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Artificial Intelligence in the Agri-Food System: Rethinking Sustainable Business Models in the COVID-19 Scenario

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Abstract: The aim of the paper is to investigate the artificial intelligence (AI) function in agri-food industry, as well as the role of stakeholders in its supply chain. Above all, from the beginning of the new millennium, scholars and practitioners have paid an increasing attention to artificial intelligence (AI) technologies in operational processes management and challenges for new business models, in a sustainable and socially responsible perspective. Thus, the stakeholders can assume a proactive or marginal role in the value creation for business, according to their own environmental awareness. These issues appear still "open" in some industries, such as the agri-food system, where the adoption of new technologies requires rethinking and redesigning the whole business model. Methodologically, we brought forward an in-depth review of the literature about major articles in this field. Especially, the study has been conducted following two phases: firstly, we extracted from scientific databases (Web of Science, Scopus, and Google Scholar) and studied relevant articles; secondly, we analyzed the selected articles. The findings highlight interesting issues about AI towards a "space economy" to achieve sustainable and responsible business models, also in the perspective of the COVID-19 pandemic scenario. Theoretical and managerial implications are discussed.

Keywords: environmental awareness; environmental space; literature review; space economy; stakeholder

1. Introduction

In the past 20 years, scholars and practitioners have taken a more thorough interest in artificial intelligence (AI) technologies. Firstly, several have made attempts to provide a definition for AI. For AI, some authors identify the ability of a "machine" to understand in a "clever" way the inputs provided by the environment, or better decipher the external variables by a flexible configuration [1,2]. In this direction, AI represents a new way to create and manage the information in a business model properly rethought [3,4], including the link between innovation and sustainability [5]. In more detail, the innovation appears as the power for business. Indeed, the adoption of innovative technologies can allow adopting business models addressing the UN 2030 Agenda (https://sustainabledevelopment.un.org). However, these models have to include three key dimensions, namely, economic, environmental, and social [6], all interdependent [7]. Furthermore, it has been highlighted that the interface between human and technical resources, as well as the natural systems, influences the achievement of 17 sustainable development goals (SDGs) included in the UN 2030 Agenda [8]. Otherwise, the need to ensure adequate nutrition for the growing human population is tied to a system able to guarantee sustainable agricultural and food production, and thus to increase efficiency of production processes and reduce their negative effects on the environment [9,10].

So, a growing number of enterprises are creating solutions for agri-food systems, based on AI capable of solving multiple problems and saving valuable resources by reducing environmental damage. The adoption of AI technologies in processes management needs business models that include sustainable and socially responsible issues. Hence, in this direction, these business models create a competitive advantage for enterprises without damage to the environment and society; this means that the business models can be defined as sustainable, and thus called "sustainable business models" (SBMs) [11,12].

In this context, the stakeholders can assume different roles in the value creation (i.e., proactive behavior in adoption of AI and sustainable practices in operational processes; or marginal behavior, that is irrelevant compared to artificial machine technologies).

The role of stakeholders (e.g., suppliers, public institutions, consumers' associations, technical equipment suppliers, and so on) in the supply chain could be ascribed to the environmentally aware toward the achievement or realization of sustainable organizations, according to the sustainable development (SD) approach that includes environmental, social, economic, digital, and training dimensions [13]. These issues seem still "open" in the agri-food industry, which has to find the balance between technologies and responsible business. Thus, the adoption of AI technologies requires a deep rethinking of the "way" to carry out business, especially the operational processes, and, more in general, a deep redesigning of the whole business model, considering also economic scenarios full of uncertainty such as the one due to the COVID-19 pandemic.

It is a challenge that can find important support in technology throughout supply chain management, from grower to end-consumer, though it is still held back by a general skills shortage that prevents its adoption on a larger scale [14].

Hence AI appears as an innovative technology that can support the businesses struggling through the COVID-19 pandemic, especially in the agri-food industry. Indeed, AI is identified as a technology tool against the effects of the pandemic. Otherwise, AI allows managing the pandemic by enforcing social distancing measures [15,16].

However, these aspects are still under-researched in the literature. Thus, starting from an in-depth and structured review on the main contributions in the literature, we try to bridge the research gap by answering the following research questions:

(Q1) What is the AI function in the agri-food business models from a sustainable perspective?
(Q2) What is the new role of the stakeholder in the agri-food supply chain?

The structure of the article is composed of four other sections. Section 2 includes the methodology conducted for our analysis. Section 3 provides the theoretical framework on the issues proposed. Section 4 describes the findings and main theoretical insights of the research. Section 5 presents the discussion and the main theoretical and managerial implications. Section 6 contains the conclusions, limitations, and future research perspectives.

2. Methodology

Our methodology used a qualitative approach focused on the content of AI articles and sustainable business models adopted in the agri-food industry. We conducted the analysis on the main contributions in the literature in order to analyze and systematize the state of art developed by main scholars on AI and SBMs towards SDGs, including the concept of "social distancing" due to the COVID-19 pandemic. Following the common research procedures [17], we collected articles in the English language using ISI Web of Science (WoS). Our database has been completed by a manual research on Scopus and Google Scholar (GS) [18]. This methodology approach has been planned in the following phases (Figure 1).

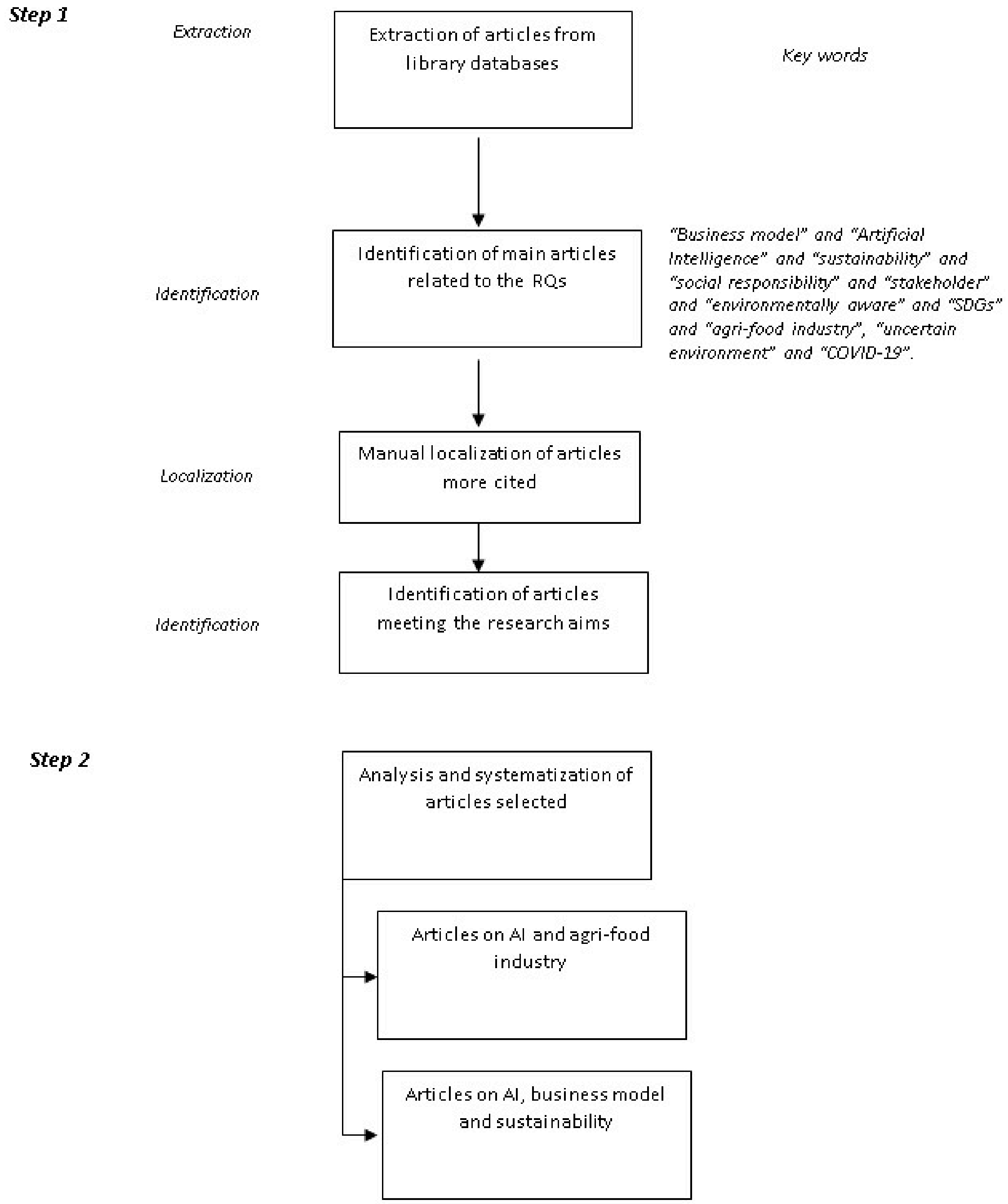

Figure 1. Methodology phases.

Firstly, we extracted and studied relevant documents; secondly, we analyzed the selected articles. The first phase was structured in four steps. Above all, we extracted the articles from library databases (extraction step); then, we identified the main articles (identification step); moreover, we conducted a manual localization of the articles most cited (localization step); finally, we identified other important articles (identification step). In the second phase, we analyzed the articles to point out and systematize the most important research paths. Especially, in order to collect all articles on the issues studied, we did not select the time on WoS, Scopus, and GS using the function imposed by default from WoS, therefore our time range was from 1990 to 2020 (including the first four months). In addition, to identify all documents useful for our research, we adopted cut-off combinations of two classes of search strings. The first class included the articles about AI and agriculture industry; the second class included the articles on AI, business models, and sustainability. We used different key words variously combined among them and in line with the aims of our research. Specifically, we combined "business model" and "Artificial Intelligence", "sustainability", and "social responsibility". Then, these words were combined from time to time with the following key words: "stakeholder", "environmentally aware", "SDGs", "agri-food industry", "uncertain environment", and "COVID-19".

By the second phase, we identified the significant articles and examined the content of each document. In more detail, we read the abstracts of each article to guarantee their relevance with the study aims. The understanding of the abstracts allowed us to highlight the relationship with the investigated topic. Moreover, we enriched the data collection by a manual search on Scopus and GS. In order to identify the relevant articles, we used the same parameters. As concerns the time range selected, we considered all articles included in the database. This allowed us to include other articles in line with the aims of our study. Afterwards (the fourth and fifth steps), all articles collected in our database were studied separately to highlight the critical and relevant aspects useful for our study. The articles not useful for our study were removed from the database, as well as the duplicates. All authors compared their own results from the analysis and wrote the sections of this paper. By the end of this phase, our database included 60 articles.

3. Theoretical Background

The emergence of AI and the potential that exists in the different sectors of society determine the evaluation of its effects on sustainable development [19]. This is because companies are increasingly required to face the challenge of sustainability, trying to improve the scope of innovations to preserve the integrity of the ecosystem and improve the use of natural resources [20]. Agriculture is at the center of a process of profound renewal. It focuses on digital technologies, above all, AI and machine learning, the Internet of Things (IoT), Cloud, and Blockchain to realize traceability of supply chains [21]. The adoption of these technologies is one of the most important modes to protect consumers and improve the quality of agricultural production. Specifically, one of the aspects to be analyzed is the application to the agri-food sector of AI, which combines modern sensory technologies with the ability of computer processing. Among the AI technologies improving agri-food quality and retail services, the main ones are: machine learning and deep learning, computer vision, experienced systems, physical robots and software robots, natural language processing and generation. In more detail, we observe that machine learning is a method of data analysis that automates construction of analytical models. It is a branch of AI and is based on the idea that systems can learn from data, identify models on their own, and make decisions with minimal human intervention [22]. In agriculture, for example, mobile apps "enhanced" by AI supplied to agronomists are able to immediately identify what the problem is of the framed plant [23]. As for robots (physical and software), these are sophisticated machines that can solve more or less complex problems. Robotic agriculture, for example, speeds up the most repetitive tasks, such as weed and fruit harvesting or packaging. Drones and self-driving tractors allow precision farming models to be translated into practice [24]. Thus, precision agriculture is revolutionizing many aspects of agri-food production systems, that is, all the operational processes. Indeed, as a matter of fact, robots can calculate the exact condition of soil and crops or connect to satellites in order to understand how much water is really needed, without wasting. This information is a valuable asset that also allows farmers to reduce the use of chemical inputs, machinery, and water using information on soil, temperature, humidity, agricultural equipment, livestock, fertilizers, soil, and sown crops.

In this direction, sustainable development (SD) needs to be achieved to harmonize the profit, social protection, and environmental respect. The UN 2030 Agenda, including all 17 SDGs, established an action program for people, the planet, prosperity, and peace [25]. Thus, SDGs establish the new sustainable development strategy for companies. Therefore, a proactive approach is required for stockholders to create sustainable and responsible organizations addressed to invest in technological development, also through partnerships with other companies.

The role of AI in the food industry is becoming increasingly important due to its ability to help save food, improve the hygiene of production sites, and clean up more processing equipment quickly; therefore, there are many cases of use of artificial intelligence and machine learning in the food industry. Automated systems can, in a few seconds, collect hundreds of data on a single food product and quickly make an assessment of it [26,27]. A system, for example, can collect and process data from hundreds of individual ingredients, as they move quickly on a conveyor belt; these systems can significantly reduce labor costs and waste. In more detail, among the cases of application of AI technologies within the food industry, we can observe [28–31]:

- AI for sorting food—One of the most advanced AI applications in the food industry is TOMRA Sorting Food, which uses optical sensor-based solutions with machine learning capabilities. TOMRA uses cameras and sensors to visualize food in the same way that consumers do; in this way, they are able to order it according to preferences, saving time and money in production and improving the quality of the product [31].
- Food industry supply optimization—AI helps in supply chain management, and technology can support companies to test and monitor food safety products at every stage of the supply chain [28].
- AI to ensure hygiene standards—A successful case is represented by the KanKan company (Las Vegas, USA) which has worked on creating intelligent solutions to improve hygiene conditions in China. The system, which can also be used in restaurants, uses cameras to monitor workers and uses facial recognition and object recognition software, in order to determine whether workers wear hats and masks as required by food safety laws. If it detects a violation, the software extracts the screen images for review [29].
- Food and drink preparation for customers—This is the case with Creator, a San Francisco restaurant that uses systems controlled by hundreds of sensors and piloted by 20 microcomputers, whose job is to ensure that every ingredient (from meat to sauces and spices) is distributed in the expected doses [30].

Hence, it is possible to say that technology has the potential to create a healthier and more thriving food industry for workers and consumers. Moreover, other technology (i.e., Blockchain) permits the agri-food supply chain to be more integrated, improving the traceability and the security of food [32].

Thanks to the development of suitable technology, such as AI, it is possible to achieve reduction of waste, toxic impact of surpluses, poverty, and malnutrition; this means that enterprises that are oriented to achieve some specific SDGs (i.e., SDG#12 "Responsible consumption and production"), indeed to achieve economic growth and sustainable development, need to reduce the "ecological footprint" by changing the production systems in terms of operations and processes, and the "way" they use goods and resources. The agriculture setting is the biggest user of water worldwide, thus the improvement of irrigation systems in terms of efficiency becomes, on one hand, a necessity for the enterprise and, on the other hand, a critical driver to achieve additional sustainable patterns of consumption by 2030. SDG#3 ("Ensure healthy lives and promote well-being for all at all ages") is the improvement of technology adopted for agri-food production contributing to the world health coverage by reducing air pollution and inadequate water and sanitation that are damaging to health [33].

In addition, the use of drones and robots on fields makes it possible to perfectly assess the ripening status of a fruit, or the need to irrigate the plant or to use herbicides and pesticides on time, exponentially decreasing the damage to human health and the environment.

According to [19], the adoption of AI by enterprises to improve the processes efficiency achieving also the sustainability targets can contribute to reaching the 17 SDGs, with significant effects on civil society and the environment. However, the effects on SDGs could be also negative. For instance, the richer and more educated classes could take advantage of AI wealth to the detriment of less-well-off classes. In addition, the enterprises may also not be able to manage the AI impacts long-term, especially as concerns the privacy issues due to AI application data [4].

In this context, new concepts are introduced, such as "space economy" and "environmental space".

The space economy is just beginning, but it is already announced as a great opportunity for the future, as also indicated in the 2019 New Space Economy Expoforum (https://www.nseexpoforum.com/press/). This new economy looks to the future and in space sees a new environment in which to develop new technologies that can be useful on Earth, starting with those in the service of the pharmaceutical industry and precision agriculture [34]. In this process, the true challenge is also to capture and preventthe market changes arising from uncertainty due to events, like that of the COVID-19 pandemic.

It is a reality that is shaping the global market as an ecosystem in which the public sector and the private sector coexist, involving new players, such as farmers, processors, distributors, and so on, and also investors who propose business models that have to include sustainability and responsibility issues, thus new global challenges [18].

Otherwise, [34] through the "prism of sustainability", has pointed out the conceptual meaning of "environmental space" focusing on criteria for the environmental and social dimensions included in this space, whereas "sustainability" includes more dimensions, such as economic and institutional. Each dimension can be defined as a complex self-regulating system combined with the other three.

Hence, the space economy and environmental space concepts represent new areas to consider separately or jointly in the rethinking and redesigning of SBMs in the agri-food setting. Anyway, the goal is to involve all stakeholders—just according to the "stakeholder value", based on the principle that an enterprise's objective is to generate value for all its stakeholders—belonging to this new ecosystem: large and small enterprises in the space sector, space agencies, governments, international users and investors, business angles and venture capital, innovative small and medium-sized enterprises (SMEs) from non-space sectors, start-ups and incubators, research centers and universities, therefore creating a system and encouraging the encounter between industry, the world of space, and research [35].

4. Findings

The analysis of articles included in our data collection has highlighted that the word that occurs most frequently is "business model"; then, in the following order, "Artificial Intelligence", "sustainability", and "social responsibility". When the words here above have been variously combined with "stakeholder", "environmentally aware", "SDGs", "agri-food industry", and "uncertain environment", the findings have not evidenced significant results.

Instead, the combination among "business model", "Artificial Intelligence", "sustainability", "social responsibility", "agri-food industry", and "COVID-19 pandemic" provided results that allowed us to identify a relevant need for coordination and communication in the food industry, which has been for several years an independent sector from agriculture industry without considering the reciprocal dependencies among firms along the "food value chain" [36].

Otherwise, some scholars have evidenced that AI technology has been considered as an application to increase the levels of efficiency and production in this industry. Especially, its adoption aims to fill the labor shortages and to reduce the environmental impacts from operations systems related to agri-food practices. Hence, the adoption of technological innovation with AI appears as a significant change for business models, whose aim is to be also a response to challenges required by environmentally and socially sustainable issues. Indeed, the adoption of AI in the fertilizers, pesticides, and systemized irrigation processes allows achieving the reduction of environmental effects. These findings show also that AI technology has advantages in terms of productivity and efficiency, as well as of profitability by the reduction of costs. This means that AI technology applications change the operation modules and their management for farms. Consequently, business models have to be rethought and redesigned around a "change being real-time forecasting" [10], including the effects of the COVID-19 pandemic. After all, the adoption of AI technology in the agri-food setting, as well as the use of other information technology applications, enables all players of the supply chain, from "farm" to "fork", to be competitive by sharing information and using the same language codes looking for the balance among government regulation frameworks and customers' and stakeholders' interest [37,38], and indeed, to ensure that food safety and sustainability become key factors in all the issues of transparency, accountability, and verifiability about resources to use in the operational processes of the agri-food chain [39]. Thus, AI, together with other technologies (e.g., Blockchain), can contribute to improving the efficiency in the agri-food supply chain, as well as the adoption of FoodTech, which is the use in this chain of disruptive digital technologies to achieve SDGs, that permits responding to hunger needs in the world without increasing the productivity of food. In more detail, the technologies require also a rethinking about the governance of firms involved in the agri-food chain, especially because the adoption of technologies reduces the involvement of a quantity of human resources in the operational processes, promoting also social distancing. Indeed, some issues are still "open". For instance, a lot of small players, mainly farmers and consumers, are not able to face up to the changes by technologies. In addition, the adoption of AI can undermine privacy until it is lost [40].

Considering the selected period for our research, from 1990 to 2020 (including the first four months), we observed that the interest from scholars to analyze the AI and business models for SD goals issues had started from 2016. This information can be explained in that in 2015, the UN 2030 Agenda and its goals had been adopted by the United Nations. However, some scholars have evidence in the relationship between AI and SBMs that sustainability has become a significant field mainly in commercial operations [25,41–46], even though AI is based on advances in machine learning, value creation through the analysis of numerous series of data and understanding of decision makers, improvement and acceleration of decision making [41–44,47]. A growing body of research shows that AI helps people make better decisions [45,46,48]. Therefore, it becomes fundamental for enterprises to identify the strategies to dominate their competitive sector and extract new information from large sets of data that could be useful to guide decision making and management [49] according to the SD perspective [50]. As our results have shown, it still remains an increasing interest from scholars on AI in the context examined, while the attention on the "environmentally aware" and "stakeholders" combined with the other key words is still scarce.

5. Discussion and Theoretical and Managerial Implications

The findings achieved from our research carried out on main contributions in the literature about the adoption of AI technologies in operational processes typical of the agri-food sector, according to the SD perspective, highlight paths still not clearly defined.

Firstly, although AI is considered a technological solution to improve the efficiency and the productivity of the sector, and its key role is recognized in its adoption to contribute to reaching SDGs, the analysis on involvement of stakeholders and their importance in this process is still missing. Secondly, if the AI issues (and more in general, the new technologies), on the one hand, lead the way to consider the agri-food sector as an ecosystem, allowing public and private organizations to coexist in the same area, on the other hand, all stakeholders involved in the supply chain (i.e., farmers, processors, investors, and so on) are considered as actors of business models founded on sustainability and responsibility themes [18]. Hence, our findings show that in the literature, the attention on the role of stakeholders in the changing processes, that is, to rethink and redesign business models for sustainability, is still under-researched. Nevertheless, some scholars on sustainability issues, especially on the disclosure topic, have highlighted that academic debate is still missing on sustainable practices adopted by the enterprises to obtain sustainable organization models [51,52]. Thus, our results on these considerations are in line with other previous studies. Otherwise, the sustainability, responsibility, environmental, social, economic, and institutional issues related to the sector investigated have been addressed separately as highlighted by the New Space Economy Expoforum in 2019 [18,34].

Hence, the "environmental awareness" of the enterprises, and specifically of all stakeholders involved in the agri-food supply chain, remains still an open issue for the literature that, in the study about the rethinking and redesigning the business models, has to provide a clear guide to investigate all its dimensions in a systemic perspective, including environmental, economic, social, digital, and training/educational issues towards the achievement of SDGs.

In this direction, for agri-food organizations, the use of AI is addressed to identify solutions to improve the competitiveness of business [42,45,47], and limit the negative effects on the environment [5,53] pursuing SDGs [42,45,47,54]. Thus, AI has the potential to address some of the most pressing challenges for the future of humanity, such as the achievement of the SDGs [55,56]. Our study has shown that there is still a research gap with respect to the implications that AI may get with respect to SDGs, such as SDG #12, SDG #3, and so on.

According to [48], the success of organizations will depend on their ability to innovate operations, products, and services, through their human capital. Indeed, even if AI will eliminate some jobs in the next decade, it can open up vast new opportunities for collaboration between man and machine. Some scholars have also examined the ethical and social aspects related to the use of AI, noting that the evolution of company automation could accentuate the disparities between people and more developed countries [57]. If political institutions do not intervene to reduce the distance between rich, technologically advanced countries and poorer and less-advanced economies, technology is likely to contribute to growing inequality. Hence, this goal encourages enterprises to adopt sustainable practices, supporting developing countries in improving their scientific and technological capabilities, in order to develop and implement more sustainable models and production and consumption tools to monitor the impacts of sustainable development.

In this way, as mentioned before and as underlined by many researchers not only about the stakeholder theory [58–60], the role of all stakeholders is fundamental for the development of the entire agri-food system, both for technological innovation and for a sustainable evolution of the system, and for the creation of advanced management methods able to support it. Innovations in the agri-food sector are needed in order to create also a technological and sustainable food supply. The diffusion of global retailers and the introduction of modern channels of distribution and sourcing, combined with affluent domestic demand for higher-quality products, have caused significant transformations in food retail systems everywhere. So, the agri-food sector requires evolutionary rather than revolutionary changes to reshape institutions. Measuring innovation and sustainability is possible against benchmarks and requires stakeholder agreement on sustainability values. The importance of multiple social views and multiple stakeholder involvement in agri-food innovation is clear more and more. Flexible goals rather than process-oriented management of innovation are really important, but so is the essential role of profit in anchoring sustainable development in business: it agrees with concepts of evolutionary innovation. There is no single best solution for making the agri-food sector more sustainable all over the world, but the combination of a range of solutions and approaches is likely to provide the best way forward. What has not yet been properly investigated so far and what we wanted to investigate and add to the basic literature is the decisive role that stakeholders can play in identifying, developing, and promoting new AI technologies; they must be able to evolve the agri-food system towards new dimensions already in the near future, both in economic terms and in terms of sustainability and business management, according to what is in the innovative possibilities also dictated by the new space economy.

6. Conclusions, Limitations, and Future Research Perspectives

The findings highlighted that the literature has developed only some aspects about SD through AI. Digital technologies can help create SBMs, increasing productivity, reducing production costs and emissions, decreasing the intensity of production process resources, improving correspondence in markets [4]. It can reply to our research question, that is, the role of AI in the agri-food business models, according to the sustainable perspective. Less attention has been paid by the UN 2030 Agenda to guidelines established for companies, called to face the challenge of the correspondence between human health and health of natural systems; as well, less attention has been addressed to the role that each stakeholder can assume in the changing of business models in the agri-food sector. This provides a reply to our second research question.

According to the "stakeholder value" belonging to the new ecosystem, both large and small enterprises in the space sector (space agencies, governments, etc.) and SMEs from non-space sectors (i.e., start-ups and incubators) have to be involved in the changing process. However, the promotion of SBMs is not the only area to be addressed. The evolution of disruptive technology has to be managed by embracing an organic vision of culture, to avoid potentially harmful uses for man and society as a whole. At the global level, politicians, researchers, and companies are coming together to develop common principles that should ensure a responsible application of all AI technologies. It is essential that scholars, professionals, and institutions accompany this effort towards "environmental awareness", in order to analyze the issues proposed in this study, to implement a public–private partnership network, and to anticipate and manage the profound social changes linked to the digital revolution.

The main limitation of this study appears to be related to analysis based only on the articles researched on the basis of specific key words, also combined among them, in order to reply to our two research questions. Otherwise, this limitation is also the advantage point of this research, because "to open" the topic to future research provided the elements for a new approach to AI adopted by the agri-food sector, that is "space economy integrated to environmental space", including new stakeholders in the defining of agri-food SBMs.

In the end, it is significant to underline that everything previously discussed must necessarily be considered in the new and difficult scenario created by the COVID-19 pandemic. With the rapid spread of the new pandemic, the attitude of food consumers has also changed rapidly. The companies had to forcefully respond to the changing needs of the population by changing their production activity. Many of the current changes are destined to remain in purchasing attitudes, even at a later stage. In order to contain the pandemic, markets have had to deal with a sharp change in population needs, which has highlighted the necessity for a rapid rethinking of management and business models.

This study has been carried out analyzing the literature until 2020 (including the first four months), including uncertainty of the environment among the key words. The literature collected and analyzed on issues introduced by our research did not include specifically the COVID-19 pandemic topic which has involved the economy globally in the first months of 2020. Hence, it being an unknown phenomenon full of uncertainty, it will be necessary to rethink the business models overhauling the following dimensions: environmental, economic, technological, educational and training, and social. This last needs to be reconsidered in terms of social distancing, where, on one hand, the adoption of technologies (especially AI) can contribute to redefining the agri-food business model, and on the other hand, it means "to sacrifice" the concept of social dimension according to the "triple bottom line" approach, and consequently also the achievement of some SDGs. In this direction, the goals of UN 2030 Agenda need to be reviewed and, in order to manage effectively and efficiently the COVID-19 pandemic phenomenon, the involvement of all stakeholders, mainly governments, will be necessary to establish and share the rules of the game, identifying the dimensions for the governance and management of SBMs in the agri-food system.

Some companies have partially or radically reinvented themselves to meet current needs. In this context, a key role is played by those sectors that have to supply basic necessities, first of all, the agri-food system, whose correct performance is of primary importance also to ensure that the fear of scarcity does not trigger a hoarding race and, consequently, a danger to public order. An important starting point for emergency management can be the activation of an emergency team, which should be made up of a small group of company chiefs, who work closely with managers, managing directors and financial directors in order to formulate cross-functional solutions based on rapid assessments of market risks and needs. The protection of consumer and employee safety must always be the first priority, promoting where possible labor in smart working mode and implementing digital tools for development and optimization of e-commerce, which are currently experiencing a very strong growth, destined to remain in consumers' purchasing attitudes even at a later stage.

Therefore, also following the need to maintain social distance for the health of all players, in the agri-food system, AI can truly represent an important aid at all levels, both for agriculture and the food industry and for large-scale distribution. Obviously, the limits of these considerations are related above all to the difficulty of making accurate predictions in such a recent state of emergency, but also to the concrete intention of the various actors to make important investments, which are able to develop new technologies in efficient and effective mode, linked to the actual needs of the moment.

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