The Digital Applications of “Agriculture 4.0”: Strategic Opportunity for the Development of the Italian Citrus Chain

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Abstract: Contemporary agriculture is increasingly oriented toward the synergistic adoption of technologies such as the Internet of Things, Internet of Farming, big data analytics, and blockchain to combine resource protection and economic, social, and environmental sustainability. In Italy, the market growth potential of “Agriculture 4.0” and “Farming 4.0” solutions is very high, but the adoption of the related technological innovations is still low. Italian companies are increasingly aware of the opportunities offered by the 4.0 paradigm, but there are still cultural and technological limits to the full development of the phenomenon. This research aims to contribute to knowledge that will improve the propensity of agricultural operators to adopt the digital solutions of “Agriculture 4.0” by demonstrating its potential, along with its limits. To this end, an integrated methodological approach was adopted, built with focus groups and multicriteria analysis, to define and assess the possible future scenarios resulting from the implementation of digital transformation. The results show an increased focus on solutions that allow the integration of new tools to support those already used in the business organization and at a sustainable cost. To enable the development of “Agriculture 4.0”, we propose that it is necessary to invest in training operators in the supply chain, and above all, raising awareness among farmers, who it is essential fully appreciate the potential benefits of the 4.0 revolution.

Keywords: digital transformation; smart agrifood; Internet of Things; Internet of Farming; Farming 4.0; precision agriculture; multicriteria analysis

1. Introduction

The digital transformation generated by information and communication technologies (ICT) affects every aspect of human society, enhancing traditional innovation and development processes. Moreover, it generates rapid product and process innovations that affect different segments of society (from the economy, communication, e-government, services, art, and archaeology to medicine and science) [1–8].

These processes are based on the use of a series of enabling technologies, divided into product-service and process innovations, which are of strategic economic importance [9,10], including, in particular, the Internet of Things and big data. The Internet of Things encompasses the applications of digital technologies in everyday life (recording of habits and actions with sensors and/or devices; exchange, storage, sharing and processing of information and data through connection to the Internet). On the other hand, big data, also known as ‘megadata’, refers to the great speed with which data are generated, stored, processed, and analyzed (thus becoming a real resource to support decision-making and process automation).

These phenomena have been growing steadily in recent years, but with different intensities from one country to another [11–14]. As reported by the FAO [15], there is a
strong digital divide between countries, caused by differences in access to information and technology, but also within countries themselves, between rural and urban areas and between different productive sectors. Especially between urban and rural areas, the digital divide constitutes a major constraint on the use of new technologies among farmers, with consequences for the diffusion of innovations and access to global markets.

The vision of the digital transformation of the European Union (EU) was defined by the European Commission in February 2020, in its communication Shaping Europe’s Digital Future [16], to achieve an inclusive use of technology that works for people and respects the core values of the EU. The White Paper on Artificial Intelligence [17] and the European Data Strategy [18] are, in fact, the first two pillars of the Commission’s new digital strategy [19,20].

Through the Internet of Things and big data in agribusiness, where “Precision Farming” solutions (IoT sensors, mobile devices, smart tractors, robots, drones) and “smart farming” solutions (management software, analytics, cloud) are being integrated, a model of “Agriculture 4.0” is being created. Through the automatic collection, integration, and analysis of data (from different sources) and the use of 4.0 technologies, it is possible to generate knowledge and support the farmer in decision-making processes, to increase the profitability and economic, environmental, and social sustainability of agriculture.

Recent surveys have shown that digital technologies supporting “Agriculture 4.0” have led to a 13% reduction in costs/ha and 30% reduction in the use of water, fuel, fertilizers, and pesticides, while in terms of environmental sustainability, a 15% reduction in the carbon footprint of crops has been recorded [21]. The adoption of 4.0 solutions is significantly influenced by the size of the land; in fact, under 10 hectares, only 25% of farms adopt 4.0 solutions, compared to 65% of those over 100 hectares [22]. However, it is also true to point out that the digital solutions currently available are mainly oriented toward precision agriculture, and to a lesser extent, interconnected agriculture (the so-called “Internet of Farming”) [23–25].

In summary, Internet of Things technologies, GIS/geospatial infrastructures, artificial intelligence, fixed and mobile ultra-broadband networks, blockchain, augmented and virtual reality, etc., also offered in outsourcing, make “green and sustainable development” possible, with applications in precision farming/Agriculture 4.0, in the traceability of the food chain [26] and in (market-driven) initiatives with “digitized” services [27–30], to guarantee users transparency of the process [31,32].

The value of the global “Agriculture 4.0” market (2020) is about $7 billion, 30% of which is generated in Europe [33]. Italy represents only 4% of the global market, but there has been rapid growth in recent years. In fact, from €100 million in 2017, the Italian “Agriculture 4.0” market has increased to 540 million in 2020. About 80% is generated by innovative offers from readily established players in the sector (e.g., suppliers of agricultural machinery and equipment) and about 20% by solutions from emerging players (mainly startups), who propose innovative digital systems and technology consulting services [34].

Despite the potential of digital tools in agriculture, the adoption rate in Europe is still low [35,36] due to strong barriers [37–41]. Adoption depends on a wide range of variables such as farmer characteristics, farm structure, location, and organizational, institutional, and information factors [42,43], although awareness of the potential of precision-farming tools is increasing among Italian farmers [43–46].

A known problem is that there is still a lack of clarity among actors in the sector on how to use these opportunities and which digital skills to invest in. The literature shows that robots and sensors of precision agriculture are used on only 2% of the utilized agricultural area and especially in the regions of Northern Italy [47–51], while digital farming systems (assisted by ICT) affect values between −1 and 4–5%, in contrast to 40–70% in China, Israel, and the USA [52–55]. The use of the Internet in the cereal, fruit and vegetable, and wine sectors, in particular, is growing very slowly [15,56,57], despite the developments that were made in the era of the COVID-19 pandemic. They were mainly applied in the cultivation
phase, while solutions supporting the planning, stock monitoring, and farm logistics phases remain underused [58,59].

This research aims to contribute to the discussion on the perception and expectations that Italian agricultural operators have about the opportunities and limits of the adoption of modern ICT solutions. To achieve these results, a classic decision-support approach was used, represented by multicriteria analysis, which is particularly useful to identify the possible future scenarios produced by digital transformation. Multicriteria analysis was combined with participatory analysis through the involvement of stakeholders. The chosen reference scenario is that of the citrus fruit sector, a source of income and employment in all areas of Italy. This choice is innovative because it constitutes a first contribution in the spectrum of research of a study carried out in the citrus fruit sector.

In summary, the research questions posed were as follows:

1. Which smart technologies are easily accessible and able to positively affect the organization and management of citrus-growing activities?
2. How does smart technology facilitate connection with the market, especially in B2B and B2C relations?
3. What functional role can smart technology play in the relevant supply chain?

2. Materials and Methods

The research aimed to integrate the latest knowledge on the phenomenon “Agriculture 4.0” in the Italian agrifood system and to assess the limits and opportunities of the use of some technological solutions through the use of a methodology little used in this field [60–63].

Operationally, we proceeded through the integration of (Figure 1):

- “participatory design” (constituting focus groups), which saw the involvement of different categories of stakeholders interested in the theme in question and its applications in citrus farming;
- “multicriteria evaluation” with the NAIADE method, which is sufficiently robust for the evaluation of “complex” qualitative and quantitative data and information, such as possible alternative scenarios arising from digital transformation in agricultural enterprises [64–67].

Figure 1. The proposed methodological approach.
In practice, as is well-known, the basic input of the NAIADE method consists of several alternative scenarios to be analyzed, proposed based on certain decision criteria and opinions provided by stakeholders, on which two types of analyses can be carried out:

1. Multicriteria analysis, which, based on the impact matrix, leads to an assessment of the scenarios, with alternative scenarios rated against specific decision criteria;

2. Equity analysis, which, based on the equity matrix (criteria/alternatives matrix), analyzes possible alliances and conflicts of interest between stakeholder groups regarding the proposed scenarios, measuring their acceptability. For this matrix, it is possible to consider very different scores such as net numbers and stochastic, fuzzy, and linguistic elements (such as “very poor”, “poor”, “good”, “very good”, and “excellent”).

This was done through:

- the identification of stakeholders (30 qualified people who answered 30 ad hoc structured questionnaires);
- the identification of the problem, made possible by an initial analysis of the elements that emerged through the focus groups;
- the definition of three alternative scenario hypotheses (defined as “Agriculture”, “Supply Chain”, and “Market”);
- the criteria valuation;
- the construction of the impact and equity matrices, which represent, as is well known, the basis for the use of the NAIADE discrete assessment model [68];
- the classification of alternative scenarios according to the decision criteria and the possible “alliances” and “conflicts” between the stakeholder groups, thus measuring the acceptability of the proposed technological solutions [69].

The types of stakeholders interviewed during the meetings were chosen to acquire useful information to build a picture of the perception of digital transformation, both in terms of strengths and weaknesses, and of possible reasons for potential adoption or distrust. In particular, the following groups were involved: producers, trade associations, retailers, consumer associations, institutions, and scientific associations (Figure 2).

![Figure 2. Categories of stakeholders who participated in the assessment survey on agrifood readiness for digital transformation innovations.](image-url)
The meetings took place in successive steps:

1. The planning of the meeting (in January 2021) was initially carried out, with a definition of the number of sessions and their duration. Eight sessions were chosen (one per category) lasting 4–8 h each; it was also decided to develop a guide to conduct the interview with and to review scientific and educational material on the technological solutions of Agriculture 4.0. Finally, the participants were selected in a stratified manner to create homogeneous groups [70];

2. Survey activities were carried out (May and June 2021) via interviews. The topic was presented, and discussion and interaction between the participants were stimulated through the use of scientific publications and explanatory images. During this phase, various ideas and opinions were acquired, which represented the reactions of the participants involved in the topics discussed.

The questionnaire used included 10 questions [71] aimed at collecting information and opinions useful for the research (perception of the potential and limits of the application of digital solutions in the citrus supply chain and needs of the actors in the supply chain) for the three proposed scenarios (agriculture, supply chain, and market):

- Agriculture scenario: adoption of “Agriculture 4.0” digital solutions to improve productivity and increase the quality of agricultural production;
- Supply chain scenario: adoption of “Agriculture 4.0” digital solutions to obtain control and price information along the chain to support management;
- Market scenario: Adoption of “Agriculture 4.0” digital solutions to improve traceability and safeguard consumer health.

The following evaluation criteria were considered: technology, communication, data, Internet of Things, automation, and networking. These criteria were considered to be the most effective in obtaining information on the perception of operators about the potential and limitations of adopting digital solutions in “Agriculture 4.0”. They were also chosen based on the objectives of the three scenarios considered and the specificities of the case analyzed, which can be considered representative of the agrifood sector.

The ranking of alternative scenarios in NAIADE is based on data from the impact matrix [72], which is used to:

- Compare pairs of alternatives for each evaluation criterion considered (the concept of distance was used. If there are crisp numbers, the distance between two alternative scenarios concerning a specific evaluation criterion is calculated by subtracting their respective crisp numbers. In all other cases, the concept of semantic distance is used, measuring the distance between two functions through which the scores of the alternative scenarios result);
- Calculate a credibility index for each comparison using preference relations between alternative scenarios (e.g., is alternative scenario (a) better or worse than alternative scenario (b)?);
- Aggregate the credibility indices into a new preference intensity index $\mu^*(a,b)$ of one alternative (a) over another (b) for all evaluation criteria. This operation is made possible by the concept of entropy $H^*(a,b)$, as a synthesis of the variation of credibility indices and the ranking of alternative scenarios.

The intensity index $\mu^*(a,b)$ of preference * (where * stands for $\gg$, $>$, $\cong$, $\approx$, $<$, << and <) of alternative a versus b is defined as follows [65,68]:

$$\mu^*(a,b) = \frac{\sum_{m=1}^{M} \max(\mu^*(a,b)_m - \alpha, 0)}{\sum_{m=1}^{M} |\mu^*(a,b)_m - \alpha|}$$  \hspace{1cm} (1)

The intensity index $\mu^*(a,b)$ has the following characteristics:

- $0 \leq \mu^*(a,b) \leq 1$
- $\mu^*(a,b) = 0$ if none of the $\mu^*(a,b)_m$ are more than $\alpha$;
- $\mu^*(a,b) = 1$ if $\mu^*(a,b)_m \geq \alpha \forall m$ and $\mu^*(a,b)_m > \alpha$ for at least one criterion.

The information provided by the preference intensity index $\mu^*(a,b)$ and correspondent entropies $H^*(a,b)$ can be used to build the degrees of truth ($\Phi$) of the following statements:
“according to most of the criteria”:

- a is better than b;
- a and b are indifferent;
- a is worse than b.

In our case study, the classification of alternatives is the result (intersection) of two different classifications: the classification \( \Phi^+ (a) \) (based on the preference ratios “better” and “definitely better”) and the classification \( \Phi^- (b) \) (based on the preference ratios “worse” and “definitely worse”).

According to [65, 68], the first \( \Phi^+ (a) \) is based on the better and much better preference relations, and a value from 0 to 1 indicates how a is “better” than all other alternatives. The second \( \Phi^- (b) \) is based on the worse and much worse preference relations, its value going from 0 to 1, which indicates how a is “worse” than all other alternatives. \( \Phi^+ (a) \) and \( \Phi^- (b) \) are calculated as follows:

\[
\Phi^+ (a) = \frac{\sum_{n=1}^{N-1} (\mu_{\succ} (a, n) \cdot C_{\succ} (a, n) + \mu_{\gg} (a, n) \cdot C_{\gg} (a, n))}{\sum_{n=1}^{N-1} C_{\succ} (a, n) + \sum_{n=1}^{N-1} C_{\gg} (a, n)}
\]

(2)

\[
\Phi^- (b) = \frac{\sum_{n=1}^{N-1} (\mu_{\ll} (b, n) \cdot C_{\ll} (b, n) + \mu_{<} (b, n) \cdot C_{<} (b, n))}{\sum_{n=1}^{N-1} C_{\ll} (b, n) + \sum_{n=1}^{N-1} C_{<} (b, n)}
\]

(3)

where \( N \) is the number of alternatives (\( n \)) and the \( \hat{\ } \) operator can again be chosen between the minimum operator, which gives no compensation, and the Zimmermann–Zysno operator, which allows for varying degrees of compensation \( \gamma \) (from 0 minimum compensation to 1 maximum compensation).

3. Results and Discussion

3.1. Characteristics of the Citrus Industry and Agriculture 4.0 Solutions

The citrus fruit sector is an important part of the Italian agrifood system [73]. According to the latest available official statistics, it is worth 900 million euros in the agricultural phase and 994 million euros in the industrial processing phase. About 18,200 hectares and 132,000 hectares are also involved, respectively.

A SWOT analysis built with the support of stakeholders highlights (Table 1):
Table 1. Cont.

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Introduction of new varieties and clones to extend the marketing calendar;</td>
<td>• Serious phytosanitary problems in important citrus-growing areas (e.g., Tristeza virus);</td>
</tr>
<tr>
<td>• Linking citrus fruits with the territory and tourism;</td>
<td>• Persistence of various forms of commercial intermediation;</td>
</tr>
<tr>
<td>• Typical production of fresh fruit, processed juices, and essential oils;</td>
<td>• High labor costs and difficulties in finding workers at peak harvest times;</td>
</tr>
<tr>
<td>• Good dissemination of designation of origin and organic production labels;</td>
<td>• High international competition based on price.</td>
</tr>
<tr>
<td>• Communication campaigns on quality and health characteristics and an increase in per capita consumption.</td>
<td></td>
</tr>
</tbody>
</table>

In this context, ICT innovations prove to be the solution to the organizational and management problems of citrus farms, which offer the hope of achieving higher levels of competitiveness and economic, social, and environmental sustainability.

The proposed solutions range from sensors to controls for environmental conditions, water management, fertirrigation, etc., which are typically used in precision agriculture for precise and refined monitoring. Solutions present in the form of suites of web tools, digital technologies, and networked machinery for crop monitoring, multispectral remote sensing by drone, geo-referenced maps thanks to GPS, etc., with investment and maintenance costs that are much lower than those of the practices they supplant. The possible financial instruments available for the introduction of these innovations were also surveyed.

3.2. Assessing the Acceptability of 4.0 Innovations

The research results show multidisciplinary perceptions and evaluations by the heterogeneous group of stakeholders involved, each with their own competencies and experiences ranging from the field/cultivation (in the case of citrus growers) to institutions (responsible for facilitating the adoption of innovations) and the world of research (universities, traditionally involved in the development of innovations and technological know-how).

As already mentioned, the following evaluation criteria were considered to identify digital transformation opportunities for the agrifood system: technology, communication, data, Internet of Things, automation, and networking.

Among the three scenarios proposed, the supply chain was the scenario with the best sharing option, although there were also positive overall assessments for the others. This was followed, in order of importance, by the agriculture scenario and the market scenario, as shown in Table 2.

Table 2. Evaluation criteria and scenarios of digital transformation for the agrifood sector.

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Scenario AGRICULTURE “A”</th>
<th>Scenario MARKET “M”</th>
<th>Scenario SUPPLY CHAIN “S”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
</tr>
<tr>
<td>Communication</td>
<td>Very Good</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Data</td>
<td>Good</td>
<td>Very Good</td>
<td>Very Good</td>
</tr>
<tr>
<td>Internet of Things</td>
<td>Poor</td>
<td>Good</td>
<td>Excellent</td>
</tr>
<tr>
<td>Automation</td>
<td>Very Good</td>
<td>Good</td>
<td>Very Good</td>
</tr>
<tr>
<td>Networking</td>
<td>Good</td>
<td>Excellent</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

Source: Produced by the authors.

In the discussion and the attribution of importance assigned by each stakeholder, the diversity of digital technology that can be implemented at each level of the supply chain was noted. Indeed, the supply of digital technology on the market is very wide to meet the complexity and requirements of the markets in this historical moment. As a
result, companies feel the need to innovate and adapt; very often, digital transformation is associated with a net change of tools and habits as well as significant economic efforts. For this reason, “innovation-friendly” companies are preferred, which allow the integration of new tools to support those already used in the business’ organization, at a sustainable cost.

Indeed, in the context of the supply chain, it is believed that an important role in fostering the adoption of Agriculture 4.0 technologies is played by business-to-business (B2B) and business-to-consumer (B2C) relationships. Therefore, the need to respond to a “customer” that requires “behavioral” assurance in business activity, greater sustainability, and innovations in response to the needs of modern consumers represents substantial leverage in promoting these processes. The more these processes are dominated by relationships of a contractual nature (e.g., supply chain relationships), the greater the need for digital transformation.

Stakeholder opinions of the NAIADE model, weighted according to a qualitative scale that can be linguistically summarized as bad, poor, average, good, very good, and excellent, showed shared preferences for the supply chain scenario, followed closely by agriculture, while the market scenario received a lower rating (Table 3).

Table 3. Scenarios by maximum consensus level obtained and their classification.

<table>
<thead>
<tr>
<th>Groups and Stakeholders</th>
<th>Scenario AGRICULTURE “A”</th>
<th>Scenario MARKET “M”</th>
<th>Scenario SUPPLY CHAIN “S”</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 Producers</td>
<td>0.7387</td>
<td>0.6311</td>
<td>0.8470</td>
</tr>
<tr>
<td>A2 Trade associations</td>
<td>0.6732</td>
<td>0.7334</td>
<td>0.6213</td>
</tr>
<tr>
<td>A3 Dealers</td>
<td>0.5764</td>
<td>0.6218</td>
<td>0.6138</td>
</tr>
<tr>
<td>A4 Consumer associations</td>
<td>0.5216</td>
<td>0.6392</td>
<td>0.8723</td>
</tr>
<tr>
<td>A5 Institutions</td>
<td>0.6283</td>
<td>0.5357</td>
<td>0.8231</td>
</tr>
<tr>
<td>A6 Scientific association</td>
<td>0.8329</td>
<td>0.7342</td>
<td>0.6379</td>
</tr>
</tbody>
</table>

Source: Produced by the authors.

The answers collected from the questionnaires were then analyzed by NAIADE to detect any alliances or conflicts between stakeholders. This was also done to prevent stakeholder evaluations from being undermined by the emergence of “opinion leaders” capable of influencing the responses of other respondents and to avoid undermining efforts to identify agreement for the proposed scenarios.

Table 4 summarizes the results of this elaboration, which show that many stakeholders agreed on the ranking of the different scenarios to be adopted, and especially converged on the supply chain scenario, while there were significant differences for the agriculture and market scenarios.

Table 4. Priorities between scenarios based on the level of consensus.

<table>
<thead>
<tr>
<th>Consensus Levels</th>
<th>AGRICULTURE “A”</th>
<th>MARKET “M”</th>
<th>SUPPLY CHAIN “S”</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>0.7525</td>
<td>0.7603</td>
<td>0.7323</td>
</tr>
<tr>
<td>A</td>
<td>0.7863</td>
<td>0.7863</td>
<td>0.7863</td>
</tr>
<tr>
<td>M</td>
<td>0.7525</td>
<td>0.7603</td>
<td>0.7323</td>
</tr>
</tbody>
</table>

Groups of “alliances” at each level of consensus

All groups | All groups, except A3 | All groups, except A3 and A4 | All groups, except A2–A6

Source: Produced by the authors.

Participants were shown different perspectives of digital transformation, including the main technologies on the market, and expressed their perceptions of the acceptability of these proposed alternatives.

In this way, useful information was obtained to improve strategic decisions, innovative ideas were offered, and new solutions were put forward (Table 5).
Table 5. Alternative scenarios and their classification obtained by multicriteria evaluation.

<table>
<thead>
<tr>
<th>( \Phi^* )</th>
<th>( \Phi^- )</th>
<th>Intersection</th>
<th>Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td>0.21</td>
<td>1</td>
<td>Scenario 1—SUPPLY CHAIN</td>
</tr>
<tr>
<td>0.71</td>
<td>0.27</td>
<td>2</td>
<td>Scenario 2—AGRICULTURE</td>
</tr>
<tr>
<td>0.62</td>
<td>0.34</td>
<td>3</td>
<td>Scenario 3—MARKET</td>
</tr>
</tbody>
</table>

The model used in the research, developed through the integration of a participatory tool and multicriteria analysis, is, therefore, strategic for investment choices in the agri-food system, particularly concerning the current situation in which the supply chain, the farm, and the consumer seek to adapt their contributions to innovation, the market, and sustainability through digital transformation.

From the information collected, the main reasons that currently hinder the diffusion of “Agriculture 4.0” in Italy are as follows:
- The first obstacle is the cultural barrier to innovation, which stalls changes from the traditional approach;
- Secondly, there is little understanding of the range of benefits attributable to “Agriculture 4.0” applications (often limited to cost-reduction only), which is compounded by a certain immaturity of supply-side actors, who have only recently begun to structure themselves to offer solutions that are effectively in line with the needs and demands.

Another element that has a negative impact, linked to the structure of Italian agriculture, is the average size of farms, which are traditionally single enterprises and often fragmented in their locations. Italian farms’ small sizes make it difficult for farmers to invest in and appreciate the advantages of precision technologies.

To enable the development of “Agriculture 4.0”, it will be necessary to invest in training operators in the supply chain, and above all, raise awareness among farmers. It is essential that they fully appreciate the potential benefits of the 4.0 revolution.

It is also essential to increase the investments of farms in “Agriculture 4.0” [74–78]. The opportunities are there for the various measures envisaged by the Italian government with the Transition 4.0 plan, in which there are benefits to be had for the actors in the agrifood chain, including farmers.

4. Conclusions

The Italian agrifood sector has begun to understand that digital innovation is a strategic lever, capable of guaranteeing greater competitiveness for the entire supply chain, from production in the field to distribution and food processing.

The first prerequisite for looking at digital transformation in the primary sector is to view this process as an extended supply chain that starts in the field and arrives at the shelf, or more generally, at the point of contact with the consumer, according to the Industry 4.0 paradigm.

Each stage of the supply chain will share the information that characterizes it and thus make it possible to build an objective representation of the Farm to Fork vision. This translates into a new traceability model, no longer one step forward and one step back, but end to end. This evolution of the concept makes it possible to verify not only the quality of production but also any food waste created. Hence, we move from a reactive model to a proactive one, which manages to combine all dimensions of sustainability: economic, environmental, and social [79].

The success of agricultural enterprises will, therefore, increasingly depend on their ability to collect and exploit the large amount of data that will be generated, especially to achieve cost control and increase the quality of production [80]. It should be noted, however, that there is still a lack of clarity among stakeholders on how to exploit these opportunities. There is a need to invest in skill creation in a sector characterized by a level of "corporate"
culture and operational processes based more on the transfer of generational skills and knowledge than on innovation and optimization of production processes [81]. The big challenge is to move from experience-based agriculture to data-driven smart agriculture.

The research results show that there is an interesting trend toward “Agriculture 4.0” but it will be necessary to invest in technologies and skills, on the one hand, and in training and knowledge of the opportunities offered by digital transformation, on the other hand.

For this reason, future research developments must look, first, at the economic validation of technologies within production units in different settings and sectors, and second, at the evaluation of the experience by those who have embarked on this path, in the hope of supporting the decision-making process of new potential entrepreneurs.

In conclusion, it is necessary to understand that a production process can no longer be seen as a set of independent events, but must be viewed as a real ecosystem where the actions, choices, and behaviors of each actor are interdependent on the others, not only at a production level but also at an environmental, ethical, and sustainable levels. The adoption of digital technologies that help to better interpret the effects of each action on others—which are not apparently contiguous—represents the solution to production improvement that will make food increasingly good for all, with security for all and to support the sustainability of the entire planet, meaning we can achieve the European objectives of Green Deal 2030.

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Informed Consent Statement: The study was carried out in accordance with privacy regulations. All participants consented to the processing of their data in anonymous and confidential form. Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

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