every business.

In this context, BMs may represent a powerful tool for widespread adoption and commercialization of IASs. BM concepts have been previously applied to other irrigation technologies such as smart irrigation networks [17], pivot irrigation systems [18], or solar pumps [19,20]. As opposite, to the best of our knowledge, there is a lack of BM application to IASs, as the literature focused mainly on quantifying the benefits associated with the adoption of the service [9,21] and on the investigation of potential users' preferences and willingness to pay [8].

Thus, the aim of this paper is to propose an innovative BM to support the successful development of IASs, encouraging the diffusion of this technology, while enhancing environmental and social benefits associated with their adoption. Drawn from the experience and the results of the OPERA (operationalizing the increase of water use efficiency and resilience in irrigation) EU research project, a BM is structured taking advantage of the opinion of relevant stakeholders and IASs' potential users to identify specific limitations and understand their needs. As a matter of fact, our BM is a tool proposed to give a first operationalization to all the results and outcomes of the OPERA project. In particular, this paper designs a BM for IASs by applying a business model canvas (BMC) developed by Osterwalder and Pigneur [22] for BM representation. By doing so, this paper does not propose any innovation for the IAS as a product, rather—as a novel contribution—it focuses on developing a value proposition and explaining how it can generate revenues to spur its market potential and increase its diffusion among potential users.

2. Background

2.1. Determinants of the Adoption of Technological Innovations in Irrigation

Nowadays, major technological innovations in irrigation are dedicated to scheduling irrigation interventions by handling a large amount of information [23], as for IASs. The adoption of these technologies is complex and may be affected by several factors. However, the literature on identifying these factors is still limited with some rare exceptions that, however, relate to the broader precision agriculture (PI) technologies. For instance, a major limitation is represented by the high costs of these technologies [24] which provide information thanks to expensive sources such as satellites, remote sensing, or sensors. Despite the usefulness of the information delivered by these sources, data may suffer from low temporal and spatial accuracy, consequently influencing their reliability [23].

Moreover, information is usually delivered neglecting the users' skills to effectively manage it. Accordingly, Galioto et al. [23] (p. 4) state that a "farmer's skills and financial capacity, coupled with his/her networking capacity and opportunity to consult service providers are considered the main factors conditioning the adoption of precision agriculture". The lack of tariffs on water use, such as water pricing, is an additional factor that negatively influences the choice of adopting PI [12]. As a matter of fact, regulatory instruments also include rules of use (i.e., turns and quotas) that may favour the adoption of more efficient irrigation technologies [25].

Regarding IASs, specific limitations have been identified by Smith and Muñoz [26]. First, they found that the complexity of data and information provided by IASs require specific knowledge and may not easily be translated into operational advice for farmers that often lack specific skills to understand the information provided. Furthermore, this complexity may result in no user-friendly interfaces. Second, the purpose of IASs is often not in line with farmers' interests and priorities; they are usually more interested in increasing productivity rather than water efficiency, as suggested also by Levidow et al. [27]. Third, most IASs are developed within specific grants with a limited time duration, and this negatively affects their adoption. Fourth, public and private financial resources to sustain the service are limited and IASs sustainability can only be guaranteed by the willingness and ability to pay farmers. Lastly, a lack of communication and trained users may reduce the adoption among potential beneficiaries.

2.2. The Business Model

Scaling-up the diffusion of IASs and overcoming their major limitations require a fundamental reconsideration of the services offered, to which users are offered and in which way. This also implies a reconsideration of the costs of sustaining the services and the revenues that are generated by those services. To propose innovations in the way IASs may sell their services, earn money, and deliver value for their users, a business model perspective has been adopted, intended as a system of interdependent activities that enable the IASs to create value [28].

The concept of the business model came to the spotlight in the 1900s to communicate business ideas to potential investors within a limited time frame [29]. Nowadays, the main purpose of any business model is to describe "how a firm does business". As a conceptual tool, a BM provides great support in assessing the performance, management, communication, and innovation of a business [30]. Chesbrough and Rosenbloom [15] defined BM as a framework to convert technical potential into economic value. Richardson [31] proposed a widely accepted framework for BMs to describe how the firm captures, creates, and delivers value. Additionally, Zott and Amit [28] considered BM as a bundle of specific activities that depicts the way a company "does business" with its customers, partners and vendors. The majority of concepts of business found in the literature closely link BMs to value creation for firms and customers [13,22,32]. This paper adopts the definition proposed by Osterwalder [33] (p. 15), according to which BM can be defined as "a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of the customers and the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams". This definition fits perfectly into our aim of designing an innovative BM capable of describing the essential elements needed to enable the value proposition to be transferred as benefits to the customers, guaranteeing the economic sustainability of IASs.

3. Material and Methods

3.1. Business Model Canvas

To design the BM, this study applies the tool "Business Model Canvas" (BMC) proposed by Osterwalder and Pigneur [22]. BMC is a visual map that represents the elements

of a business model in a holistic manner, also displaying potential interconnections among these and showing how they can impact on value creation [34]. The tool is based on nine interconnected axes where each represents a specific and essential BM component as: the customer segments, the value proposition for the customers, the channels to communicate with the customers, the customers' relationships, key resources, key activities, the definition of the key partnerships, costs, and revenues. By providing a visual representation of each element of the business system, BMC is particularly helpful to explore potential innovations with an inside-out approach [35,36]. Notably, BMC has represented an effective tool to address sustainability issues [34,37]. Nowadays, the success of a business increasingly encompasses the ability to design business models that are able to deal with challenges and opportunities linked to the society and its transition towards sustainability. Hence, the integration of social and environmental issues while creating and delivering value is fundamental.

3.2. Data Collection

This paper builds on the results obtained within the OPERA project to understand both the limitations behind the adoption of an IAS and the needs of stakeholders involved in the agricultural sector (i.e., farmers, water managers, and policymakers). Data were collected in six countries (i.e., France, Spain, Italy, The Netherlands, South Africa, and Poland), namely the six case studies of the OPERA project (Table 1). Each of them presents different climatic conditions; however, water scarcity conditions and the urgency to increase water use efficiency are the common denominator at all sites.

Table 1. Location of the OPERA case studies and stakeholders involved.

Country	Pilot Area	Stakeholders Involved
France	Crau aquifer area	Farmers, irrigation association, water agency, aquifer syndicate, municipalities, and farmers associations.
Italy	Campania	Farmers, regional government, land and water reclamation authorities, farmer associations, local policy makers, and legislators.
Poland	sub-catchment Zglowiaczka	Farmers, regional agricultural advisory centre, and local policymakers.
South Africa	Breede River valley	Farmers, officials in the water sector, consultants, and academics.
Spain	Andalusia	Farmers associations, irrigation associations, local policymakers, and NGOs.
The Netherlands	Reusel	Meteo service and Farmers.

Stakeholders were surveyed to identify their needs, perceived barriers to adopting IASs, and their preferences towards the characteristics of IASs. These data allowed for the definition of the BMC elements to develop an innovative business model for IASs,

designing a value proposition fully tailored to potential customers' needs and capable of overcoming all the possible barriers to IASs' adoption.

More specifically, two different data collections were conducted along with the project. The first questionnaire was administered between 2017 and 2018 to a total of 123 stakeholders involved in water management, including farmers, water users' associations (WUAs), and local authorities in the six case studies of the project (see Table 1). The main aim of the survey was to identify the needs and demands of the agricultural sector. To do so, respondents were asked to elicit the main important actions to increase their competitiveness, their propensity to adopt new technologies in irrigation, and how to increase their water use efficiency. Data were collected through a structured questionnaire with closed-ended questions. Results show that stakeholders are interested in improving the sustainability of the production process and are willing to adopt new technologies for increasing water use efficiency. However, respondents from each case study identified the cost of sensors or advice tools as a limitation to adopt new technologies. The full results of the questionnaire are available in the "D1.1 Assessment of user requirements of the sector" of OPERA at this link http://opendata.waterjpi.eu/dataset/2a2a87e0-5c84-42cd-a9da-ecac0bbb9257/resource/09d7444c-c5e2-4473-835b-9c28f27d20d3/download/d1.1_report_stakeholder_opera.pd (accessed on 11 October 2022) [38].

A second data collection took place between 2018 and 2019 involving only farmers as respondents. From the six case studies of OPERA, 108 farmers were surveyed using face-to-face interviews. The questionnaire was composed of two parts. The first part consisted in a strengths, weaknesses, opportunities, and threats (SWOT) analysis that was implemented to understand the most important internal and external factors influencing IASs' adoption. As suggested by many authors, e.g., [39,40], the SWOT analysis represents a valid methodology for examining problems related to water management in agriculture. This method is largely adopted because it has the potential to clarify the present conditions with respect to the strengths and weaknesses (i.e., internal factors), and the future implications from opportunities and threats (i.e., external factors). Through the SWOT analysis, it was possible to understand farmers' opinions about IASs implementation within the agricultural sector. The strengths section considers the gains and advantages of the adoption of the IAS. Results show that water saving is considered the main strength followed by costs reduction. Weaknesses represent the obstacles to adopting IAS: among these, the results show the low ability to use electronic devices for water management. Opportunities are related to external benefits generated for farmers when adopting IAS. Here, farmers identified different benefits such as the improvement of agricultural productivity and an increased competitive advantage in the market. Lastly, threats represent the elements that may friction the diffusion of the IAS at farm levels. Major threats for farmers are their low level of education and the perceived lack of public financial support. Table 2 resumes the main findings of the SWOT analysis conducted within the OPERA project.

The second part of the questionnaire was used to investigate farmers' preferences for IASs through a choice experiment (CE), by examining several IASs alternatives based on five different attributes plus a monetary option to investigate their willingness to pay for IASs. The results, which are widely described by Altobelli et al. [8], show that the adoption of IASs is positively influences by the time length of forecasts (more days available in the future are preferred), and the need to record water information (longer time intervals needed to record information are preferred). On the other hand, the adoption is negatively influenced by the price, the duration (time length) of the contract, and the frequency of satellite data availability for crop monitoring. The full results of the SWOT and CE analysis are described in the "D4.1 Report on socio-economic assessment" of OPERA [41].

To sum up, the results from these data collections represent the foundation for designing the BMC for IASs, which is at the core of this work that draws from stakeholders' and farmers' opinions of our value proposition for the customers, the cost structure, and the revenue strategy. Based on these three main elements we defined what are the key activities

to be implemented, the resources needed, the possible partners, and the communication and marketing channels (Table 3).

Table 2. SWOT analysis results. Source: adapted from OPERA project—Report on socioeconomic assessment.

Internal Parameters (Present)		**External Parameters (Future)**	
Strength	**Weakness**	**Opportunity**	**Threat**
S.1 Water savings	**W.1** Low use of electronic devices for water management	**O.1** Improving agricultural productivity	**T.1** Social aspect, education
S.2 Cost reduction	**W.2** Negative perception of information provided by IASs	**O.2** New market and consumers	**T.2** Lack of funding
S.3 Capacity and competence	**W.3** Lack of funds for IASs implementation	**O.3** Increase water management through ITC	**T.3** Lack of institutional mechanisms to link rural communities
S.4 Good network of land reclamation and irrigation consortia		**O.4** Reducing environmental pollution	
S.5 Innovation development			
S.6 Provisioning of water measurements			

Table 3. Description of the data collection elements taken to implement the BMC.

Data Collection	**Scope**	**Elements of the Questionnaires**	**Elements of the BM**
Stakeholders questionnaire	Identifying the sector needs to increase water use efficiency	Q1. Actions to increase the competitiveness of farm into the market	Value proposition; Customer segments.
		Q2. Interest in adopting new technologies	Value proposition; Customer segments.
		Q.3 Main limitation on improving irrigation efficiency	Value proposition; Customer segments.; Revenues strategy
		Q4. Preference options that an irrigation support tool should include	Value proposition; Cost structure; Customer segments; Revenues strategy
SWOT analysis	Understand farmers' opinions about IASs implementation within the agricultural sector	Strengths, Weaknesses, Opportunities and Threats of IASs	Value proposition
CE and WTP	Investigate farmers' preferences for IASs	IASs attribute preferences	Value proposition; Cost structure
		Willingness to pay for IASs	Revenues strategy

4. Results and Discussion

4.1. Business Model Development

This section outlines the business model development through the description of key components of the BMC. The stakeholders involved in the OPERA project were essential for our research purposes and represented a relevant source of knowledge to understand IASs' limitations and, consequently, to design the BM. Indeed, the BM design is intended to propose a new way to create and deliver value within IASs that may be helpful to overcome the identified limitations linked to the adoption and diffusion of IASs.

First, potential IASs' users and their needs are identified. Then, the value proposition and the elements that create value in the service are described. A strategy to generate revenues that outweigh costs is proposed to ensure the IASs' financial sustainability. The other axes of the BMC are briefly described through a graphic visualization of the canvas (Figure 1).

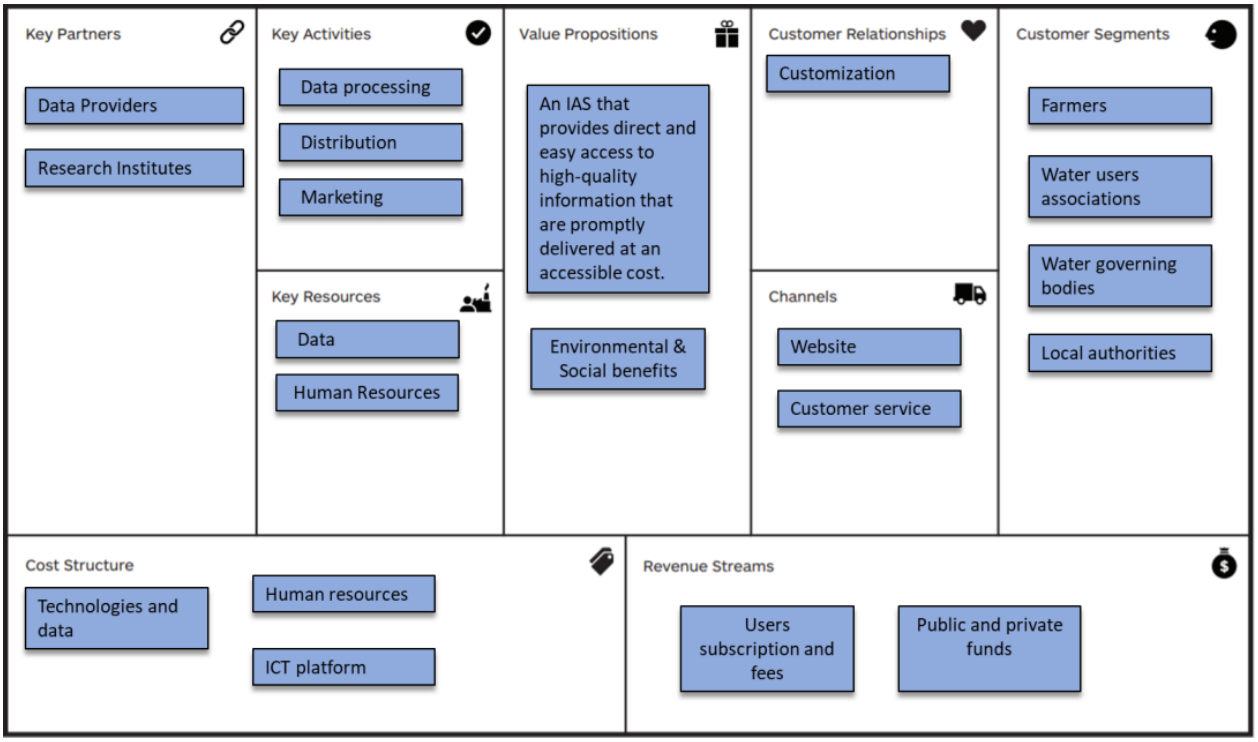

Figure 1. The nine elements of BMC for OPERA-related IASs.

4.1.1. Customer Segments and Their Needs

The first step in developing our business model was to define potential adopters of IASs. As a matter of fact, a financially sustainable IAS relies on the willingness to pay of its users. The OPERA potential users are all those who manage water resources for irrigation purposes and those who take decisions about water resources management. Generally, three main user segments, their interests and needs can be identified, as shown in Figure 2. Farmers have to decide on how much and when to irrigate to maximize crop productivity and profits. In addition, managers of water users' associations have to monitor the irrigation water consumption over seasons to comply with the exploitation plan, while regional authorities require a spatially distributed monitoring of the water-exploitation plan on the irrigation schemes, aquifers, or river basins. All these actors require access to a great amount of information coming from different sources to properly manage water resources.

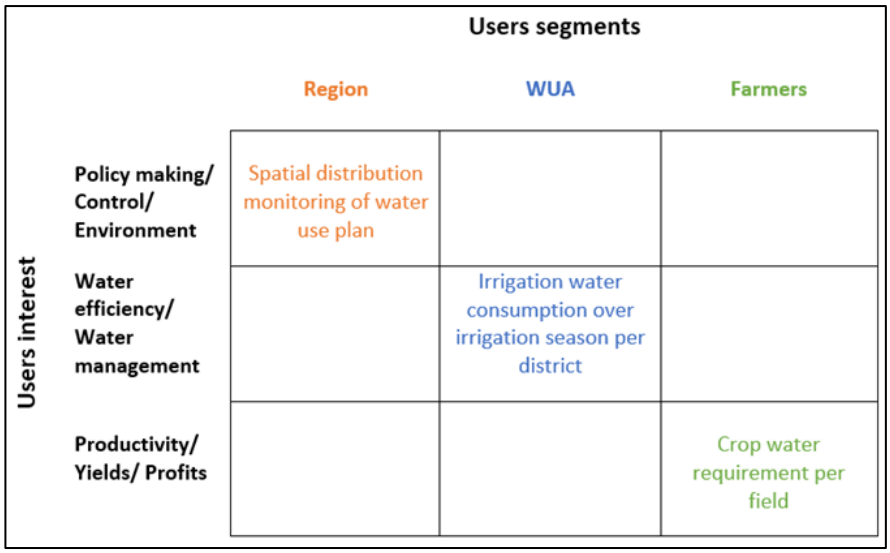

Figure 2. User needs: description of the user segments (region, water users' associations—WUA, farmers) and relationship with their interests.

However, the availability of data for water management alone is not sufficient to guarantee the increase of water use efficiency in irrigation. Much depends on how these data are delivered and used. According to the results from the stakeholders' need assessment, the most important characteristic of an IAS should be the "affordable cost", followed by "direct access to the information", "easy use of information", and "regularity in the delivery of information". Farmers and other water users are inclined to adopt new technologies to increase water efficiency in irrigation together with a proper irrigation strategy, as technologies can increase their market competitiveness, improve the sustainability of the production process, and lower the costs. However, stakeholders consider several constraints to the market expansion of IASs in the private sector: affordability (cost of the technology relative to the farmer's income level, awareness (knowledge about the technology), accessibility (options for obtaining the technology), and lack of customization (capacity to match farmer needs with technological solutions). Based on this, it is possible to conclude that users prefer IASs characterized by a direct and easy access to high-quality information that are promptly and constantly delivered at an accessible cost.

4.1.2. The Value Proposition

The value proposition represents the core of any business model. According to Osterwalder [33], value propositions are products and services that create value for a specific customer segment. The ambition was to develop a service that could effectively support water users in decision-making for irrigation-management purposes, particularly under the anticipation of climate variability and critical moments of water scarcity. However, it is fundamental that sustainable innovation meets user needs to be adopted successfully [42]. Hence, in our value proposition, value is created to address the specific needs of the users. To this purpose, the IAS will be built upon some key features: **integration**, **customization**, **accessibility**, and **sustainability**.

The main aspect to consider is integration. the IAS will make use of numerous available technologies (e.g., Earth-observation or sensor) consequently providing different data outcome and information. Data will be collected and integrated into an information and communication technology (ICT) solution to be used by final users. The wide availability of data will allow the users to choose the information that is most useful to them to meet their water management needs. Indeed, the needs of users are very different depending on the socioeconomic context and the climatic and environmental conditions. This translates into a need for customization of the service that starts with the possibility of choosing from a wide range of information and continues with a payment service based on the

concept of pay for what you use. As high costs have been recognized as one of the main limitations in adopting IASs, a pay-for-what-you-use approach may be able to limit the cost for the users. This means that users will not be forced to pay a fee for the whole irrigation advisory service; instead, they will pay to access the information they need when they need it. Lowering the costs means increasing the accessibility of the service by reaching more and more users. The concept of accessibility also refers to the possibility of accessing the information provided by IASs. As a matter of fact, among the major limitations identified by stakeholders, there is the complexity of information that may result in not user-friendly interfaces and in difficulties to interpret and effectively use the data. Hence, the IAS will be built to offer an intuitive interface that allows the users to use the products in the easiest way and to visualize complex information in a simple graphic vest. Additionally, the data will be prior processed and returned to the users as accessible and ready-to-use practical irrigation advice. Practically, the service will be an ICT solution accessible through a smartphone application, with a user-friendly interface. The tool will work with a great amount of processed data providing (i) the ability to explore data from a catalogue by choosing them based on specific needs; (ii) the possibility of evaluating the scenarios resulting from the choices; and (iii) the possibility to receive daily weather bulletins and alerts when extreme events are coming. Finally, integration, customization and accessibility are essential to reach the sustainability of IAS (Figure 3). Thus, here the IAS is conceived to be an ICT tool for the optimization of irrigation management, by increasing water use efficiency and reducing production costs for farmers, but also to ensure sustainability throughout all the service processes. Sustainability is intended in its environmental, social, and financial terms. From the environmental perspective, the widespread diffusion of the IAS among farmers and other water users will result in a more sustainable agriculture able to produce more with less water resources, minimizing the negative environmental impact of irrigation. Improving water efficiency also brings social benefits by optimizing the access to water among different stakeholders and making water available for purposes different from agriculture (e.g., more water for citizens), thus ensuring increasing water security for all. Moreover, the increased water efficiency and productivity will result in increased agricultural outputs that can be translated into greater food security. As for the case of Gebrezgabhe et al., 2021 [19], our value proposition is intended not only to attract customers to adopt IASs but also to encourage sustainable water management practices in line with the perspective of a sustainable BMC [34].

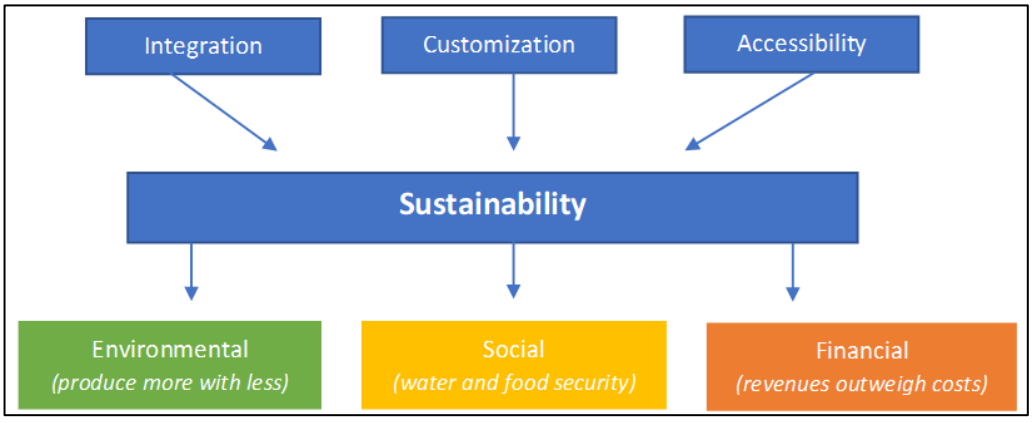

Figure 3. Workflow of sustainability in the value proposition.

4.1.3. Revenues and Financial Sustainability

Since financial sustainability is fundamental to the deployment of IASs, a separate paragraph describes our revenues-generation strategy. Among the main limitations in adopting IASs, financial constraints, namely the lack of funding to sustain the IAS and the high costs of the service, are the most relevant, resulting in low affordability for the users. Most IAS are developed under research projects and consequently can rely on limited

funding over time. In these cases, the service is offered for free—or almost for free—to the users. Instead, where private enterprises provide the service, the cost of the IAS is much higher with respect to the farmer's income level. A financially sustainable IAS should depend on the willingness to pay of its potential users rather than external funding. For this reason, IASs must operate a shift from service for free to service for fee. On the other hand, the high costs associated with the provision of this service represent an adoption barrier. However, the result of our WTP analysis shows that farmers are willing to pay to introduce an irrigation advisory system that results in an economic advantage over their current situation. The effects of better irrigation management can be successful in terms of increasing farmers' income and to diminish the energy costs incurred by the management of water bodies.

For all these reasons, a revenue strategy that is based on the concept of pay for what you use is proposed, namely pay as you go (PAYG). Business models based on PAYG give users the ability to pay for only what they use as they need it (e.g., the information they need at any time they need it) and can afford it. In addition, they can also choose to pay a fixed fee for a contract that can be monthly or yearly. The contract can be customized with features that reflect the users need (e.g., interval of information delivery, amount of information, time length of forecasts, and use of scenario for the decision making). All these features will shape the total amount of the fee so that all those who manage water for irrigation purposes can access the service even with basic functionalities. This payment model enables a win-win situation in which the risks are minimized both for users and providers. Indeed, users can access modern irrigation technologies at an affordable cost while IASs providers reduce the operational risk and recover its cost. PAYG models are widely adopted for irrigation technologies, especially when farmers' access to finance is limited [43,44].

Additionally, IAS may rely on external funding for extra revenues and benefits. As a matter of fact, access to financing represents a great challenge to scaling-up agricultural and irrigation technologies. Different finance mechanisms can include national direct and indirect support programs, such as credit guarantee funds, value chain financing, and price smoothing.

5. Conclusions

IASs improve water efficiency in irrigation, gaining increased productivity, and reducing costs for farmers, together with environmental and social benefits. However, their widespread adoption has been limited among users and managers of water for irrigation. Surveying relevant stakeholders and potential users within the OPERA project revealed that the constraints in adopting IASs may arise either from the user's side, including farmers' low skills and knowledge of new technologies, and the services side, such as the low accessibility of information or the high costs. Despite the existing limitations, farmers are willing to adopt IASs. Nevertheless, they require that the service is easily accessible, with high-quality information that are delivered at an affordable cost. BM seems to be a crucial tool to support IASs' strategic organization through the representation of the elements that the service may innovate to create, deliver, capture, and exchange value with its customers. The proposed BM is innovative in the sense that it is tailored to the needs of potential users and has the potential to overcome the IASs diffusions barriers. The implementation of this innovative business model will ensure that IAS becomes financially sustainable, without the need for continued public funding, but only relying on the willingness to pay its users. Further, a well-structured business that leaves the service profitable and that is capable to ensure environmental and social sustainability while providing water use efficiency, will attract potential investors, including governments and public agencies, to fund new schemes. This research contributed to expanding the literature on business models and their relationship with sustainable innovations for irrigation. Despite business models seeming to be promising tools to support the diffusion and commercialization of IASs,

further research is needed to empirically analyze the response of the users and the markets to new ways to create value.

Limitations of the Study

This study represents novel research on IASs by taking a step forward in the application of BMC to potentially scale up IASs through innovation and business perspectives. However, it has several limitations. First, the lack of previous studies related to the topic limited the possibility of conducting a systematic literature review and created some difficulties in discussing our results. Indeed, the concept of BM has been rarely applied to IASs. A second limitation can be found in the study regarding the design of the BM. As a matter of fact, it was not possible to segment our value proposition accordingly to the different potential users that have been identified. This occurred because, during the data collection, results were not classified according to stakeholders' categories (i.e., farmers, authorities, WUAs, etc.). Hence, the value proposition has been designed to be as inclusive as possible to take into account the needs of all the customer segments. Lastly, our study represents a theoretical exercise with the scope of understanding enablers and barriers of IASs to propose an innovative business strategy capable to increase their diffusion. The application of the BM to a specific case study is missing. Further research should address this issue by implementing a BM in a real IAS company.

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