

Article

Fostering Digitalization: How Local Policies Are Transforming Rural Areas in Italy

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Abstract: In recent years, several policies and strategies have been developed by the European Union to promote innovation and digitalization in the agricultural and forestry sector, including the Common Agricultural Policy (CAP), which allocates just under EUR 150 billion for the period of 2023–2027. In Italy, digitalization in the agricultural and forestry sector has grown significantly over the past decade, with 3.8% increasing to 15.8% of farms now being computerized. This growth has been fostered by the Italian strategy for digitalization in agriculture, part of the CAP Strategic Plan, implemented at the regional level through the Rural Development Complements (RDCs), adopted in 2023. This study analyzes the RDCs of Italian regions, comparing the strategies adopted in terms of digitalization and innovation from both technical and economic perspectives. This analysis focuses on the interventions of three regional support groups (SRGs)—SRG07, SRG08, SRG09—assessing whether they have been activated in all regions and delves into the political and technical reasons behind any lack of implementation. The study compares the funding allocated for each intervention, highlighting regional differences and underlying causes. The main strengths, weaknesses, opportunities, and threats of digitalization in the agricultural and forestry sector were prioritized through an A’WOT analysis. The major strengths include the provision of job security and sustainability, while the major weaknesses comprise the challenges of the digital divide and a lack of technical training. The opportunities identified include the potential for the development of precision agriculture and eco-sustainable practices, but these are hampered by critical issues such as spatial fragmentation and limited economic resources. This analytical framework offers a comprehensive view of regional dynamics in Italy, providing useful insights for the development of more effective policies that can promote equitable and innovative digitalization in the agricultural and forestry sector.

Keywords: digitalization; local policy; Common Agricultural Policy; European strategy; rural areas; A’WOT analysis



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1. Introduction

Over the last decade, digital transformation as a tool for rural development and the growth of the competitiveness of the agricultural and forestry sector (i.e., agriculture, fishing, forestry, and mining) has assumed increasing importance in the eyes of European Union (EU) policymakers [1,2]. According to the agenda of EU policymakers, digital transformation plays a key role in improving agricultural and forestry production, while at

the same time reducing negative impacts on the environment, such as habitat destruction, resource depletion, and air and water pollution [3]. In other words, digitalization can be a useful tool to reconcile the objectives of the new Common Agricultural Policy (CAP) 2023–2027 [4] with those regarding the implementation of digital transformations and innovations, e.g., blockchain, Internet of things, artificial intelligence, and immersive reality, to the agricultural and forestry sector supply chains [5]. In this sense, the first milestone is the vision of the European Green Deal, which emphasizes the need for a digitalized and sustainable society. To this end, innovative applications of digital technologies will be able to reduce the use of natural resources and the release of harmful substances (e.g., pollutants and greenhouse gases (GHGs) emissions) in production processes [6]. On the other side, the new CAP 2023–2027 has adopted the Agricultural Innovation Systems (AIS) approach by including among its objectives a cross-cutting objective for digitalization, knowledge, and innovation [7]. The belief of EU policymakers is that digital technology can improve the effectiveness and efficiency of agricultural policy by achieving precise spatial and temporal targets for specific attributes of EU farms [8]. In addition, the NextGenerationEU (NGEU) 2021–2026 [9] emphasized the need of digitalization to ensure sustainable economic development and to reduce the impacts of climate change through the ability of smart technologies to monitor energy consumption, reduce waste, capture carbon, and diminish GHGs emissions [10]. The NGEU 2021–2026 also represents the most important financial support for rural digitalization in the coming years.

From a theoretical point of view, digitalization can be defined as a transition process to a digital territory, a transformation of processes of cross-regional, inter-sectoral, and inter-personal interaction in a territory due to the penetration of digital technologies, aimed at improving the population's quality of life, as well as all aspects of life [11]. More broadly, digitalization is defined as a process of implementing digital technologies in all spheres of human life and society [11] or a sociotechnical process surrounding the use of several digital technologies that have an impact on social and institutional contexts [12].

Digitalization is a mantra for the development of rural and marginal areas to ensure local economic development and improve the quality of life and well-being of rural populations [13]. To this end, agricultural and forestry digitalization ensures that everyone benefits from the information and improves agricultural and forestry production via upgraded technologies [14]. As emphasized by many authors, the contributions of digitalization to rural development are related to a reduction of manual labor, an increase and stabilization of agricultural production, an improvement in agricultural efficiency, and an enhancement of social inclusion [14].

In Italy, the digitalization of the agroforestry sector was supported by the new Rural Development Complements (RDCs) adopted by each Italian region in 2023. The RDCs define—based on the National Strategic Plan—the national and regional priorities, outlining the specific measures to be adopted to improve the competitiveness of the agricultural sector, promote the sustainable management of natural resources, and stimulate the socioeconomic development of rural areas [15]. They are divided into six types of intervention:

- SRA—Commitments regarding climate and environment (total financial allocation: EUR 131 million);
- SRB—Natural constraints allowance (total financial allocation: EUR 85 million);
- SRD—Investments (total financial allocation: EUR 383 million);
- SRE—Youth (total financial allocation: EUR 35 million);
- SRG—Cooperation (total financial allocation: EUR 81.5 million);
- SRH—AKIS—Agricultural Knowledge and Innovation Systems (total financial allocation: EUR 29 million).

The main line of intervention, aimed at encouraging the digital transition in the agricultural sector and technological innovation in agricultural and forestry companies, is SRG–Cooperation (Table 1).

Table 1. SRG interventions list.

SRG	Cooperation
SRG01	Support operational groups for agricultural
SRG02	Establishment of producer organizations
SRG03	Participation in quality schemes
SRG05	Leader preparatory support
SRG06	Leader-implementation of local development strategies
SRG07	Cooperation for rural and local development; smart villages
SRG08	Support for pilot actions and innovation testing actions
SRG09	Cooperation for innovation support actions and services aimed at the agricultural, forestry, and agrifood sectors
SRG10	Promotion of quality products

Starting from these considerations, the aim of the present study is to investigate the role of digitalization in rural development in Italy by highlighting its current strengths, weaknesses, opportunities, and threats. To this end, the study was comprised of three steps: (1) a literature review regarding digitalization in rural areas at the international and national level; (2) a detailed analysis of the new RDCs adopted by the Italian regions, comparing the funding allocated to the three intervention forms SRG07, SRG08, and SRG09; (3) the involvement of experts in the development of a quantitative SWOT analysis. These interventions were chosen because they are most representative of the Italian system of financing for the digitalization of agricultural, forestry, and mountain areas.

The key research questions (RQ) are as follows: (RQ1) Which Italian regions have activated all three interventions? (RQ2) What technical factors have hindered the implementation of SRG07, SRG08, and SRG09 in some areas? (RQ3) How do the funds allocated to these interventions differ between regions? In addition, this study examines how regional strategies, in terms of both activation and funding, influence the level of digitalization and innovation in the agroforestry sector.

This study seeks to address a significant gap in the Italian literature, in which comprehensive analyses of the digitalization of the agroforestry sector remain scarce. By focusing on this underexplored area, the research underscores the need for a deeper investigation into the political and economic strategies adopted by individual Italian regions to foster digital transformation within the sector. The study aims to provide a nuanced and up-to-date overview of the state of digitalization in the agroforestry domain across Italy, with the dual objective of informing scholarly discourse and supporting evidence-based policymaking. By doing so, it offers valuable insights for a wide audience, including academics, researchers, policymakers, and institutional representatives, facilitating a better understanding of regional approaches, challenges, and opportunities in leveraging digital technologies to enhance sustainability, productivity, and competitiveness in this critical sector.

2. Literature Review

As a first step of the study, the review of scientific literature on digitalization in rural areas was performed through a bibliometric network analysis to identify and analyze the

recent peer-reviewed publications (e.g., books, chapters, articles, and papers published in international proceedings) on this topic. The bibliometric network analysis is a useful tool to assess trends and patterns of scientific literature from a quantitative point of view, combining bibliometric review with the social network approach [16,17]. The bibliometric review is aimed at analyzing the scientific productivity on a specific topic [18], while the social network analysis is intended to investigate the relationships among all components (e.g., concepts, words) of a system [19].

In this study, the peer-reviewed publications were retrieved from the Scopus database (<https://www.scopus.com>) accessed on 25 July 2024 using “DIGITALIZATION” AND “RURAL*” as keywords. The keywords used in the bibliometric analysis were searched in the title, abstracts, and keywords of the individual peer-reviewed publications, using 1990–2024 (timeframe of 35 years) as the reference period. All data were exported as “comma-separated values” (CSV) files and processed through a bibliometric network analysis using the VOSviewer software [20].

The bibliometric network analysis was performed to highlight the most important concepts (“hot topics”) concerning digitalization in rural areas (i.e., agricultural and forestry sectors) developed by the international literature in English. For this purpose, co-occurrence analyses—number of publications in which two keywords occur together in the title, abstract, or keyword list—were carried out to identify the most important keywords and consequently, the concepts investigated.

At the end of the data collection, 784 peer-reviewed publications were identified, with a significant increase in the number of annual publications from 2018 onwards (Figure 1). Approximately 105 documents were published per year (SD = 68) in the period 2018–2023, while in the first seven months of 2024, 117 documents had already been published. It is interesting to highlight that the international literature began to systematically investigate digitalization as a tool for rural development in 2016. The scientific community’s interest in digitalization is due to a series of key documents from those years, such as the EU eGovernment Action Plan 2016–2020, accelerating the digital transformation of governments in the EU; Made in China 2025 (MiC2025), an industrial policy program for technological development launched by the commission in 2015; Internet Plus, an action plan promoted by China for the integration of internet technologies with different economic sectors; Digital Canada 150, a document published in 2016 that represents Canada’s strategy for digitalization and digital economic growth on the occasion of Canada’s 150th anniversary; and the Digital Single Market Strategy (2015), a strategy to improve access to digital goods and services across the EU.

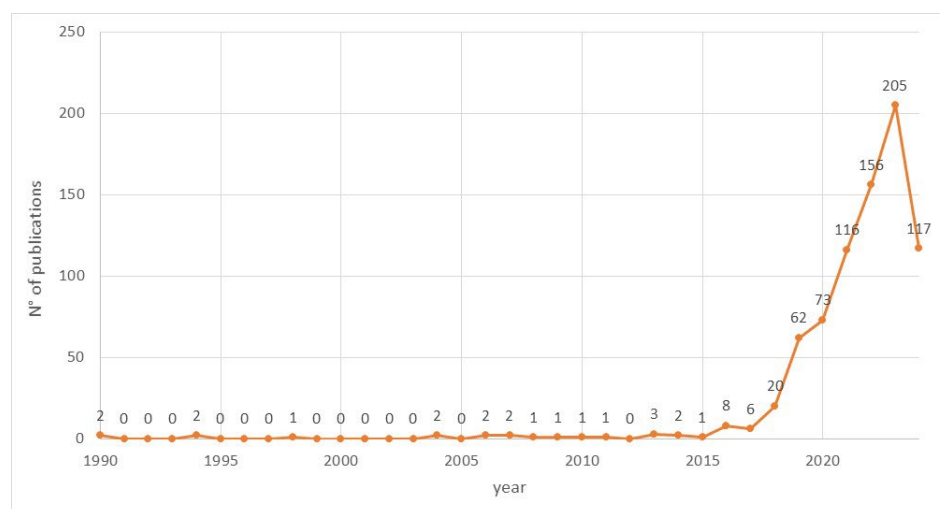


Figure 1. Trend of publications on digitalization in rural areas from 1990 to 2024.

The analysis of the keywords connected to digitalization in rural territories showed 4470 results, while only 224 met the threshold of at least five co-occurrences. Observing the network of the keywords used in the studies about digitalization in rural areas, the results show four main clusters (dark blue, red, green, sky blue—Figure 2). The first (dark blue) cluster is composed by 33 keywords and includes studies conducted in Europe (e.g., Germany, Finland, Italy, Sweden) regarding citizens' perceptions of new technologies and digitalization processes. The second (red) cluster is comprised of 67 keywords and focuses on the economic and social impacts of digitalization on sustainable development in rural areas. It is important to mention that in this cluster, there are studies focused on digitalization in the forestry sector (e.g., precision forestry). The third (sky blue) cluster focuses on agricultural digitalization to improve the production and allocation of products on the market. This cluster is composed of 25 keywords and includes the main studies on the digital economy, digital technologies, and the use of big data in agriculture. The fourth (yellow) cluster is composed of 44 keywords and mainly comprises studies on the role of smallholder farmers and agricultural workers in digital agricultural development. In addition, this cluster includes studies on digital (inclusive) finance and rural revitalization.

The overlay visualization of the co-occurrence network map is shown in Figure 3. The results show that the previously mentioned yellow cluster includes the most recent studies (from 2023 to today), while the other three clusters include research conducted during the previous three years (2020–2022). This confirms the growing number of studies concerning digitalization in the agricultural and forestry sector in China and the adoption of a bottom-up approach to digitalization. This last line of studies is particularly interesting because it focuses on the degree of use and adoption of digital technologies by end users (i.e., farmers and agricultural workers).

Regarding the Italian literature on digitalization in rural areas, ref. [21] investigated the main characteristics of the Italian agricultural sector through in-depth interviews conducted with 16 farmers. Those authors highlighted that the adoption of digitalization in agriculture is leading to an increasing demand for skilled workers who not covered by the current job market. Similarly, ref. [22] stressed that digitalization has increased the productivity and optimal use of inputs in agriculture in the Calabria Region, along with a significant labor market mismatch between the employment opportunities offered by local farms and the aspirations of job seekers. Ref. [23] emphasized that some Italian regions in Southern Italy have invested in the modernization and restructuring of agricultural, agrifood, and forestry farms, generating positive impacts on the environment and on the reduction in the use of renewable and non-renewable resources. In another recent study, ref. [24] conducted a comprehensive critical review on digitalization in rural areas, highlighting the main opportunities related to improving the attractiveness of rural areas such as the quality of the rural environment, social relationships, work, and services. Moreover, those authors emphasized the key role of digitalization in strengthening local governance. Finally, some studies have investigated the importance of digitalization in favor of rural tourism and eco-tourism. Among these studies, ref. [25] highlighted a significant boost in digitalization in rural tourism related to wine sector during the COVID-19 pandemic, while [26] emphasized that in recent years, the innovative digital management technologies have enhanced the cultural heritage of Italian rural areas.

In summary, the current Italian literature on digitalization in rural areas emphasizes the increase in efficiency, sustainability, and the reduction in the use of input resources as its main strengths, with the low skills of the operators in the sector (lack of training) and the lack of homogeneity in the adoption of digital technologies between the Italian regions as its main weaknesses. Regarding the opportunities, some authors have underlined the main prospects as the opening of new markets thanks to the e-commerce platforms; the

vertical collaboration between farmers/forest owners, academia, and institutions; and the strengthening of local governance. Conversely, the main threats concern the resistance of the operators in the sector to change, cyber security, and the potential impacts on the environment.

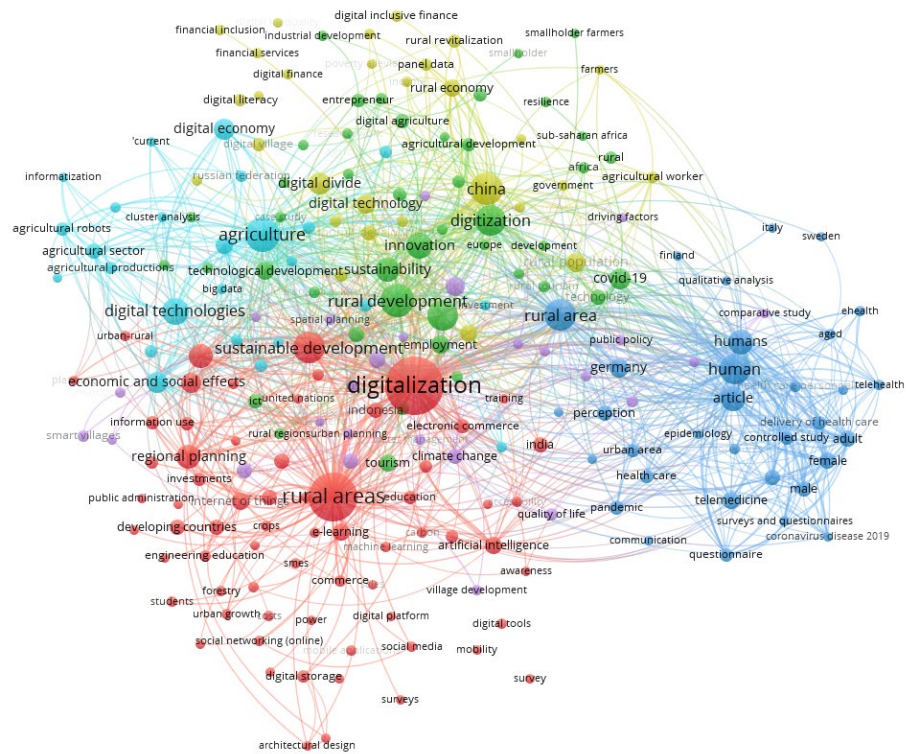


Figure 2. Co-occurrence network map of the most used keywords in the literature on digitalization in rural areas (network visualization).

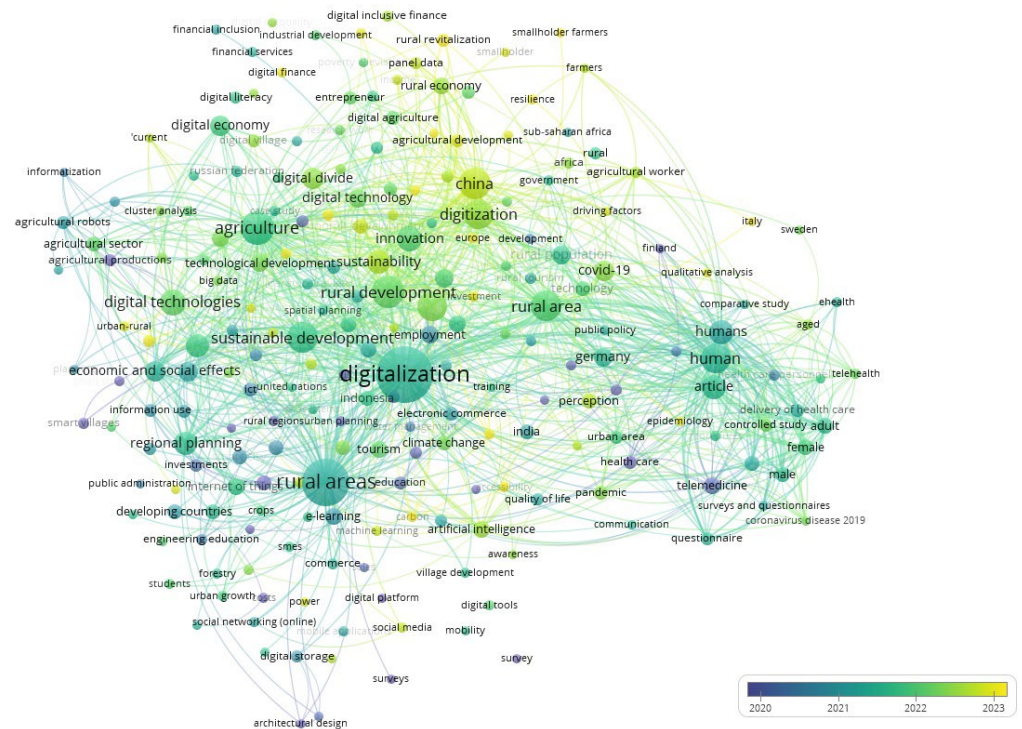


Figure 3. Co-occurrence network map of the most used keywords in the literature on digitalization in rural areas (overlay visualization).

3. Materials and Methods

3.1. Economic Analysis of Rural Innovation and Digitalization Funding-Methodology

In Italy, the level of digitalization of agricultural and forestry businesses has increased in the last decade, reaching 15.8% compared to 3.8% in the previous decade. This has also occurred thanks to the CAP and European strategies encouraging innovation and digitalization in agriculture [27]. The data about the level of digitalization of agricultural and forestry businesses also includes smaller mobile devices, such as PCs, smartphones, and tablets, which have a low economic cost but important functionality [27]. With the new 2023–2027 programming, the CAP introduces significant reforms aimed at strengthening technological development and digitalization in the agricultural and forestry sector and allocating funds for a total of EUR 81.5 million. How was this funding distributed in Italy? Two different sources were consulted to analyze the Italian framework, showing the choices made by regions in implementing rural development: the Europlanning Guide (<https://www.guidaeuroprogettazione.eu/en/>, accessed on 30 August 2024) and *Rete Rurale Nazionale* (RRN) (<https://www.reterurale.it/en>, accessed on 3 September 2024), which supports rural development policies through the exchange of experiences and knowledge between rural areas and through the improved implementation and management of rural development programs in Italy. RRN produced a report for each SRG, showing financial economic indicators for each intervention in the national territory [28].

The Europlanning Guide provides a detailed overview of the financial resources allocated to the European Agricultural Fund for Rural Development (EAFRD), organized by the RDCs. The amounts allocated to SRG07, SRG08, and SRG09 were then analyzed and assessed, both in relation to the overall funding of SRG-Cooperation and in relation to the national territory, with an in-depth analysis of each region.

3.2. A'WOT Analysis-Methodology

In the last step, the study implemented a mixed approach by integrating SWOT analysis with the analytic hierarchy process (AHP) method, known as A'WOT. This qualitative–quantitative approach allows stakeholders to assess their views on the challenges and opportunities of digitalization in rural Italy. Through this combination of methods, the research aimed to provide a thorough and strategic picture of the dynamics of computerization in the agricultural and forestry sector, providing useful insights to guide future policies and interventions.

SWOT analysis is a widely used strategic planning framework for evaluating a business project, plan, or activity [29], as well as for gathering and structuring stakeholder opinion on a specific issue, such as in this case, i.e., digitalization in the agricultural and forestry sector. This approach is based on examining four key areas, divided into two main dimensions: internal factors (strengths and weaknesses) and external factors (opportunities and threats) [30]. Strengths and weaknesses reflect stakeholder perceptions of the internal attributes of the sector, while opportunities and threats refer to the external conditions and environmental context in which the agricultural and forestry sector operates.

To develop the SWOT analysis, a two-step approach was adopted as described below.

In the first step, the most important strengths, weaknesses, opportunities, and threats were identified and described based on the literature review. In particular, the results of bibliometric network analysis, focused on the studies conducted in Italy, have allowed us to highlight the main factors of the SWOT analysis relating to the digitalization of the agricultural and forestry sector.

In the second step, a structured questionnaire was developed on the EU Survey platform, and the link was distributed via e-mail to a selected group of experts in the field. The selection was performed through established professional networks, collaborative networks,

and academic partnerships. At the end of the expert selection, 25 Italian experts on digitalization in the agricultural and forestry sector were identified and subsequently contacted.

The questionnaire included a first section comprised of the personal information of the respondent (i.e., organization, field, and years of expertise) and a second section focused on the importance assigned to the individual SWOT factors (Table 2). In particular, a pairwise comparison matrix of alternatives for each factor was adopted, following the principles of the AHP method. This approach allowed for the systematic collection of stakeholder perceptions and priorities, providing a solid basis for a strategic analysis of the field.

Table 2. SWOT factors and alternatives.

SWOT Factors and Alternatives	Description of Alternatives
Strengths	What digital technologies have most improved efficiency and sustainability in your farming practices?
S1: Increased efficiency and connectivity	Using drones with sensors to monitor crop health allows farmers to quickly identify problem areas, reducing the use of pesticides and fertilizers. In addition, the implementation of rural Wi-Fi networks has improved access to these technological tools.
S2: Data management	IoT and cloud platforms enable real-time collection and analysis, enabling better informed decisions.
S3: Sustainability	Digital technologies support sustainable farming practices by reducing the use of fertilizers and pesticides through resource optimization.
S4: Safety in the workplace	Using smart DPI, such as helmets with sensors to monitor heart rate and body temperature, helps prevent heat strokes or injuries among workers during the hottest working hours.
Weaknesses	What are the main barriers you have encountered in adopting digital technologies?
W1: Digital divide	Lack of connectivity in many rural areas of Italy limits the adoption of technologies (e.g., the platforms for agricultural data management or remote crop monitoring).
W2: Lack of training	The difficulty of older farmers in using new technologies is linked to low digital literacy.
W3: High initial costs	The investment needed for digital infrastructure can be a barrier for small and medium-sized agricultural enterprises.
W4: Fragmented adoption	The lack of homogeneity in the adoption of digital technologies between the different Italian regions creates disparities in agricultural production.
Opportunity	How do you think the political support of CAP 2024–2027 can promote digitalization and thus create new opportunities for growth and competitiveness in the agricultural sector?
O1: Climate-smart agriculture	Digital technologies offer new opportunities to adapt agriculture to climate change and improve crop resilience (e.g., AI-based predictive models can help farmers plan crops more resilient to changing weather conditions, such as droughts or heavy rains).
O2: Precision agriculture	The use of sensors, GPS-driven machines, and AI allows for optimization in the use of water, fertilizers and pesticides.
O3: New markets	E-commerce platforms can open new market opportunities for small farmers.
O4: Collaboration and knowledge sharing	Digital technologies facilitate collaboration between farmers, researchers, and institutions by promoting innovation and knowledge sharing.

Table 2. Cont.

SWOT Factors and Alternatives	Description of Alternatives
Threats	What do you think are the main risks associated with the growing use of digital technologies in agriculture?
T1: Computer security risks	Digitalization exposes agriculture to risks of cyber-attacks and data security breaches.
T2: Resistance to change	Resistance to the adoption of digital technologies can be influenced by traditions or skepticism towards new practices.
T3: Regulatory challenges	Adaptation to new digital regulations is an administrative burden for small farms.
T4: Environmental impact	The use of digital hardware and electronic waste management can have environmental consequences, if not properly managed.

The AHP method involves assigning weights to SWOT factors through a pairwise comparison matrix, transforming qualitative assessments into quantitative data. This combination has shown great potential for improving the effectiveness of strategic analyses [31,32]. For this process, we use a nine-value scale proposed by ref. [33]. The table shown below (Table 3) highlights the scale of values considered for this A/WOT analysis.

Table 3. Intensity of absolute importance and values used in this analysis.

Intensity of Importance on an Absolute Scale	Definition	Code Used in the Questionnaire	Definition	Value
1	Equal importance	1	Very strong importance of one over another	5
3	Moderate importance of one over another	2	Strong importance of one over another	3
5	Essential or strong importance	3	Equal importance	1
7	Very strong importance	4	Less importance of one over another	1/3
9	Extreme importance	5	Very less importance of one over another	1/5

2, 4, 6, 8 are intermediate values between the two adjacent judgments (in this analysis, they are not considered).

Stakeholders were asked to critically compare the SWOT factors in pairs, rating their relative importance according to the previously described scale (Table 3). The scores resulting from the pairwise comparisons were represented in a reciprocal matrix (A), in which each a_{ij} element indicates the relative weight of factor i compared to factor j . The a_{ij} elements are located on the right side of the main diagonal of the matrix, while the reciprocals ($1/a_{ij}$) are located on the left side. The main diagonal of the matrix consists exclusively of values equal to 1 ($a_{ij} = 1$), since each factor compared with itself has the same weight.

The reciprocal matrix can be expressed as follows.

$$A = (a_{ij}) = \begin{matrix} & w1/w1 & w1/w2 & \dots & w1/wn \\ w2/w1 & w2/w2 & \dots & w2/wn & \\ \dots & \dots & \dots & \dots & \\ wn/w1 & wn/w2 & \dots & wn/wn & \end{matrix}$$

Next, the vector of relative weights (w) is calculated, representing the relative importance of each alternative relative to the others. This vector is obtained by multiplying the reciprocal matrix (A) by the vector of weights themselves, generating a new vector proportional to $[\lambda_{\max} \cdot w]$, where λ_{\max} is the maximum eigenvalue of matrix A .

The maximum eigenvalue (λ_{\max}) provides a measure of the consistency of the ratings: if $\lambda_{\max} = n$, the ratings are perfectly consistent; the more λ_{\max} deviates from n , the greater the inconsistency in the comparisons provided by the experts.

To check the consistency of the A matrix, the consistency ratio (CR) is calculated as follows:

$$CR = \frac{CI}{RI}$$

where

CI is the consistency index calculated as $CI = \frac{(\lambda_{\max} - n)}{(n - 1)}$.

RI is the random consistency index, which represents the average value of expected inconsistency for a randomly generated reciprocal matrix of size n [34], in this specific case, for a reciprocal matrix in order $n = 6$, $RI = 1.24$.

A CR value of less than 0.1 indicates the consistency and acceptability of the data; conversely, a higher value requires revision of the evaluations and repetition of the process [35].

4. Results

4.1. Economic Analysis of Rural Innovation and Digitalization Funding-Results

According to RRN report in Italy, a total of 31 SRGs were activated among the three considered in this study, as follows: 10 SRG07, 10 SRG08, and 11 SRG09. Figure 4 shows details of the three SRGs activated in the different Italian regions. In regards to RQ1, it appears that for intervention SRG07, the regions of Valle d'Aosta, Emilia-Romagna, Sardinia, Lazio, Marche, Molise, Calabria, Puglia, Trentino-Alto Adige, and Friuli Venezia Giulia have not activated any financing. Similarly, for the SRG08 intervention, no financing has been activated in Trentino-Alto Adige, Veneto, Friuli Venezia Giulia, Liguria, Lazio, Marche, Molise, Campania, Sicily, and Sardinia. Finally, for the SRG09 intervention, the regions of Lombardy, Trentino-Alto Adige, Friuli Venezia Giulia, Emilia-Romagna, Liguria, Umbria, Lazio, Abruzzo, and Molise have not allocated any funding.

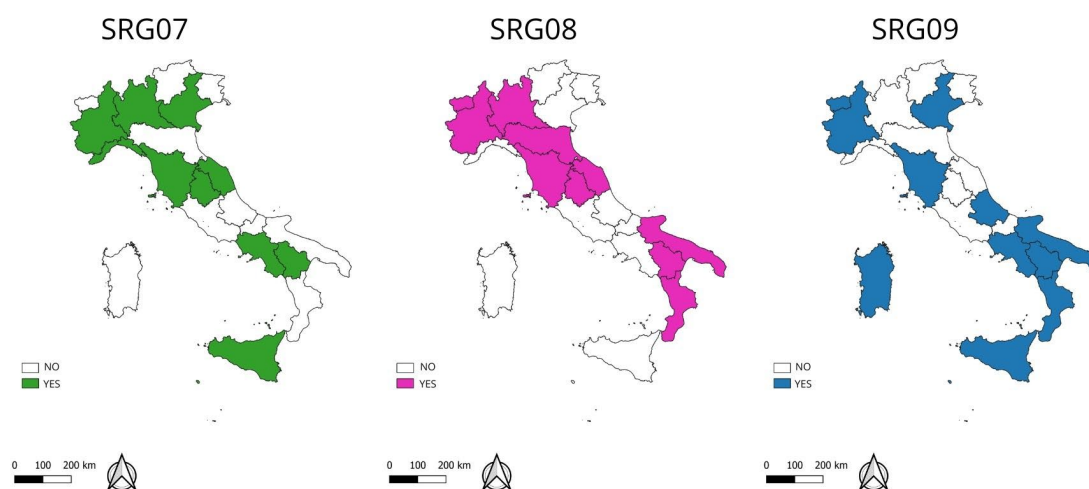


Figure 4. Distribution of the three SRGs examined across the national territory. Regions that have activated SRG07 are shown in green, those for SRG08 in purple, and those for SRG09 in blue.

According to the Europlanning Guide, the total national funding activated for SGR-Cooperation amounts to EUR 1350.02 million, while the national totals for the analyzed SRGs

are EUR 78.81 million for SRG07, EUR 37.30 million for SRG08, and EUR 33.36 million for SRG09. However, these figures for the Emilia-Romagna Region appear to contradict the reports from RRN, which indicate that Emilia-Romagna has not activated any of the three SRGs. In contrast, the Europlanning Guide shows that SRG07 and SRG09 are activated, with EUR 9.68 million and EUR 9.98 million, respectively, in Emilia-Romagna. Excluding the active funding for Emilia-Romagna, the national totals for the SRGs are revised to EUR 69.13 million for SRG07, EUR 37.30 million for SRG08, and EUR 23.38 million for SRG09. Figure 5 displays a bar chart in which the total SGR–Cooperation funding activated by each region is ordered in ascending order. The data sources also disagree on SRG09 for the Basilicata Region: while the Europlanning Guide indicates that funding has not been activated, the RNN report indicates that it has been activated but with an amount to be defined.

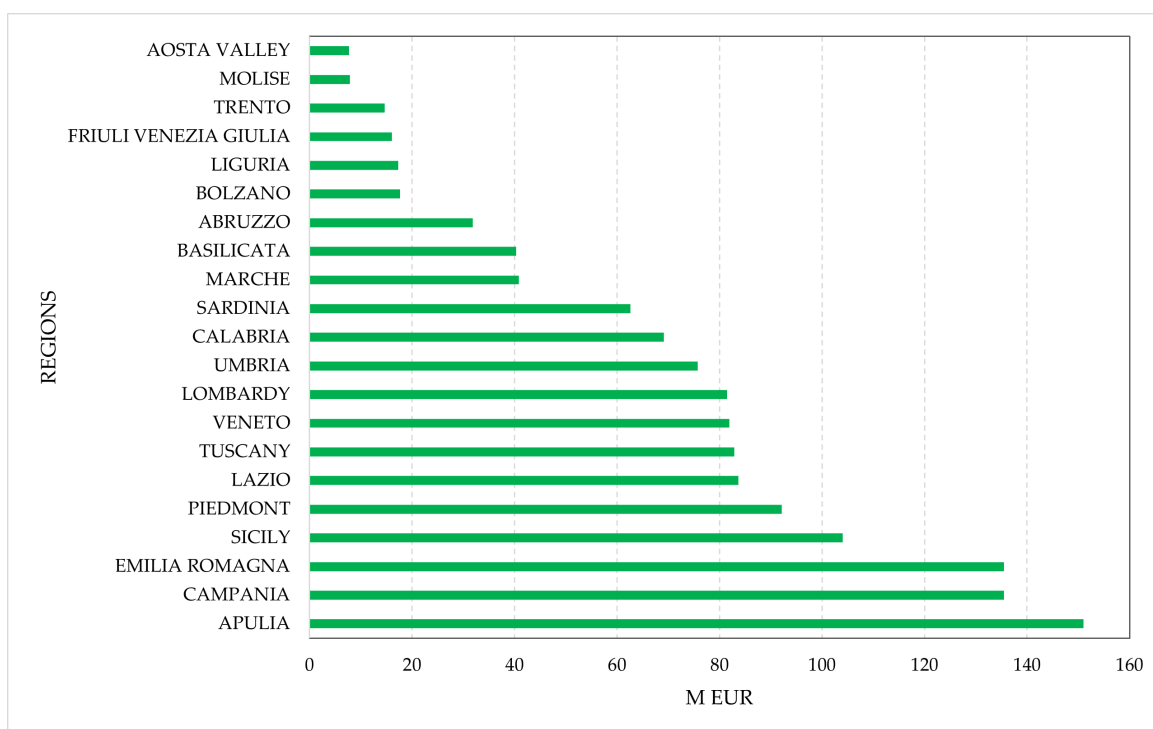


Figure 5. Bar chart of total SGR–Cooperation funding activated by each region.

Assessing regional funding in detail, according to the Europlanning Guide, the Lazio, Molise, and Friuli Venezia Giulia regions and the autonomous provinces of Trento and Bolzano have not activated any of the three examined SRGs. In contrast, only Tuscany and Piedmont have activated all three SRGs. All other regions have activated only two of the three SRGs considered.

Figure 6 presents, in descending order, the funding activated by the regions for SRG07, SRG08, and SRG09, providing a direct answer to RQ3. The region with the highest active funding is Umbria, with EUR 10.60 million for SRG08 and EUR 24.75 for SRG09, followed by Tuscany, which has activated all three SRGs, with a total funding of EUR 11 million, and Campania, which has activated SRG09 with EUR 9.98 million and SRG07 with EUR 9.68 million.

4.2. A'WOT Analysis-Results

At the end of data collection, 15 experts filled out the questionnaire, corresponding to a response rate of 60%. The experts involved in the survey work mainly in public administration (e.g., research organizations, universities), with 80% belonging to the agricultural/forestry sector, 13% to the engineering sector, and 7% to and the legal sector. As

for work experience regarding the topics covered, 67% of the respondents have more than 10 years, 26% less than 5 years, and 7% between 6 and 10 years of experience.

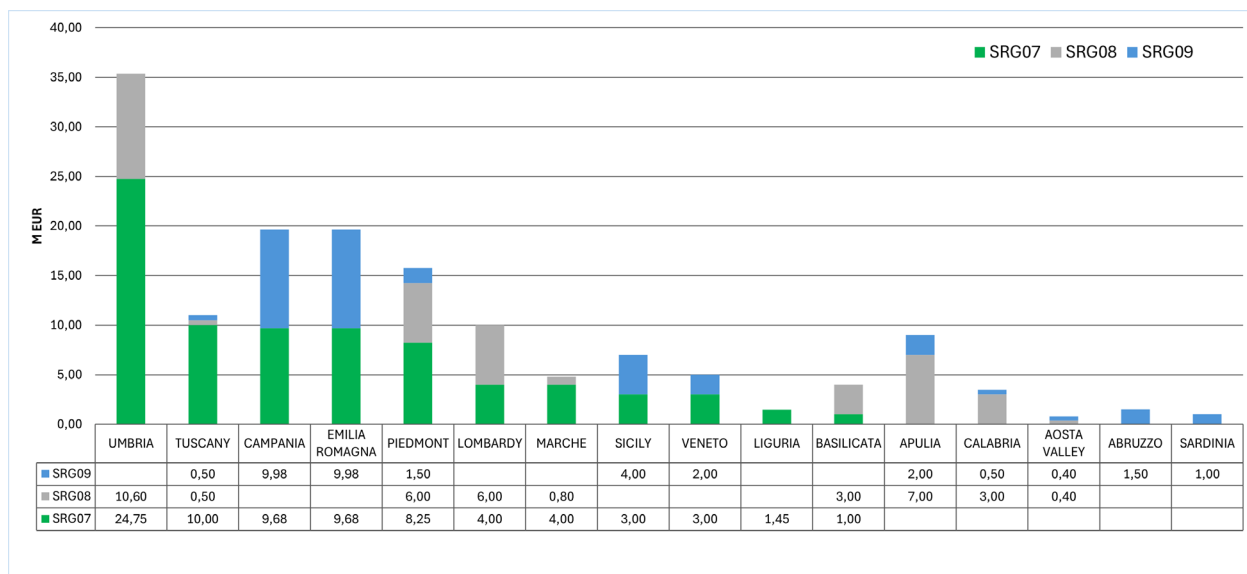


Figure 6. Regional financing details for SRG07, SRG08, and SRG09.

Regarding the A’WOT analysis, the prioritization of the alternatives, obtained by calculating the local priority for each alternative within the factors analyzed, makes it possible to identify which option exerts the greatest impact or influence within each SWOT factor (Table 4). In other words, the local priority represents the relative contribution of each alternative to the others, thus highlighting the relative importance of each option in relation to the strengths, weaknesses, opportunities, and threats revealed by the analysis.

Table 4. Priority score assigned by the experts to the alternatives in the SWOT analysis.

Alternatives	Priority Score	CI	CR
S1	0.241609217		
S2	0.21546418		
S3	0.263202645	−0.23330341	−0.188147911
S4	0.279723958		
W1	0.284282711		
W2	0.387594621		
W3	0.168671334	−0.249630576	−0.201314981
W4	0.159451333		
O1	0.303808022		
O2	0.318242239		
O3	0.176079906	−0.240928044	−0.19429681
O4	0.201869833		
T1	0.201837704		
T2	0.343971982		
T3	0.252611338	−0.243253392	−0.196172091
T4	0.201578976		

Next, a cumulative bar graph is presented summarizing the prioritization of alternatives for each SWOT factor (Figure 7).

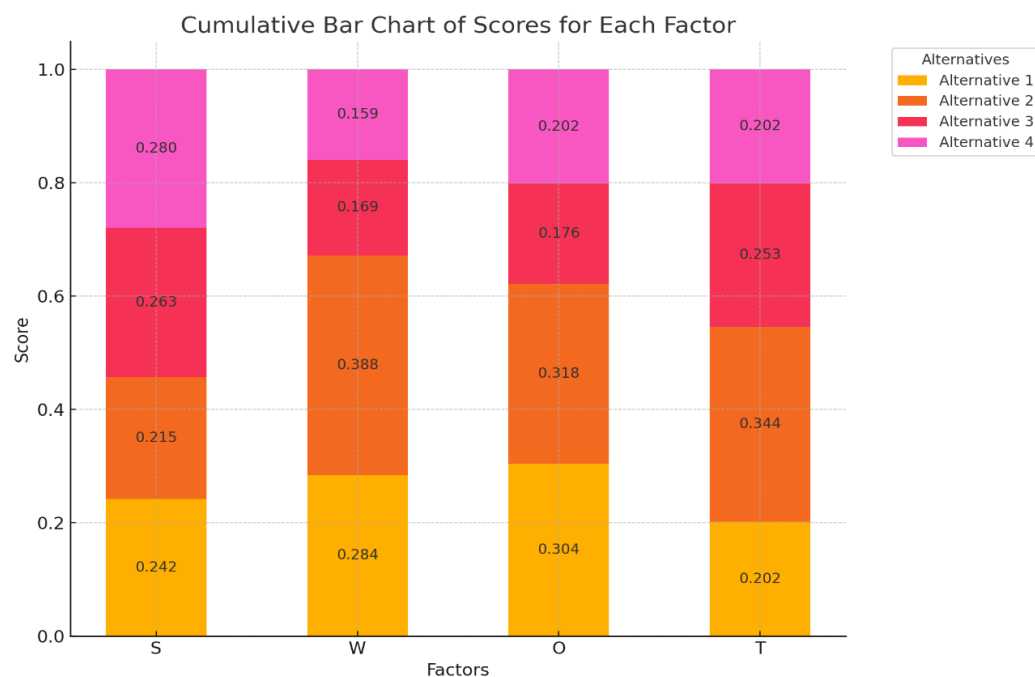


Figure 7. Cumulative bar chart of scores for each factor (strengths, weaknesses, opportunities, and threats) and for each alternative.

Regarding the strengths, the highest scoring alternative was found to be safety in the workplace, at 28%, followed by sustainability, at 26%. Next came efficiency and connectivity, both at 24%, while data management ranked as the last priority, at 22%.

In regards to weaknesses, the alternative considered most relevant by experts is the lack of training, which stands out clearly at 39%. This is followed by the digital divide at 28%, the economic barrier at 17%, and finally, territorial fragmentation at 16%.

For opportunities, the least relevant alternative is new markets at 18%, followed by increased cooperation among farmers at 20%. In contrast, eco-sustainable agriculture and precision farming emerge as the most significant opportunities, reaching 30% and 32%, respectively.

Finally, considering the threats, resistance to change emerges as the top priority at 35% (0.34). This is followed by regulatory challenges at 25%, while cyber risks and environmental impact both come in at 20%.

5. Discussion

Digital connectivity and emerging technologies play a central role in improving food security, growing the bioeconomy, managing natural resources, and mitigating climate change while supporting agrifood value chains [36]. These advances are stimulated by international initiatives, such as the European Farm to Fork and Biodiversity strategies. However, the heterogeneity of rural areas, influenced by globalization, urbanization, and environmental change, presents a complex challenge [37]. The analysis conducted integrates two main aspects related to the strategic planning and management of the agricultural sector in Italy: the prioritization by experts of strategic alternatives within the SWOT analysis and the assessment of the distribution of funding of the new CAP according to Regional Support Groups (SRGs). These findings offer a synergistic view of the strategic and operational dynamics related to land and agricultural management, providing useful insights for more effective policymaking.

In terms of both geographical and economic distribution, there was a considerable heterogeneity in funding, as detailed in the results section. This is due to Italy's regional legal system, which grants regions significant technical, economic, and administrative discretionary power to decide how to allocate resources provided by the government and the European Union, while adhering to the required principles and directives. The differing distribution of funding across regions may be attributed to variations in the level of digitalization achieved and the prioritization of other interventions deemed more urgent than digitalization (RQ3).

The A'WOT analysis revealed a clear hierarchy among the strategic factors. Among the proposed strengths, occupational safety emerges as a top priority, underscoring the increasing focus on safe and healthy operating conditions, in line with European social sustainability goals [38]. Sustainability, efficiency, and connectivity also score high, demonstrating their crucial role in the success of agricultural initiatives [39], while data management, though less of a priority, remains key to accelerating digitalization [40].

Among the weaknesses, the lack of technical and digital training is the most critical issue, emphasized by the digital divide that particularly penalizes rural areas [41]. Although less central, economic barriers and spatial fragmentation still require targeted structural interventions. In fact, the digitalization of agriculture will not only transform the existing ecosystem, but also foster the emergence of new technological enterprises [42].

Although digitalization may lead to a reduction in the demand for manual labor, it is important to consider the potential parallel increase in the demand for professionals specialized in the technologies applied to agriculture and forestry. The introduction of digital innovations does not eliminate the need for human skills but changes their nature, shifting the focus towards the management of technological tools, data interpretation, and programming of intelligent systems [43].

This transformation can lead to the creation of new professions, such as precision agriculture specialists, agricultural drone technicians, environmental data analysts, and software developers, for the optimization of natural resources. Furthermore, through appropriate training and refresher programs, professional requalification paths can be promoted to allow those who currently work in the sector to acquire the skills necessary for them to integrate into the new working context.

In this sense, digitalization represents not only a challenge but also an opportunity to promote inclusive social development, incentivize qualified employment, and stimulate innovation in the agroforestry–pastoral sector [44].

In this context, the EU's farm-to-table strategy, launched in 2020, promotes the use of digital technologies to innovate business models and improve interactions between actors in the agrifood supply chain, with the aim of driving a sustainable transition [45]. Precision agriculture and environmentally sustainable practices are confirmed as areas of high potential, highlighting the central role of technological innovation in the future of the agricultural sector [46]. However, to take full advantage of these opportunities, further developments in collaborative dynamics and economic support will be needed [47].

Among the threats identified, resistance to change poses a significant barrier to adopting new technologies, emphasizing the need for measures to mitigate perceived risks. Regulatory challenges and cyber risks also play a crucial role, underlining the importance of clearer regulations and robust security measures. Additionally, factors such as perceived usefulness, willingness to innovate and take risks, and the ease of use of these technologies are critical determinants for successful adoption [48].

The analysis of the data on the activation and distribution of SRG funding revealed significant territorial disparities, chief among which were the discrepancies between data sources: inconsistencies between the RRN Report and the Europlanning Guide suggest the

need for greater transparency in monitoring systems. The example of Emilia-Romagna, for which funding data do not match, is a case in point. Additionally, the concentration of funding is also a concern. Regions such as Umbria, Tuscany, and Campania received most of the funds, demonstrating high administrative capacities, while others, such as Lazio and Molise, did not activate any SRGs. This reflects uneven participation that may be due to divergent regional priorities or administrative difficulties.

Generally speaking, a sort of polarization emerges. Farms in the north, i.e., the Autonomous Provinces of Trento and Bolzano, where more than half of the farms present are found to be digitized, are characterized by a higher degree of digitalization, while those in the center (except Tuscany), and especially in the South, are still characterized by a delay in computerization [49].

The integration of SWOT results with those related to SRG funding offers useful insights for the improvement of agricultural policies in Italy.

1. Training and innovation: targeted investments in technical training and digitalization are essential to reduce the digital divide and improve the effectiveness of agricultural policies, as confirmed by recent studies on the importance of digital skills in this sector [41].
2. Coordinated policies: regional disparities require greater coordination between regional and national entities, as well as the adoption of more effective monitoring tools to ensure the fair and efficient distribution of funds [50].
3. Transparency and trust: discrepancies in available data underscore the importance of greater harmonization and transparency, which are necessary to improve stakeholder trust and optimize resource allocation [51].

6. Conclusions

The transition to digital agriculture is a complex process, full of challenges and opportunities that require a multifaceted approach [51]. An integrated approach that combines strategic assessments, based on the results of SWOT analysis priorities, with effective and homogeneous operational management of SRG funding is a key to overcoming current critical issues and maximizing the effectiveness of computerization interventions in the agricultural sector.

The results of the study showed that investing in training, digitalization, and cooperation between regions would not only reduce spatial disparities but also create a more resilient and competitive agricultural system capable of meeting the emerging challenges of modern agriculture. Regarding the potential labor challenges posed by the digitalization of the agricultural and forestry sectors, it is emphasized, as mentioned earlier, that a decreased demand for manual labor will inevitably be offset by an increased need for technologically skilled and trained workers. From a generational perspective, the younger generations are likely to benefit most from the digital transition in the agricultural and forestry sector. However, this transformation will not occur abruptly but will instead unfold gradually over time, ensuring a transition that allows for the integration of new skills while reducing the roles centered purely on manual labor [44].

From a theoretical point of view, the present study provided a methodological approach capable of integrating the results of the bibliometric network analysis into a qualitative–quantitative SWOT analysis approach. From a practical point of view, the results provided by this study will support policymakers in allocating future national funds to support the digitalization of the agricultural and forestry sector to overcome the current weaknesses. Furthermore, the comparative analysis between Italian regions will allow for the provision of better support to those regions that are lagging in the implementation of digitalization.

From a methodological point of view, the main strength of this study is that it has provided both qualitative data, such as the results of the SWOT analysis, and quantitative data, such as the key concepts provided by the bibliometric network analysis and the priority order of the SWOT analysis factors. Conversely, the main weaknesses of the study are the small sample size of the experts involved in the survey (15 participants) and the limited number of factors considered in the A'WOT. This last aspect is due to the methodological need not to make the compilation of the pairwise comparison grid of the SWOT analysis factors too long. Therefore, it was decided to limit the total factors to 16 (four strengths, four weaknesses, four opportunities, and four threats), even though a greater number was identified during the literature review.

Finally, future developments of the study will concern a more in-depth analysis of digitalization in the agroforestry sector throughout the various Italian regions via the opinions of regional experts through in-depth interviews.

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