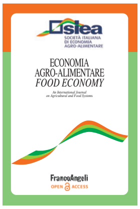
Economia agro-alimentare /
Food Economy

An International Journal on Agricultural and Food Systems

Vol. 26, Iss. 3, Art. 6, pp. 137-160 - ISSNe 1972-4802
DOI: 10.3280/ecag2024oa17604



Innovativeness in organic farming system: The case of the Marche region

Selene Righi[*,a], **Elena Viganò**[b]

[a] University of Pisa, Italy
[b] University of Urbino Carlo Bo, Italy

Abstract

The importance of research and innovation is crucial for addressing the challenges posed by evolving climatic and environmental conditions, along with the urgent need to mitigate greenhouse gas emissions and to deal with unstable markets.

To establish Sustainable Agri-Food Systems, in environmental, social, and economic terms, it is essential to ensure access to technologies that can reduce biological and market risks.

The objective of this paper is to understand how different factors influence the innovativeness of organic farmers in the Marche region, in Italy, with a particular focus on the adoption of a digital tool, Decision Support System (DSS).

The analysis, developed through the application of the SEM model to a sample of organic farmers, highlights the significant role of support services in facilitating the implementation of innovations. Therefore, it is important for policymakers, especially at the regional level, to define specific and coherent measures that incentivize the adoption of innovations.

Article info

Type:
Article
Submitted:
29/03/2024
Accepted:
04/11/2024
Available online:
18/12/2024

JEL codes:
Q16, O32, O13

Keywords:
Farm innovation
Support services
Organic agriculture
Decision Support System
Italy

Managing Editors:
Chiara Rinaldi
Vladi Finotto
Christine Mauracher

* *Corresponding author*: Selene Righi - Department of Agriculture, Food and Environment - University of Pisa. E-mail: selene.righi@agr.unipi.it.

Introduction

The agri-food system, both at the national and international level, is facing profound transformations related to the current global challenges resulting from the consequences of climate change and the Russian-Ukrainian conflict. Rising temperatures and related phenomena (i.e., reduced agricultural resources availability, loss of fertility, declining biodiversity, etc.) present multiple problems for agrarian enterprises, which are exposed to an increasing biological risk (Barberi, 2015; Hoek *et al.*, 2021). Conflict-related speculation and a post-pandemic situation also expose businesses to high market risk, resulting in an increasingly turbulent situation leading to a rise in price volatility, reinforced by other market-based drivers (generated by demand or supply shocks via levels of domestic consumption and production) and external shocks (e.g., trend in oil prices and exchange rates), especially in agricultural commodity markets such as wheat, corn, and barley (Santeramo *et al.*, 2018; Viganò *et al.*, 2022). In Italy, in years marked by extreme climatic phenomena (drought or excessive rainfall in the months preceding the harvest), durum wheat prices were characterized by strong variability and a downward trend, against an increase in production costs, mainly linked to the rising trend in fossil fuel prices (Righi *et al.*, 2022).

In this context, research and innovation play a pivotal role in facilitating adaptation to emerging climatic and environmental conditions, mitigating greenhouse gas emissions and responding to market shocks. This includes the provision of Decision Support System (DSS), defined as "a computer-based support system for decision-makers that uses data from different sources to provide recommendations to improve the quality of decisions" (Ara *et al.*, 2021; Fenu & Malloci, 2020; Zhai *et al.*, 2020). In the European Union, the application of these tools is increasing dramatically, primarily because they are considered essential for the transition to a more sustainable agri-food system, particularly within organic farming (European Commission, 2020). However their implementation may be hindered by a lack of support, specific knowledge, and farmers' motivations (Bàrberi *et al.*, 2017; Barnes *et al.*, 2019; Fenu & Malloci, 2020).

This paper aims to analyze the propensity to innovate and the relative motivations of a sample of organic farmers in the Marche region, located in central Italy. Specifically, we want to investigate the various factors (farmer and farm characteristics, personal innovation, social influence, effort expectancy in the use of innovation, performance expectancy, and various facilitating conditions) that may encourage (or hinder) the propensity to implement the DSS tool, paying particular attention to the organizational dimension.

The Marche region represents an interesting case because it is a "zipper region", between Northern and Southern Italy, both in geographical terms and in general economic and social conditions (Canavari *et al.*, 2022). It's also one of the most important Italian regions regarding agricultural area dedicated to organic farming, amounting to 21,416 hectares (ha), in 2022, or 25.5% of the UAA (www.sinab.it). The durum wheat sector is particularly noteworthy: Marche is the first region in the Centre-North in terms of the incidence of the area dedicated to the cultivation of organic durum wheat out of the total organic area (6.4%) and the fifth in Italy, following Basilicata (22.8%), Molise (13.5%), Apulia (13.5%) and Sicily (9.6%) (www.sinab.it/bio-statistiche).

The study was developed through a participatory approach, conducting focus groups with experts and stakeholders (in particular, associations of producers and regional consortium), interested in identifying the main elements of the innovation processes, designing a questionnaire, collecting data, and discussing the results.

Through a farmer survey and econometric analysis of the survey data, we analyzed the relationships between the farmer's choice to adopt DSS and the set of personal, professional, and organizational elements that may shape this decision.

The paper is structured as follows. The main conceptual arguments proposed in the literature to illustrate the factors influencing farmers' innovativeness are presented in Section 1. Section 2 describes the material and methodology adopted, starting with the data collection process and the presentation of the variables, followed by an illustration of the choice of the theoretical framework and the hypotheses of the study, and finally by explaining the statistical model chosen for the analysis. The results of the estimation procedures are reported and discussed in Section 3. Lastly, Section 4 presents the conclusions with some implications of the study carried out for stakeholders and policymakers and, at the same time, provides some suggestions for further research.

1. Literature review of factors influencing farmers' innovativeness

In the literature on the sustainability of agri-food systems, innovation is recognized as a clear opportunity for transitioning to specific production models, particularly organic farming, which represents the main alternative to industrial/intensive methods, offering numerous positive environmental benefits and revitalizing rural areas (Canavari *et al.*, 2022; Mouratiadou *et al.*, 2024; Rijswijk *et al.*, 2021; Sturla *et al.*, 2019). The European Commission's communication "Farm to Fork" as part of the "European

Green Deal" (European Commission, 2020), emphasizes that this transition will require greater investment in Research and Development (R&D) as well as a higher level of professionalization of entrepreneurs, which can be achieved through the enhancement of training programs and support services (such as advisory services) (Bàrberi *et al.*, 2017; Frantzeskaki *et al.*, 2012; Mencarelli & Mereu, 2021; Righi & Viganò, 2023).

A significant challenge for farmers in adopting more sustainable production models is the lack of knowledge transfer agencies and technical-organizational support (Barnes *et al.*, 2019; Läpple & Kelley, 2013; Liu *et al.*, 2019), which are increasingly essential.

Innovation is a broad and powerful concept and can be understood as the ability of different stakeholders to collaborate for "knowledge sharing" (Fieldsend *et al.*, 2020). This includes digital innovations and their implications for implementation (e.g., artificial intelligence, drones, big data, robotics, etc.), i.e., the so-called innovation 4.0 (Rijswijk *et al.*, 2021; Rose *et al.*, 2021).

Understanding the factors that contribute to the adoption of an innovative technology requires a deep awareness of the distinctive characteristics of farmers and farms. It is essential to consider the natural, geographical, and socio-economic conditions and reasons that may influence them (Firsova & Derunov, 2018; Pivoto *et al.*, 2019; Vecchio *et al.*, 2020). It is also crucial to go beyond just the "technical aspects", and to look at the attitudes, mindsets, social, organizational, environmental, and cultural contexts of farmers. This will help and support professionals working with technology and make them understand the key factors that can contribute to adoption (Mir & Padma, 2020).

In the literature, personal characteristics of the farmer ("Individual Factors") that can explain innovation adoption behaviour ("Use Behaviour") include, for instance, age, level of education, and gender (Canavari *et al.*, 2022; Diederen *et al.*, 2015; Firsova & Derunov, 2018; Ronaghi & Forouharfar, 2020). Additionally, farm characteristics, such as farm size, play a key role (Tamirat *et al.*, 2018). Some research papers point out that larger farms are more likely to innovate due to their greater financial resources and better access to technical assistance, contracts, and production planning services (Barnes *et al.*, 2019; Vecchio *et al.*, 2020; Xu *et al.*, 2020). However, some inherent characteristics of agriculture, such as small size, the lack of young and highly educated individuals, the prevalence of family farm business model, and the unregulated labour phenomena may be elements that slow down or block the adoption of innovation ("Personal Innovation") (Agarwal & Prasad, 1998; Pino *et al.*, 2017; Yi *et al.*, 2006). Often, agricultural entrepreneurs do not have access to scientific and technical advancements or to other information that could be crucial for their development, so they find innovation too difficult to implement ("Effort Expectancy") (Ibragimov, 2014; Mencarelli & Mereu, 2021; Momani, 2020; Venkatesh *et al.*, 2003; Verma & Sinha, 2018). Another important factor to consider is the risk aversion of agricultural entrepreneurs. They may feel uncertain about innovating without clear expectations regarding the outcomes of such innovation (Rommel *et al.*, 2022; Takácsné György *et al.*, 2018). In addition, the adopters' perceptions of innovation and its usefulness ("Performance Expectancy") (Avolio *et al.*, 2014; Momani, 2020; Venkatesh *et al.*, 2003; Verma & Sinha, 2018) and the influence of others' opinions on adopting these innovations ("Social influence") (Aubert *et al.*, 2012; Momani, 2020; Sezgin *et al.*, 2017; Venkatesh *et al.*, 2003; Verma & Sinha, 2018) are also decisive. For farmers to effectively access certain services, they must recognize their usefulness and ease of use, as well as have the necessary tools and support to access them (Ibragimov, 2014; Olim *et al.*, 2020).

Other factors that may influence the adoption of new technologies are the organizational and technical structures ("Facilitating Conditions") capable of supporting the use of technology (Momani, 2020; Ronaghi & Forouharfar, 2020; Venkatesh *et al.*, 2003). For instance, organizational solutions, which involve greater coordination among supply chain actors and promote the dissemination of knowledge, can only be effective if organic farmers' levels of training and professionalization are sufficient to take advantage of them (Bàrberi *et al.*, 2017).

Lastly, a user's intention ("Behavioral Intention"), defined as the decision to implement plans concerning technology use (Momani, 2020; Ronaghi & Forouharfar, 2020; Venkatesh *et al.*, 2003).

2. Materials and methods

2.1. *Data collection*

Data were collected through a questionnaire entitled "The innovative needs of organic farms" sent to 400 organic farmers in the Marche region (cereal farmers) which has a total of 3.160 organic producers (www.sinab.it). Out of this group, 80 agricultural producers responded. The survey administration was made possible thanks to the support of various professional associations and cooperatives[1], which allowed us to get in touch with farmers during their

1. Among these, the *Consorzio Marche Biologiche*, that is an agricultural cooperative founded by three of the leading cooperative farms in the organic cereals sector, has developed new strategies to support organic farming and improve the competitiveness of organic products from the Marche region on national and international markets (https://conmarchebio.it/).

initiatives and meetings. Based on the literature and the goal of our analysis, we selected the variables to be included in our study, as detailed in Table 1.

Table 1 - Variables that influence farmers' innovativeness

	Items	**Scale**
Individual Factors		
Age	Age	From 18 to over 65
Educational Qualification	educ_n	1 = "Primary school"; 2 = "Middle school, high school diploma"; 3 = "university degree"; 4 = "postgraduate degree"
Gender	gender_d	0 = "Male"; 1 = "Female"
Farm Characteristics		
UAA	size_n	From "<10 ha" to ">100"
Legal Form	legalform_n	1 = "General Partnership"; 2 = "Sole Proprietorship"; 3 = "Simple Partnership"; 4 = "Limited Liability Company"
Totally organic	organic_d	0 = "No"; 1 = "Yes"
Facilitation Conditions		
Consortium	cons_n	0 = "No"; 1 = "Yes"
Cooperative/OP (Organization of Producers)	coop_n	0 = "No"; 1 = "Yes"
Association of Producers	ass_of_prod_n	0 = "No"; 1 = "Yes"
Enterprise Network	ent_net_n	0 = "No"; 1 = "Yes"
Supply Chain Contract	sup_chain_contr_n	0 = "No"; 1 = "Yes"
Consulting Services	cons_serv_n	0 = "No"; 1 = "Yes"
Personal Innovation		
If I became aware of a new digital technology that I thought would be useful for my company, I would try to implement it	PI_1_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
Among my colleagues, I am usually one of the first to experiment with new digital technologies	PI_2_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
I like experimenting with new digital technologies	PI_3_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"

Social Influence		
People whose opinions I value are in favour of adopting new digital technologies	SI_1_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
At work, my colleagues and family members who are important to me think that I should adopt new technologies if I had the chance	SI_2_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
Effort Expectancy		
I think a new technology such as the Decision Support System (DSS) is easy to implement	EE_1_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
I think the importance of a new technology like the Decision Support System (DSS) is easy to understand	EE_2_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
Overall, I believe that a new technology such as the Decision Support System (DSS) is easily understood	EE_3_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
Performance Expectancy		
I think that implementing a new technology such as the Decision Support System (DSS) can improve my work performance and efficiency	PE_1_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
Overall, I find the implementation of a new technology such as the Decision Support System (DSS) useful in my work	PE_2_n	0 = "Disagree"; 1 = "Undecided"; 2 = "Agree"
Innovation and Intention to Innovate		
Would you intend to implement the Decision Support System?	BehavIntent	0 = "No"; 1 = "Yes"
Does your farm have a Decision Support System (DSS)?	BehavUse_DSS	0 = "No"; 1 = "No but I'd like to use it in the future"; 2 = "Yes"

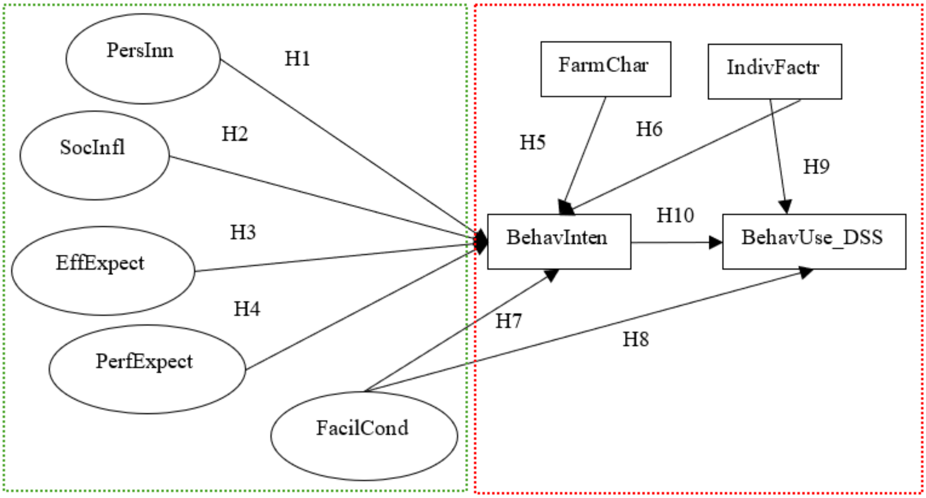
Source: Author's elaboration.

2.2. *Theoretical framework and hypothesis*

After analyzing several models related to the acceptance of new technologies (El Bilali *et al.*, 2021; Momani, 2020; Sezgin *et al.*, 2017; Shang *et al.*, 2021; Venkatesh *et al.*, 2003), including the "Theory of Reasoned Action (TRA)" (Davis *et al.*, 1989; Sheppard *et al.*, 1988), the "Theory of Planned Behavior (TPB)" (Ajzen, 1991), the "Innovation Diffusion Theory (IDT)" (Rogers *et al.*, 2014) and the "Technology Acceptance Model (TAM)" (Davis, 1985), the theoretical framework chosen for this analysis is a revised model of the "Unified Theory of Acceptance and Use of Technology (UTAUT)" (Venkatesh *et al.*, 2003). By integrating elements and the most advantageous constructs (theoretical concepts that cannot be measured directly, namely latent variables explained by observable indicators) of previous theories/models, the UTAUT has become one of the most exhaustive and widely adopted models for examining users' ability and motivation to accept new technologies.

More specifically, in this study, UTAUT allows us to: examine the direct effects of four determinants on behavioural intention ("Personal Innovation", "Social Influence", "Effort Expectancy", and "Performance Expectancy"); understand the impact of this intention variable, along with the variable expressing the "Facilitating Conditions" on the dependent variable "Behavioral Use" (referring to DSS); consider "Individual Factors" (i.e., farmer characteristics) and "Farm Characteristics" as moderator variables (i.e., capable of influencing the strength or direction of a relationship between two variables, which can be either latent or observable).

Figure 1 - Revised version of "Unified Theory of Technology Acceptance and Use (UTAUT)"



Source: Author's elaboration.

Figure 1 illustrates our theoretical framework, with all the variables involved and their relationships that allow us to understand how they influence farmers' adoption of DSS. The latent variables are within the ellipses, while the observed variables, i.e., the directly measured data, are within the rectangles.

All relations can be summarised according to the research of Venkatesh *et al.* (2003) as follows:
H1 =PE -> Behavioral Intention
H2 = SI -> Behavioral Intention
H3 = EE -> Behavioral Intention
H4 = PE -> Behavioral Intention
H5 = Farm char (legal form, size, organic) -> Behavioral Intention
H6 = Individual Factors (age educ and gender) -> Behavioral Intention
H7 = Facilitating Conditions -> Behavioral Intention
H8 = Facilitating Conditions -> Behavioral Use_DSS
H9 = Individual Factors (age educ and gender) -> Behavioral Use_DSS
H10 = Behavioral Intention -> Behavioral Use_DSS

2.3. *The Statistical Model*

The model chosen for the analysis of the theoretical model explained in the previous section is the "Structural Equation Modelling" (SEM) which involves the application of two analysis steps:

1. The measurement model allows us to assess the relationships between the different observable and latent variables, though it does not automatically determine them; therefore, before applying SEM, we define their structure by conducting a factor analysis (Sezgin *et al.*, 2017; Wang *et al.*, 2019) obtaining: "Personal Innovation" (PersInn), "Social Influence" (SocInfl), "Effort Expectancy" (EffExpect) and "Performance Expectancy" (PerfExpect) (green rectangle in Figure 1);
2. The structural part of the model, which includes regression analysis (eq. 1.1) to examine the relationships between the variables considered in the study, i.e., the "Effect of intention" (BehavInten) and different "Facilitating Conditions" (FacilCond) on the dependent variable expressing digital innovation (BehavUse_DSS) and by testing the model with moderator variables "Farm Characteristic" (FarmChar) and "Individual Factors" (IndivFact) (red rectangle in Figure 1).

$$BehavUse\_DSSi = \beta_0 + \beta_1 BehavInten_i + \beta_2 IndivFact_i + \beta_3 FacilCond_i + e_i \quad (1.1)$$

Where:

$$BehavInten_i = \alpha_0 + \beta_2 PI_i + \beta_3 SI_i + \beta_4 EE_i + \beta_5 PE_i + \beta_6 FarmChar_i + \beta_7 IndivFact_i + \beta_8 FacilCond_i + u_i$$

Specifically, given the relatively small sample size, we decided to use the "Maximum Likelihood with Missing Value (MLMV)" method, which involves an approach that uses the model variables to predict missing variables, under the assumption of joint normality of all variables (observed and latent) and that missing values are random (Acock, 2013). This technique is used in Social and Behavioral Science research where small observational samples (often between 50-100 participants) are possible (Maydeu-Olivares, 2017; Maydeu-Olivares & Shi, 2017).

3. Results

3.1. *Descriptive analysis results*

The frequencies and percentages of the variables referring to the sample of 80 farmers in the Marche Region, allow us to make some initial reflections.

In particular, Table 2 presents the results of the observable variables used in the model, which are the individual characteristics of the farmers, the attributes of their farms, and lastly their level of innovativeness (both intention and actual use of digital technology).

Firstly, we note that the majority of the sample is male, aged between 31 and 59, and with a high school diploma. Regarding utilized agricultural areas, most of the sample have a UAA between 11 and 30 ha; they predominantly operate as sole proprietorships, and nearly all of them are completely organic.

Table 2 - Sample profile: results of descriptive analysis (observable variables)

Variables		**Frequency**	**%**
Individual Factors			
Age (years)	18-30	8	10.81
	31-59	40	54.05
	60-90	26	35.14

Educational qualification	Primary school	2	2.50
	Middle school	14	17.50
	High school diploma	39	48.75
	University degree	19	23.75
	Postgraduate degree	6	7.50
Gender	Male	61	76.25
	Female	19	23.75
Farm characteristics			
UAA (ha)	<10	13	16.25
	11-30	22	27.50
	31-50	16	20.00
	51-100	20	25.00
	>101	9	11.25
Legal form	GenPart	2	2.60
	SoleProp	55	71.43
	SimplePart	18	23.38
	LLC	1	1.30
	Coop	1	1.30
Totally organic	No	5	6.25
	Yes	75	93.75
Innovation and intention to innovate			
Behavioral Intention	No	26	32.50
	Yes	54	67.50
Behavioral Use_DSS	No	41	51.25
	No, but I'd like to implement it	30	37.50
	Yes	9	11.25

Source: Author's elaboration.

Most of the sample does not currently use DSS but would like to implement it in the future. Therefore, it would be necessary to understand the factors that are problematic as well as those that may favour its adoption.

In Table 3, we have instead the additional variables considered in the analysis used to construct the latent variables, such as "Personal Innovation", "Social Influence", "Effort Expectancy", "Performance Expectancy", and various forms of "Facilitating Conditions" which refer to different organizational and integration forms in our case.

The majority of the sample states that they are passionate about innovations and that social influence is important in the adoption of digital innovation. However, they are not entirely convinced that it is easy to implement, although they understand its potential to enhance the performance and efficiency of their production process.

Table 3 - Determinants for the adoption of innovations: results of descriptive analysis (constructs for latent variables)

Variables		**Frequency**	**%**
Personal Innovation			
If I became aware of a new digital technology that I thought would be useful for my company, I would try to implement it	Disagree	2	2.50
	Undecided	17	
	Agree	61	76.25
Among my colleagues, I am usually one of the first to experiment with new digital technologies	Disagree	10	12.50
	Undecided	36	45.00
	Agree	34	42.50
I like experimenting with new digital technologies	Disagree	7	8.75
	Undecided	20	25.00
	Agree	53	66.25
Social Influence			
People whose opinions I value are in favour of adopting new digital technologies	Disagree	3	3.75
	Undecided	24	30.00
	Agree	53	66.25
At work, my colleagues and family members who are important to me think that I should adopt new technologies if I had the chance	Disagree	4	5.00
	Undecided	21	26.25
	Agree	55	68.75
Effort Expectancy			
I think a new technology such as the Decision Support System (DSS) is easy to implement	Disagree	12	15.00
	Undecided	36	45.00
	Agree	32	40.00
I think the importance of a new technology like the Decision Support System (DSS) is easy to understand	Disagree	10	12.50
	Undecided	34	42.50
	Agree	36	45.00
Overall, I believe that a new technology such as the Decision Support System (DSS) is easily understood	Disagree	10	12.50
	Undecided	33	41.25
	Agree	37	46.25
Performance Expectancy			
I think that implementing a new technology such as the Decision Support System (DSS) can improve my work performance and efficiency	Disagree	0	
	Undecided	30	37.50
	Agree	50	62.50

Overall, I find the implementation of a new technology such as the Decision Support System (DSS) useful in my work	Disagree	1	1.25
	Undecided	29	36.25
	Agree	50	62.50
Facilitating Conditions			
Consortium	No	54	67.50
	Yes	26	32.50
Cooperative/OP (Organization of Producers)	No	34	42.50
	Yes	46	57.50
Association of Producers	No	61	76.25
	Yes	19	23.75
Enterprise Network	No	72	90.00
	Yes	8	10.00
Supply Chain Contract	No	29	36.25
	Yes	51	63.75
Consulting Services	No	51	63.75
	Yes	29	36.25

Source: Author's elaboration.

The results for the "Facilitating Conditions" variable show the involvement (or not) in different forms of aggregation. Many respondents engage in various forms of integration through supply chain contracts, while others belong to cooperatives and producer organizations. Adherence to consortia, producer associations, business networks, and even advisory support is present, though to a lesser and more variable extent.

3.2. *Statistical model results*

In the initial part of the analysis, the SEM, through the measurement model, enables us to see the relationship between the observables and latent variables. Before running the model, though, we decided to conduct a factor analysis to determine the latent variables. This allows us to reduce the measurement error and improves the overall interpretation of the model (Acock, 2013; Diamantopoulos *et al.*, 2012).

Table 4 reports the constructs used to create the latent variables that express the farmer's personal innovativeness, the influence of the social context, the expectation regarding the effort required to implement an innovation, and the benefit deriving from it. It also includes the facilitating conditions linked to the various forms of organization along with their correlation scores explained based on the factors after rotation.

Table 4 - Rotated factor loading_for PI, SI, EE, PE, FC

Variable	**Value**	**Uniqueness**
Personal Innovation		
If I became aware of a new digital technology that I thought would be useful for my company, I would try to implement it	0.8214	0.3252
Among my colleagues, I am usually one of the first to experiment with new digital technologies	0.6672	0.5548
I like experimenting with new digital technologies	0.8791	0.2272
Social Influence		
People whose opinions I value are in favour of adopting new digital technologies	0.6227	0.6123
At work, my colleagues and family members who are important to me think that I should adopt new technologies if I had the chance	0.6227	0.6123
Effort Expectancy		
I think a new technology such as the Decision Support System (DSS) is easy to implement	0.8405	0.2936
I think the importance of a new technology like the Decision Support System (DSS) is easy to understand	0.9244	0.1454
Overall, I believe that a new technology such as the Decision Support System (DSS) is easily understood	0.9179	0.1575
Performance Expectancy		
I think that implementing a new technology such as the Decision Support System (DSS) can improve my work performance and efficiency	0.9064	0.1785
Overall, I find the implementation of a new technology such as the Decision Support System (DSS) useful in my work	0.9064	0.1785
Facilitating Conditions		
Consortium	0.5228	0.7267
Cooperative/OP (Organization of Producers)	0.2880	0.9171
Association of producers	0.4710	0.7782
Enterprise Network	0.5077	0.7422
Supply Chain Contract	0.2850	0.9187
Consulting services	0.3826	0.8537

* An absolute value of at least 0.30 or 0.40 is generally considered significant and good when it is above 0.55
Source: Author's elaboration.

Table 5 provides the Cronbach's alpha values "α" for each construct used in the SEM analysis.

Table 5 - Values of reliability of the constructs used in the analysis

Synthesis variables	**Cronbach's alpha (α)***
Personal Innovation	0.8480
Social Influence	0.6778
Effort Expectancy	0.9325
Performance Expectancy	0.9338
Facilitating Conditions	0.5579

* α indicates strong reliability when $\alpha \geq 0.8$, good reliability if $0.7 \leq \alpha < 0.8$, and acceptable reliability if $0.6 \leq \alpha < 0.7$)
Source: Author's elaboration.

The values associated with "Personal innovation", "Effort Expectancy" and "Performance Expectancy" have high reliability, in contrast to "Social Influence" which has a slightly smaller measure. The lower value of the factor expressing "Facilitating Conditions" may be attributed to data variability, which has many different items.

The results from the MLMV estimation of the structural model reported in Table 6, show that both "Performance Expectancy" and "Personal Innovation" are significant and have a positive impact on the intention to innovate. This suggests that if farmers perceive the benefits and are more innovative this will have a positive impact on their intention. Additionally, among farm characteristics, "Size" positively influences the user's intention (the larger one is, the more one tends to innovate).

Table 6 - Standardized results from the Structural Equation Model

Number of observations: 80				
Estimation method = MLMV				
Log Likelihood = –1486.5991				
	Behavioral Use_DSS		**Behavioral Intention**	
Structural	**Coef.**	**S.E.**	**Coef.**	**S.E.**
Intercept	2.744	0.776	/	/
Behavioural Intention	0.220	0.107*** (0.040)	/	/

Facilitating Conditions	0.392	0.150*** (0.009)	–0.301	0.240
Gender	–0.014	0.110	–0.082	0.103
Age	–0.195	0.120* (0.103)	0.047	0.123
Educational level	–0.003	0.123	0.202	0.141
Size	/	/	0.226	0.135* (0.093)
Legal form	/	/	0.138	0.109
Totally organic	/	/	0.001	0.101
Personal Innovation	/	/	0.313	0.156** (0.045)
Social Influence	/	/	0.063	0.124
Effort Expectancy	/	/	–0.132	0.163
Performance Expectancy	/	/	0.535	0.140*** (0.000)

* = p < 0.1; ** = p < 0.05; *** = p < 0.01
Source: Author's elaboration.

To assess the model we used the Comparative Fit Index (CFI), the Root Mean Squared Error of Approximation (RMSEA), and, on the size of residuals, the Standardized Root Mean squared Residual (SRMR) and the Coefficient of Determination (CD) (Kline & St, 2022), which show good performance in all measures of fit (Table 7).

Table 7 - Evaluation of the model fit

Index	**Value***
CFI	0.909
RMSEA	0.069
SRMR	0.074
CD	1

*CFI acceptable when it is ≥ 0.90
RMSEA good adaptation when it is ≤ 0.05
SRMR good fit when it is ≤ 0.08
CD better explanation of the variance in the data when it is close to 1
Source: Author's elaboration.

Regarding the dependent variable of the use of digital innovation, the variables "Behavioral Intention" and "Facilitating Conditions" are significant and positively influence it, while, among personal characteristics, "Age" negatively affects the likelihood of implementing DSS (as people get older, they are less likely to implement digital technology).

Consequently, successfully disseminating these innovations requires a generational shift, alongside individuals who already have their propensity for change and innovation, as well as adequate organizational and support structures to facilitate them.

This is in accordance with the responses of the interviewees who expressed a willingness to explore new technology, recognizing its role in improving their work and efficiency. They emphasized the importance of proper support structures, appropriate farm sizes, and the involvement of enthusiastic, digitally literate young people for effective implementation.

Conclusions

To address current environmental challenges and face growing market risks, it is essential a transition to sustainable and innovative agri-food systems, capable of producing positive externalities (in terms of both conservation and protection of the landscape, ecosystems and biodiversity, and climate change mitigation). This transition will also require the adoption of digital innovations (European Commission, 2020). A "twin transition" (ecological and digital) (Brunori, 2022) is therefore necessary to achieve the Sustainable Development Goals of the "Agenda 2030" (Colglazier, 2015; UN, 2015), including those relating to food security.

However, the impact of innovations largely depends on farmers' acceptance level and their ability to perceive the benefits for their businesses, as well as their ability to use them (El Bilali *et al.*, 2021). In this respect, our work aimed to identify the set of factors that influence (positively or negatively) agricultural entrepreneurs' decisions, regarding a specific innovation, namely the DSS.

The first conclusion of our study is the need to strengthen not only R&D activities to create an adequate proposal of innovative packages but also the system of dissemination of information and knowledge, through the promotion of different forms of integration of agricultural enterprises. Among the various variables considered, indeed, "Facilitating Conditions" emerged as a significant factor to enhance the implementation of DSS. Clearly, the willingness to innovate and age are essential elements for changing business management models but sharing knowledge and understanding the benefits of innovations are essential steps to boost entrepreneurs' confidence in adopting new technologies. This is particularly important in Italy, where the adoption of these is even more problematic than in other European countries. Structural and cultural characteristics, including small farm sizes, aging owners, and the prevalence of family businesses, alongside economic, social, institutional factors, and the geographical context, complicate this process.

Organizational innovation is therefore strategically important. This means that in the implementation of agricultural policies (especially the Common Agricultural Policy-CAP) it would be necessary to define new measures aimed at informing and training farmers. For instance, advisory services within Agricultural Knowledge and Innovation Systems (AKIS), through the involvement of professionals and advisors, can enhance the flow of knowledge from researchers to end-users (European Commission, 2022a, 2022b) and increase farmers' skills, reducing the perceived complexity of the adoption process (Vecchio *et al.*, 2020), with positive implications also for their socio-economic context. Similar considerations apply to strengthening of peer support, networking, and cooperation among farmers, as these can be effective vehicles for knowledge sharing (European Commission, 2017).

Facilitating this process requires both a cultural change within farmers and the definition of a coherent set of policies and interventions. Improving the management capacity of agricultural enterprises, through the adoption of specific actions, such as, for example, developing new products, making new structural and technological investments or implementing promotional activities, necessitates a change of perspective. A collaborative approach should be adopted, involving stakeholders across the supply chain, from companies to research institutions and policymakers.

Structures such as consortia, cooperatives, or other forms of association can play a significant role in developing projects for knowledge and information transfer also by accrediting themselves as consultancy providers, increasing the competitiveness of associated farmers, and strengthening production chains and relationships within them. However, to encourage farms to join the different forms of integration/association, not only ad hoc measures would be necessary, but also the introduction of rewarding criteria in their favour in the calls for the provision of the different types of funding under the CAP.

Our study presents several limitations, mainly due to the specific sectoral and territorial characteristics of the context examined and the small sample size. Nonetheless, the study's conclusions can be considered valid at least for the organic cereals supply chain of the Marche region. It should be emphasized, in any case, that the analysis involved the administration of a carefully defined questionnaire through continuous consultation with sector experts. This approach compensated for the limited data quantity with high quality.

To generalize the findings, however, it is essential to design and carry out further research activities in production contexts beyond the organic cereal sector and in other Italian regions. At the same time, it is important to further analyze the measures adopted by the various regional administrations (and the relative distribution of funding) that directly or indirectly promote the spread of integration among actors. These forms of collaboration, as highlighted in the study, remain crucial to facilitate innovative processes in agriculture.

Acknowledgements

This research was funded and conducted as part of the PhD project in Global Studies, XXXV cycle, titled "Models for the diffusion and impact assessment of innovations for organic food chains" at the Department of Economics, Society and Politics at the University of Urbino Carlo Bo, promoted by the Marche region. We are grateful to all the stakeholders of the Marche region who participated in the survey. We also thank the revisors of the PhD thesis and the anonymous reviewers of the journal for their valuable comments and suggestions. Lastly, we appreciate the feedback received during the XXXI SIEA Conference (2023) on *"Innovazione digitale e ambientale per la sostenibilità dei modelli di business nell'agroalimentare*", where we presented an initial draft of our analysis. Any remaining errors are solely the responsibility of the authors.

References

Acock, A. C. (2013). *Discovering structural equation modeling using Stata*. College Station: Stata Press.

Agarwal, R., & Prasad, J. (1998). A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology. *Information Systems Research*, *9*(2), 204-215. doi: 10.1287/isre.9.2.204.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211. doi: 10.1016/0749-5978(91)90020-T.

Ara, I., Turner, L., Harrison, M. T., Monjardino, M., deVoil, P., & Rodriguez, D. (2021). Application, adoption and opportunities for improving decision support systems in irrigated agriculture: A review. *Agricultural Water Management*, *257*, 107161. doi: 10.1016/j.agwat.2021.107161.

Aubert, B. A., Schroeder, A., & Grimaudo, J. (2012). IT as enabler of sustainable farming: An empirical analysis of farmers' adoption decision of precision agriculture technology. *Decision support systems*, *54*(1), 510-520. doi: 10.1016/j.dss.2012.07.002.

Avolio, G., Blasi, E., Cicatiello, C., & Franco, S. (2014). The drivers of innovation diffusion in agriculture: Evidence from Italian census data. *Journal on Chain and Network Science*, *14*(3), 231-245. doi: 10.3920/JCNS2014.x009.

Barberi, P. (2015). Functional Biodiversity in Organic Systems: The Way Forward? *Sustainable Agriculture Research*, *4*(3), 26. doi: 10.5539/sar.v4n3p26.

Bàrberi, P., Canali, S., Ciaccia, C., Colombo, L., & Migliorini, P. (2017). *Agroecologia e agricoltura biologica*. *BioReport 2016*. 101-113. -- www.researchgate.net/publication/320710691_Agroecologia_e_agricoltura_biologica.

Barnes, A. P., Soto, I., Eory, V., Beck, B., Balafoutis, A., Sánchez, B., Vangeyte, J., Fountas, S., van der Wal, T., & Gómez-Barbero, M. (2019). Exploring the adoption of precision agricultural technologies: A cross regional study of EU farmers. *Land Use Policy*, *80*, 163-174. doi: 10.1016/j.landusepol.2018.10.004.

Brunori, G. (2022). Agriculture and rural areas facing the "twin transition": Principles for a sustainable rural digitalisation. *Italian Review of Agricultural Economics*, *77*(3), 3-14. doi: 10.36253/rea-13983.

Canavari, M., Gori, F., Righi, S., & Viganò, E. (2022). Factors fostering and hindering farmers' intention to adopt organic agriculture in the Pesaro-Urbino province (Italy). *AIMS Agriculture and Food*, *7*(1), 108-129. doi: 10.3934/agrfood.2022008.

Colglazier, W. (2015). Sustainable development agenda: 2030. *Science*, *349*(6252), 1048-1050. doi: 10.1126/science.aad2333.

Davis, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: Theory and results*. Massachusetts Institute of Technology, Massachusetts, USA (1985).

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management science*, *35*(8), 982-1003. doi: 10.1287/mnsc.35.8.982.

Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., & Kaiser, S. (2012). Guidelines for choosing between multi-item and single-item scales for construct measurement: A predictive validity perspective. *Journal of the Academy of Marketing Science*, *40*(3), 434-449. doi: 10.1007/s11747-011-0300-3.

Diederen, P., Meijl, H. V., Wolters, A., & Bijak, K. (2015). *Innovation Adoption in Agriculture: Innovators, Early Adopters and Laggards*. doi: 10.22004/ag.econ.205937.

El Bilali, H., Hassen, T. B. E. N., Bottalico, F., Berjan, S., & Capone, R. (2021). Acceptance and adoption of technologies in agriculture. *AGROFOR*, *6*(1). doi: 10.7251/AGRENG2101135E.

European Commission (2017). *Communication from the commission. The Future of Food and Farming*. -- https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017DC0713.

European Commission (2020). *Communication from the Commission to the european parliament, the council, the european economic and social committee and the committee of the regions – A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system*. 0-20. -- https://eur-lex.europa.eu/resource.html?uri=cellar:ea0f9f73-9ab2-11ea-9d2d-01aa75ed71a1.0009.02/DOC_1&format=PDF.

European Commission (2022a). *Agricultural Knowledge and Innovation Systems (AKIS)*. -- https://ec.europa.eu/eip/agriculture/sites/default/files/eip-agri_agricultural_knowledge_and_innovation_systems_akis_2021_en_web.pdf.

European Commission (2022b). *Commission staff working document. Executive summary of the evaluation of the CAP's impact on knowledge exchange and advisory activities*. -- https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0138.

Fenu, G., & Malloci, F. M. (2020). DSS LANDS: A decision support system for agriculture in Sardinia. *High Tech and Innovation Journal*, *1*(3), 129-135. doi: 10.28991/HIJ-2020-01-03-05.

Fieldsend, A. F., Cronin, E., Varga, E., Biró, S., & Rogge, E. (2020). Organisational Innovation Systems for multi-actor co-innovation in European agriculture, forestry and related sectors: Diversity and common attributes. *NJAS: Wageningen Journal of Life Sciences*, *92*(1), 1-11. doi: 10.1016/j.njas.2020.100335.

Firsova, A., & Derunov, V. (2018). *Monitoring of innovative activities effectiveness in agriculture*. *18*(3), 89-100. -- https://tapipedia.org/content/monitoring-innovative-activities-effectiveness-agriculture.

Frantzeskaki, N., Loorbach, D., & Meadowcroft, J. (2012). Governing societal transitions to sustainability. *International Journal of Sustainable Development*, *15*(1-2), 19-36. doi: 10.1504/IJSD.2012.044032.

Hoek, A. C., Malekpour, S., Raven, R., Court, E., & Byrne, E. (2021). Towards environmentally sustainable food systems: Decision-making factors in sustainable food production and consumption. *Sustainable Production and Consumption*, *26*, 610-626. doi: 10.1016/j.spc.2020.12.009.

Ibragimov, G. A. (2014). *Consulting Services in Uzbekistan Agriculture – ReCCA-Conference, n. 212557, Institute of Agricultural Development in Transition Economies (IAMO)*. doi: 10.22004/ag.econ.212557.

Kline, R., & St, C. (2022). *Principles and Practice of Structural Equation Modeling*. Guilford publications.

Läpple, D., & Kelley, H. (2013). Understanding the uptake of organic farming: Accounting for heterogeneities among Irish farmers. *Ecological Economics*, *88*, 11-19. doi: 10.1016/j.ecolecon.2012.12.025.

Liu, X., Pattanaik, N., Nelson, M., & Ibrahim, M. (2019). The Choice to Go Organic: Evidence from Small US Farms. *Agricultural Sciences*, *10*(12), 1566-1580. doi: 10.4236/as.2019.1012115.

Maydeu-Olivares, A. (2017). Assessing the size of model misfit in structural equation models. *Psychometrika*, *82*(3), 533-558. doi: 10.1007/s11336-016-9552-7.

Maydeu-Olivares, A., & Shi, D. (2017). Effect sizes of model misfit in structural equation models. *Methodology*. doi: 10.1027/1614-2241/a000129.

Mencarelli, E., & Mereu, M. G. (2021). *Anticipazione dei fabbisogni professionali nel settore dell'agricoltura e silvicultura. Report tecnico*. -- https://oa.inapp.org/xmlui/handle/20.500.12916/833.

Mir, S. A., & Padma, T. (2020). Integrated Technology Acceptance Model for the Evaluation of Agricultural Decision Support Systems. *Journal of Global Information Technology Management*, *23*(2), 138-164. doi: 10.1080/1097198X.2020.1752083.

Momani, A. (2020). The Unified Theory of Acceptance and Use of Technology: A New Approach in Technology Acceptance. *International Journal of Sociotechnology and Knowledge Development*, *12*, 79-98. doi: 10.4018/IJSKD.2020070105.

Mouratiadou, I., Wezel, A., Kamilia, K., Marchetti, A., Paracchini, M. L., & Bàrberi, P. (2024). The socio-economic performance of agroecology. A review. *Agronomy for Sustainable Development*, *44*(2), 19. doi: 10.1007/s13593-024-00945-9.

Olim, M., Ablaqulovich, I. G., & Ugli, K. A. M. (2020). Service Provision And Development In Agriculture. *International Journal of Innovations in Engineering Research and Technology*, *7*(07), 84-88. -- www.neliti.com/publications/337216/service-provision-and-development-in-agriculture.

Pino, G., Toma, P., Rizzo, C., Miglietta, P. P., Peluso, A. M., & Guido, G. (2017). Determinants of farmers' intention to adopt water saving measures: Evidence from Italy. *Sustainability*, *9*(1), 77. doi: 10.3390/su9010077.

Pivoto, D., Barham, B., Waquil, P. D., Foguesatto, C. R., Corte, V. F. D., Zhang, D., & Talamini, E. (2019). Factors influencing the adoption of smart farming by Brazilian grain farmers. *International Food and Agribusiness Management Review*, *22*(4), 571-588. doi: 10.22434/IFAMR2018.0086.

Righi, S., Russo, C., & Viganò, E. (2022). Il ruolo dei contratti di filiera nei mercati «turbolenti» di oggi. *Informatore Agrario*, *(30)*, 32-34. -- https://hdl.handle.net/11576/2712592.

Righi, S., & Viganò, E. (2023). How to ensure the sustainability of organic food system farms? Environmental protection and fair price/Come garantire la sostenibilità delle aziende agricole del sistema alimentare biologico? Protezione dell'ambiente e prezzo equo. *IL CAPITALE CULTURALE. Studies on the Value of Cultural Heritage*, *27*, 377-400. doi: 10.13138/2039-2362/3185.

Rijswijk, K., Klerkx, L., Bacco, M., Bartolini, F., Bulten, E., Debruyne, L., Dessein, J., Scotti, I., & Brunori, G. (2021). Digital transformation of agriculture and rural areas: A socio-cyber-physical system framework to support responsibilisation. *Journal of Rural Studies*, *85*, 79-90. doi: 10.1016/j.jrurstud.2021.05.003.

Rogers, E. M., Singhal, A., & Quinlan, M. M. (2014). Diffusion of innovations. In *An integrated approach to communication theory and research* (pp. 432-448). Routledge.

Rommel, J., Sagebiel, J., Baaken, M. C., Barreiro-Hurlé, J., Bougherara, D., Cembalo, L., Cerjak, M., Čop, T., Czajkowski, M., & Espinosa-Goded, M. (2022). *Farmers' risk preferences in eleven European farming systems: A multi-country replication of Bocquého et al. 2014)*. doi: 10.1002/aepp.13330.

Ronaghi, M. H., & Forouharfar, A. (2020). A contextualized study of the usage of the Internet of things (IoTs) in smart farming in a typical Middle Eastern country within the context of Unified Theory of Acceptance and Use of Technology model (UTAUT). *Technology in Society*, *63*, 101415. doi: 10.1016/j.techsoc.2020.101415.

Rose, D. C., Wheeler, R., Winter, M., Lobley, M., & Chivers, C.-A. (2021). Agriculture 4.0: Making it work for people, production, and the planet. *Land Use Policy*, *100*, 104933. doi: 10.1016/j.landusepol.2020.104933.

Santeramo, F. G., Lamonaca, E., Contò, F., Nardone, G., & Stasi, A. (2018). Drivers of grain price volatility: A cursory critical review. *Agricultural Economics (Czech Republic)*, *64*(8), 347-356. doi: 10.17221/55/2017-AGRICECON.

Sezgin, E., Özkan-Yildirim, S., & Yildirim, S. (2017). Investigation of physicians' awareness and use of mHealth apps: A mixed method study. *Health Policy and Technology*, *6*(3), 251-267. doi: 10.1016/j.hlpt.2017.07.007.

Shang, L., Heckelei, T., Gerullis, M. K., Börner, J., & Rasch, S. (2021). Adoption and diffusion of digital farming technologies – Integrating farm-level evidence and system interaction. *Agricultural Systems*, *190*, 103074. doi: 10.1016/j.agsy.2021.103074.

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of consumer research*, *15*(3), 325-343. doi: 10.1086/209170.

Takácsné György, K., Lámfalusi, I., Molnár, A., Sulyok, D., Gaál, M., Domán, C., Illés, I., Kiss, A., Péter, K., & Kemény, G. (2018). Precision agriculture in Hungary: Assessment of perceptions and accounting records of FADN arable farms. *Studies in Agricultural Economics*, *120*(1), 47-54. doi: 10.22004/ag.econ.273117.

Tamirat, T. W., Pedersen, S. M., & Lind, K. M. (2018). Farm and operator characteristics affecting adoption of precision agriculture in Denmark and Germany. *Acta Agriculturae Scandinavica, Section B – Soil & Plant Science*, *68*(4), 349-357. doi: 10.1080/09064710.2017.1402949.

Vecchio, Y., Agnusdei, G. P., Miglietta, P. P., & Capitanio, F. (2020). Adoption of Precision Farming Tools: The Case of Italian Farmers. *International Journal of Environmental Research and Public Health*, *17*(3). doi: 10.3390/ijerph17030869.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425-478. doi: 10.2307/30036540.

Verma, P., & Sinha, N. (2018). Integrating perceived economic wellbeing to technology acceptance model: The case of mobile based agricultural extension service. *Technological forecasting and social change*, *126*, 207-216. doi: 10.1016/j.techfore.2017.08.013.

Viganò, E., Maccaroni, M., & Righi, S. (2022). Finding the right price: Supply chain contracts as a tool to guarantee sustainable economic viability of organic farms. *International Food and Agribusiness Management Review*, 1-16. doi: 10.22434/ifamr2021.0103.

Wang, Y., Jin, L., & Mao, H. (2019). Farmer Cooperatives' Intention to Adopt Agricultural Information Technology – Mediating Effects of Attitude. *Information Systems Frontiers*, *21*(3), 565-580. doi: 10.1007/s10796-019-09909-x.

Xu, Q., Huet, S., Perret, E., & Deffuant, G. (2020). Do farm characteristics or social dynamics explain the conversion of dairy farmers to organic farming? An agent-based model of dairy farming in 27 French cantons. *Journal of Artificial Societies and Social Simulation*, *23*(2). doi: 10.18564/jasss.4204.

Yi, M. Y., Jackson, J. D., Park, J. S., & Probst, J. C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. *Information & Management*, *43*(3), 350-363. doi: 10.1016/j.im.2005.08.006.

Zhai, Z., Martínez, J. F., Beltran, V., & Martínez, N. L. (2020). Decision support systems for agriculture 4.0: Survey and challenges. *Computers and Electronics in Agriculture*, *170*, 105256. doi: 10.1016/j.compag.2020.105256.

Selene Righi
Department of Agriculture, Food and Environment, University of Pisa, Italy
Via del Borghetto 80 – 56124 Pisa (PI), Italy
E-mail: selene.righi@agr.unipi.it
Research Fellow at the University of Pisa since February 2023. Earned a PhD in Global Studies, Economy, Society and Law (University of Urbino, Department of Economics, Society and Politics, July 2023) with a project on the dissemination of innovation in organic cereal supply chains in the Marche Region. Holds a Master's degree in Economics of the Environment and Sustainable Development (University of Siena, Department of Economics, April 2019).
Current research interests are related to innovation in organic supply chains, sustainability assessment in food value chains (with a focus on the livestock sector), transition to Sustainable food systems and consumer behaviour.

Elena Viganò
Department of Economics, Society, Politics, University of Urbino Carlo Bo, Italy
Via A. Saffi, 42 – 61029 Urbino (PU), Italy
Tel. +39 0722 305549
E-mail: elena.vigano@uniurb.it
After the Degree in Agricultural Sciences, she obtained Diploma of specialization in Agricultural Economics from CSREAM-Portici, and PhD in Agricultural Economics and Politics from the University of Naples "Federico II". She was appointed as Researcher at the University of Naples "Federico II" (1994-1998) and at University of Urbino Carlo Bo (1998-2001). Currently, she is a Full Professor in Agricultural Economics and Rural Appraisal and Vice-Rector of Sustainability and Valuing Differences at University of Urbino Carlo Bo.
Her current research interests include the evaluation of the impact of innovations in the agricultural sector and the analysis of policies for the sustainability of the agri-food system, with a specific focus on agricultural production, distribution of value in agrifood supply chains, quality and food safety/security, organic farming, ethical and fair trade.