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Farmer's adoption of agricultural insurance for Mediterranean crops as an innovative behavior

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Abstract

Agriculture is a risky industry and is present in every management choice the farmer makes. Farms can experiment with different tools that can contain the impact of adverse events to protect production facilities, investments, and income generated by farming. This is the context for the study conducted in Sicily on a sample of farms of different types to explain farmers' decision-making process in adopting insurance offered in the subsidized market. The study adopted three socio-psychological constructs, Attitude (ATT), Subjective Norm (S.N.), and Perceived Behavioural Control (PBC), derived from the Theory of Planned Behaviour (TPB). It proposed the addition of a new construct, Risk Factors (RISK), and farm type. The results indicated that factors including Attitude, S.N., and PBC are positively significant when understanding farmers' intentions to adopt insurance. However, the additional factors included in the regression model (RISK and farm type) were statistically insignificant, rejecting the efficiency of an extended theory of planned behavior framework. Based on these results, it was concluded that combining extension services to improve awareness of the importance of insurance facilitated by the public contribution service could significantly influence farmers' intention to adopt it.

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Introduction

Economic activity is exposed to risk factors, and the agricultural sector is no exception. Indeed it is probably one of the most vulnerable (Sulewski *et al.*, 2014). Farmers have limited or no control over shocks and events related to external factors, such as adverse weather conditions or market and policy changes, even though such events have a direct impact on agricultural products and outcomes, such as yields, revenues, and incomes (Komarek *et al.*, 2020; Basile *et al.*, 2000). Additionally, farmers are being compelled to adopt tools and strategies to manage various sources of risk in agriculture by growing uncertainty and instability brought on by high price volatility in product markets, the reduction of traditional market regulation instruments in the European Union (E.U.), and the rise of extreme weather events (Iyer *et al.*, 2020).

Moreover, compared to other economic activities, the spectrum of risks affecting the performance of agriculture is quite broad and directly impacts the stability of food production and supply and, consequently, food security (Calicioglu *et al.*, 2019). Risks in agriculture can vary in severity depending on whether the events disrupting the farm outcome are related to production, the market, financial resources, and institutional or personal aspects (Sarwar *et al.*, 2013). The primary source of risk in agriculture is nature-related: unfavorable weather conditions, plant or livestock diseases, pests, and other natural factors can reduce yields. Complexities of the global climate and its evolutionary trends make the effects of weather challenging to generalize. The frequency and timing of hail, heavy rain, windstorms, or frost are unpredictable and strongly impact agricultural activities.

Furthermore, other factors such as drainage, irrigation systems, and the quality of farm management interact with weather conditions and can enhance and amplify their effects (OECD, 2020; Porrini *et al.*, 2019). Therefore, the vulnerability and susceptibility of the agricultural sector lead to systemic risks, which is one of the main limitations of insurability.

Changes in the market and institutional environment are another source of risk in agriculture. Variations in agricultural policies and legal frameworks, i.e., trade liberalization and the introduction of new standards, contribute to rapidly changing in the institutional environment in which farmers operate and require rapid adaptation to avoid facing operational and financial difficulties (El Benni *et al.*, 2012; Koundouri, 2009).

Furthermore, the effects of climate change (Ndamani *et al.*, 2017; Prokopy *et al.*, 2016), increasing global competition, food security (Ferrer *et al.*, 2015), unexpected events such as the recent Covid-19 pandemic (Štreimikienė *et al.*, 2021) and the war economy, linked to the Russia-Ukraine conflict, are added to these type of risk (Figus, 2020).

Different criteria have been used to classify risk in agriculture (Komarek *et al.*, 2020; Marin, 2019). According to nature, agricultural risk can be natural-climatic, agrobiological, or technological. Additionally, all risk factors in agricultural activities are classified based on how frequently they occur, how likely they are to occur, and how severely they affect farmers. Thus, according to the OECD (2020), it is possible to distinguish between: (i) normal risks, i.e., events that occur with high frequency at the local level and usually with minor damage to farms; (ii) tradable risks, which refer to those events that are less frequent, but more challenging to manage due to their greater magnitude for farmers alone; and (iii) catastrophic risks, i.e., events with a very low probability of occurrence, but with very high and systemic impacts. Further classifications consider other factors and characteristics, such as the degree of typicality of the risk phenomenon in a given area, the frequency and intensity of its occurrence, and the degree of predictability and impact on specific stages of crop development.

There is no way to suppress pure risk resulting from the interplay between the organization and the environment in which it operates. However, risk management practices adopted by farmers are not widespread (Cioffi *et al.*, 2011; Ogurtsov *et al.*, 2008) and not only because of a different risk aversion and perception (Iyer *et al.*, 2020; van Winsen *et al.*, 2016; Menapace *et al.*, 2016).

All this happens even though the CAP 2014/2020 has expanded the tools for risk management (Frascarelli, 2007; Bielza *et al.*, 2008; Meuwissen *et al.*, 2013) in a perspective of revisiting the overall support to agriculture, dedicating specific financial resources to "agricultural insurance", "mutual funds" and "income stabilization tools", access to which is facilitated (most recently by E.U. Regulation 2017/2393, Reg. OMNIBUS), and to measures 17 of the National Rural Development Plan (RDPN) with the coverage of the consequent burdens borne by the farm (Trestini *et al.*, 2017 and 2018; Severini *et al.*, 2021).

Agricultural insurance today represents an essential innovation for farmers that, if adopted, would improve risk management for farms and is becoming increasingly important as an agricultural policy tool, both in Europe and the United States (Cordier, 2015). In particular, Italy has paid much attention to insurance instruments. It is one of the European countries making more extraordinary efforts to support the subsidized insurance market, which remains the basis of the risk management system. Despite efforts by the public to encourage participation, only around 15 percent of farmers take part in insurance programs due to factors such as high bureaucratic costs, payment delays, lack of experience with insurance contracts, and inadequate information on insurance options (Santeramo, 2019). The Defense Consortia has been introduced to address this issue and facilitate matches between

insurers and farmers in the subsidized crop insurance market, as well as reduce information asymmetry. However, there is a territorial divide between Northern and Southern Italy, with Defense Consortia being more effective in the North where there is a stronger presence of producer organizations and cooperatives that aggregate demand for crop insurance. This limits farmers' participation in the South. (Santeramo *et al.*, 2016; Rippo and Cerroni, 2023).

The purpose of this paper is to present a conceptual framework using the TPB to study farmers' decisions to purchase insurance. Several works in the literature (Bagheri *et al.*, 2019; Borges *et al.*, 2014; Lalani *et al.*, 2016; Maleksaeidi and Keshavarz, 2019; Bruijnis *et al.*, 2013) indicate that TPB is one of the most common socio-psychological frameworks to explain the factors influencing farmers' intentions towards their behavior.

Specifically, in this study, an additional construct in the TPB model and the type of farming was considered to increase its validity and predictive ability. These variables could be correlated with other TPB variables and provide more reliable results. As Ajzen (1991) states, the TPB is open to further elaboration with important additional constructs that could increase the model's predictive ability. Some crucial studies have used the TPB by including additional constructs to the model to increase its explanatory capacity (Bagheri *et al.*, 2019; Gao *et al.*, 2017; Maleksaeidi and Keshavarz, 2019; Soorani and Ahmadvand, 2019).

1. Materials and methods

1.1. *Agricultural insurance*

Several researchers have investigated the impact of agricultural insurance on farmers' incomes, and opinions are divided into two major camps. According to some research, agricultural insurance positively influences agricultural production and farmers' income, while others take the opposite view. In the 1980s, Yamauchi (1986) used the farmers who had purchased rice insurance in Aomori Prefecture, Japan, as the research object. He found that compulsory agricultural insurance helped stabilize farmers' income, especially in severe disasters. Xavier *et al.* (2008) studied farmers who purchased insurance against storms in southern India and found that agricultural insurance increased local farmers' income. According to Hosseini and Gholizadeh (2008) and Enjolras (2014), agricultural insurance can reduce farmers' income volatility and increase their income. Another study (Barry *et al.*, 2001) concluded from statistics that farmers' income in years exposed to agricultural risks exceeds more than half of their expected production years, illustrating the positive impact of agricultural insurance on farmers' income.

Further research (Robert *et al.*, 2014) found, through statistical data analysis, that the impact of agricultural insurance on farmers' income is not necessarily significant. Even in some years, the two have an inverse relationship. Several scholars have also looked at agricultural insurance and agricultural production. Most believe there is a significant positive correlation between agricultural insurance and agricultural production (Huang and Pu, 2015; Cheng *et al.*, 2016; Jiang and Zhang, 2018). Zhou and Zhao (2016) and Wang (2011) used a dynamic panel model to conduct an empirical analysis and concluded that agricultural insurance broadly promoted agricultural production. However, some researches do not believe there is a strong relationship between these two aspects. According to Zhang *et al.* (2006), the total output of agricultural products will not change significantly as long as the level and percentage of agricultural insurance subsidies are low. Further research (Hu, 2012) analyzed the impact of agricultural insurance on agricultural production capacity using hypothesis tests. The results showed that the impact is almost non-existent, and there is no significant correlation between agricultural insurance and food production.

Other research has also focused on the factors influencing farmers' demand for agricultural insurance. It is believed that the demand for agricultural insurance is not only influenced by farmers' income. Abraham *et al.* (2013) used a three-stage sampling procedure to select 120 rural households in their research. They concluded through a questionnaire survey that age, education level, and agricultural income can influence farmers' willingness to participate in agricultural insurance. According to Moschini and Hennessy (2005), farmers' risk preferences influence their participation in agricultural insurance; farmers with a high-risk tolerance tend to self-insure, whereas risk-averse people may not use agricultural insurance to transfer risks. A recent study (King and Singh, 2020) identified that the demand for insurance is replaced by access to private transfers. However, participation in a farmers' union helps to understand why farmers value index-linked insurance. According to further research (Coble *et al.*, 2008), a single economic factor influences farmers' participation in agricultural insurance, including risk awareness and crop risk status. The study by Sujarwo *et al.* (2017) proposed that experience in purchasing farm insurance and even being willing to attend farmers' group meetings influence farmers' willingness to accept farm insurance. Furthermore, age, female gender, and previous insurance experience seem to favor the adoption of insurance (Ghosh *et al.*, 2022). Giampietri *et al.* (2020) also emphasized the significance of trust in insurance underwriting in Italy. They underscored how trust plays a crucial role in decision-making, particularly when faced with uncertainty, and suggested that trust may act as a substitute for knowledge when it comes to insurance.

Therefore, knowing the characteristics and determinants of the propensity to insure in the primary sector becomes all the more important because such information is fundamental for designing public policies to support and expand demand. Determining agricultural entrepreneurs' behavioral motivations and psychological factors is a rather complex task (Adnan *et al.*, 2017; Borges *et al.*, 2014; Mesa-Vázquez *et al.*, 2021). The choice of a behavioral model turns out to be necessary because the intention on the part of the farm to implement or not to purchase an insurance package clashes with human psychology (Berti and Mulligan, 2016; Hannus and Sauer, 2021; Judge *et al.*, 2019; Brudermann *et al.*, 2013).

The economic literature on farmers' decisions is based on normative theory and the assumption that decisions can only be modeled in terms of individual profit-maximizing actions (Austin *et al.*, 1998; Willock *et al.*, 1999). However, this literature fails to capture the full complexity of farmers' decisions (Austin *et al.*, 1998). Moreover, these models fail to recognize that farmers' behavior is not only driven by profit maximization (Willock *et al.*, 1999). In agricultural economics, farmers' decisions and behavior have been studied using two main approaches: one is based on purely economic models, in which Expected Utility Theory (EUT) plays a central role. The second approach is based on socio-psychological theories, in which psychological constructs explain farmers' behavior. One of the most essential theories used by researchers to understand farmers' behavior was developed by Fishbein and Ajzen (1975), the Theory of Reasoned Action (TRA). The TRA was extended by Ajzen (1991), resulting in the Theory of Planned Behaviour (TPB).

1.2. *Theoretical background*

The TPB, proposed by Ajzen (1991) as a reference model in the field of the theory of reasoned action (TRA), includes a basic framework for clarifying the reasons for individual behavior. The central assumption of TPB is that behavioral intention determines behavior in a more immediate way, which is explained as an individual's willingness to perform a particular behavior (Ajzen, 2002; Fishbein and Ajzen, 1975). Intention, in turn, depends on the individual's beliefs towards a particular behavior, which is based on three factors, including subjective norm (S.N.), perceived behavioral control (PBC), and attitude towards the behavior (Daxini *et al.*, 2018; Sok *et al.*, 2021). However, specific behaviors might be better predicted by only some of these factors (Shapiro *et al.*, 2011). In TPB, it is hypothesized that a higher perceived social pressure is caused by a more positive attitude toward the outcome of the behavior. Considering the numerous promoting

factors, there is a higher intention to carry out the behavior (Wang *et al.*, 2018). Attitude refers to an individual's positive or negative evaluation of a particular behavior based on expected outcomes (Ajzen, 2005; Velde *et al.*, 2015). Therefore, it is the product of a set of relevant beliefs about the consequences of performing the behavior, which is pondered by evaluating the importance of each consequence (Lean *et al.*, 2009; Quine *et al.*, 2001). An intention to perform the behavior exists in a person with a very positive attitude towards a behavior (Zhang *et al.*, 2014; Senger *et al.*, 2017). Consequently, attitudes toward the willingness to purchase insurance refer to the individual's positive or negative evaluation. PBC is the perceived difficulty or facility in performing an expected behavior (Ajzen, 1991, 2002). PBC is a multidimensional construct (Phipps *et al.*, 2015; Trafimow *et al.*, 2002) that has been reconceptualized in recent years, incorporating measures of perceived control (i.e., controllability) and perceived difficulty (i.e., self-efficacy) (Ajzen, 2006; O'Callaghan and Nausbaum, 2006; Saeedi *et al.*, 2022). PBC is a significant predictor of intention in TPB, as individuals will show greater intention to perform a particular behavior if they perceive more significant control over themselves (Webb *et al.*, 2013; Tóth *et al.*, 2020). Therefore, in the case of insurance in agriculture, it is expected that the perceived ease or difficulty in adopting it may influence the likelihood of implementing this behavior. S.N. is initially described as 'the perceived social pressure exerted by the person to perform or not to perform the behavior under investigation' (Ajzen, 2005). According to TPB, the greater an individual's perceived pressure and expectations, the more remarkable that person's intention to perform the behavior (Ajzen, 1991; Matthies *et al.*, 2012; Ru *et al.*, 2018; Shi *et al.*, 2017; Sarkar *et al.*, 2022). Therefore, the objective is to investigate whether others influence farm insurance adoption.

1.3. *Research questions*

The research, using the Theory of Planned Behaviour (Ajzen, 1985) as a model, focused on the survey of a sample of 100 companies in Sicily to investigate the decision-making process that leads to risk management and the intention to purchase an insurance package to counteract the negative impact of accidental events, to provide useful indications to public and private stakeholders because of the definition of the future 2023-2027 programming, to be implemented both at a regional and national level.

According to the theory of planned behavior, attitude is the most effective predictor of entrepreneurial intention, followed by subjective norms and perceived behavioral control (Timpanaro and Cascone, 2022; Zhang *et al.*, 2015). A positive attitude is a belief that individuals are capable

of performing a given task, subjective norms operate as a self-regulatory mechanism that determines whether individuals will take actions, and behavioral control is instrumental in determining what individuals do with the skills and abilities they possess (Gao *et al.*, 2017; Hansson *et al.*, 2012; Soorani and Ahmadvand, 2019).

Specifically, following the literature, this study adopted an integration of the Theory of Planned Behaviour (TPB) by including an additional variable to increase its predictive accuracy (Joao *et al.*, 2015; Rezaei *et al.*, 2018; Sarkar *et al.*, 2022; Tama *et al.*, 2021). This conceptual model considers, in addition to the three classical TPB factors, i.e., attitude (A), subjective norms (S.N.), and perceived behavioral control (PBC), a fourth variable, i.e., Risk Factors (RISK), and hypothesizes that all of these four elements could directly or indirectly influence the intention to purchase an insurance package (Hou and Hou, 2019; J. Müller *et al.*, 2021; Wauters *et al.*, 2010).

To this extension of the theory of planned behavior, the different entrepreneurs type of farming was added to understand whether they increase the model's accuracy and, secondly, to understand which industries are characterized by a higher intention to adopt insurance. To this purpose, a specific question was added to the questionnaire asking each respondent to choose their preeminent type of farming. So, the variable was codified as a dummy variable in the dataset ("1" if chosen by the respondent, "0" otherwise).

The additional variable, Risk Factors (RISK), is the fourth element considered for the conceptual model. We used a 7-point Likert scale system for seven items to evaluate this construct, as described in Table 1.

Based on this knowledge, we have formulated five hypotheses:

H1: Respondents' attitude (ATT) towards purchasing insurance influences their intention;

H2: Respondents' subjective norms (S.N.) towards purchasing insurance influence their intention;

H3: Respondents' perceived behavioral control (PBC) towards purchasing insurance influences their intention;

H4: Risk factors (RISK) have a positive influence on entrepreneurs' intention to take out insurance;

H5: The Extended Theory of Planned Behaviour allows a more accurate explanation of farmers' behavior toward insurance.

1.4. *Data acquisition and processing*

To adequately achieve the objectives of the research, a reference scenario was firstly constructed based on the secondary data available (e.g., ISMEA, 2021), data also used for comparison with various stakeholders active on the subject (Condifesa managers, insurance companies, officials of the Regional Department of Agricultural and Food Resources of Sicily, category representatives, etc.). We then proceeded to the primary data collection phase using a GoogleForm questionnaire circulated through social media within organized groups of agricultural entrepreneurs or on mailing lists granted by the prominent category representatives between June and September 2022.

The questionnaire was divided into sections aimed at capturing general business and entrepreneurial characteristics, general aspects of risk management, the propensity to adopt insurance, the characteristics of the contracts taken out, etc. The latter sections of the questionnaire are those concerning the elements of the TPB concerning the intention to purchase an insurance package and mostly use the 7-point Likert scale, where higher scores indicate greater compliance with the items, as Table 1 shows.

*Table 1 - Constructs and measurement items included in the questionnaire**

Construct	**Measurement items**
Intention	In the coming year, I intend to adopt an insurance
	In the coming year, I plan to adopt an insurance
	In the coming year, I will adopt an insurance
Attitude	For me, the adoption of insurance is a wise choice
	For me, the adoption of insurance is an advantaged choice
	For me, the adoption of insurance is a satisfying choice
	For me, the adoption of insurance is a strategic choice
	For me, the adoption of insurance is a valuable choice for income protection from risks
	For me, the adoption of insurance is a valuable choice for economic sustainability
	For me, the adoption of insurance is an indifferent choice (R)
Subjective norm	My family would approve my choice to adopt insurance
	My employees would approve my choice to adopt insurance
	Farms close to me would approve my choice to adopt insurance
	Defense consortia would approve my choice to adopt insurance

Construct	Measurement items
Perceived behavior control	I have the resources and the knowledge to adopt insurance
	The decision to adopt insurance on the farm is under my control
	Adopting insurance on the farm is easy for me
	I do not have a financial problem purchasing insurance
	Insurance prices are reasonable, considering the coverage offered
	Using insurance is the easiest way to manage the risk
	Insurance is not well known to me (R)
Risk factors	For my farm, adverse weather/climate changes are a source of risk
	For my farm, pests and other phytosanitary problems are a source of risk
	For my farm, the market prices of my products are a source of risk
	For my farm, increasing production costs for factors such as energy, fertilizers, labor, etc., are a source of risk
	For my farm, bank debts and difficulties in repaying loan amounts are a source of risk
	For my farm, substantial changes in the CAP 2023 are a source of risk
	For my farm, contractual conditions with POs, GDOs, etc., are a source of risk

R - Reversed item.
* Our elaboration.

Once the planning phase of the questionnaire was completed, and before starting data collection, we moved on to the control phase. In this phase, the necessary checks were carried out to ensure that there were no programming errors (bugs or malfunctions) and that the questionnaire was computerized appropriately to achieve the research objectives. One hundred fifty responses were collected from as many farms as 100 were selected as suitable for data analysis. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27.

First, we cleaned and checked the data to identify missing values or irregularities. Secondly, we calculated descriptive statistics (e.g., averages and standard deviations). The collected data were then subjected to Cronbach's alpha test to check the data's robustness/reliability. Through exploratory factor analysis (EFA), we attempted to associate the variables with the various latent factors. Subsequently, Pearson correlation coefficients were calculated to assess the correlation between the factors (Adnan *et al.*, 2018). We then determined the most important factors influencing farmers' intentions using hierarchical regression analyses. In this study, we

examined psychological factors by hypothesizing that these could explain more significant variation in the dependent variable (intention) than farmers' socioeconomic characteristics. The TPB variables (ATT, S.N., and PBC) were considered independent, while the intention was used as the dependent variable in the first stage. Keeping the same dependent variable, the variable Risk Factors (RISK) was added in the second stage. Then, in the third stage, the farmers' type of farming was included and assessed whether the inclusion of the various types of farming also improved the validity of the model and which of the various farm types showed the most striking propensity for insurance. We then examined whether the additional variable (RISK) explained the variations in intention to a greater extent than the farmers' TPB variables.

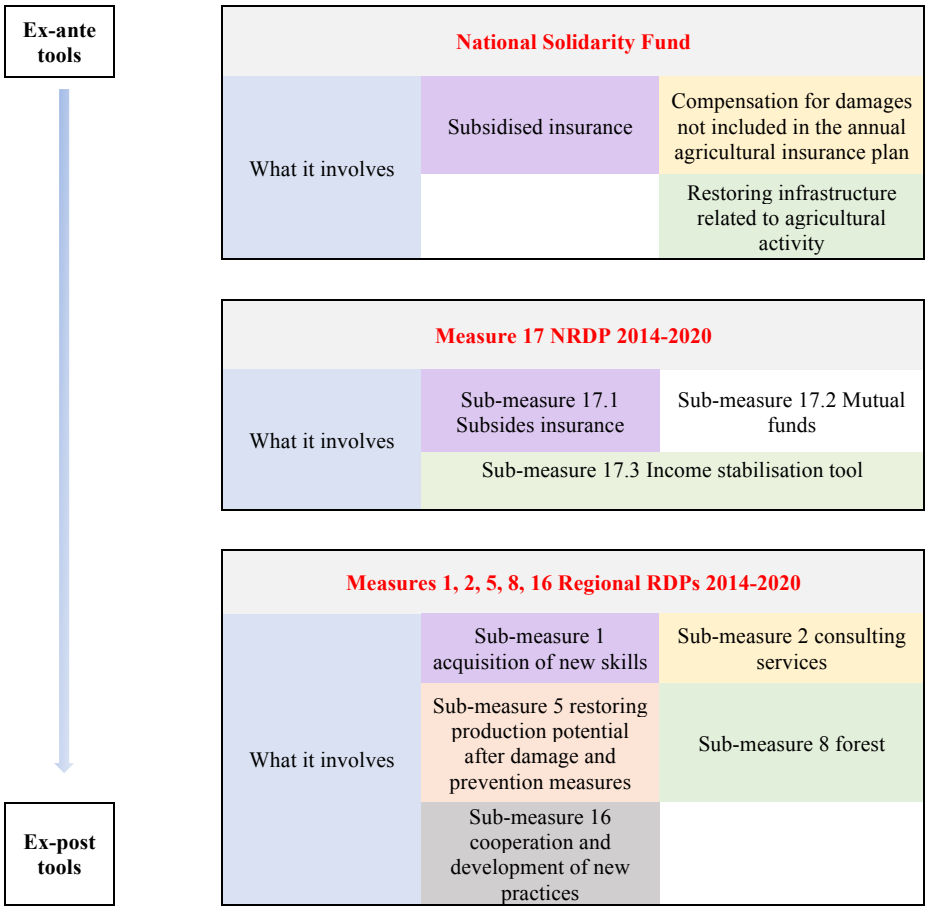
2. Main results

2.1. *Risk management in Sicily in the context of national interventions*

Farm risk management in Italy is linked to individual regional RDPs 2014-2020 through the measures included in the so-called 'Focus area 3B' (Supporting the prevention and management of farm risks). Furthermore, it is necessary to add the public contribution system connected to the 2014-2020 National Rural Development Programme (RDPN), which provides for the so-called Measure 16 and the National Solidarity Fund-FSN (D.lgs. n. 102/2004 e following). Therefore, the range of risk management tools (Figure 1) includes the facilitated insurance under sub-measure 17.1 of the 2014-2020 RDPN, alongside the mutual funds against adverse weather events and phytosanitary risks (sub-measure 17.2 of the 2014-2020 RDPN) and the sector income stabilization tool (sub-measure 17.3 of the 2014-2020 RDPN). The National Solidarity Fund continues to serve as a funding source for the implementation of ex-post compensation interventions, as do the ex-ante interventions (farm structure policies, loss of income for milk and honey production, and carcass disposal), as well as the experimental policies (index-based and revenue policies). (ISMEA, 2022). The Ministry of Agricultural Policy (MASAF) annually publishes the Agricultural Risk Management Plan, specifying the rules for participation in the various initiatives and the types of insurable events on which the insurance supply and demand system of farmers is built.

Despite the complexity and variety of initiatives planned in Italy, the risk management system complains of noticeable delays in adhering to Measure 17 of the RDPN, with consequent problems linked to high costs for

*Figure 1 - Risk management tools available in Italy for farmers**



* Our elaboration.

multi-risk insurance; to bureaucratic complexity due to the involvement of multiple actors (insurance companies, defense consortia, CAA, AGEA, etc.) (Raccosta, 2019); to the limited interest of insurance companies (Sherrick *et al.*, 2004; De Pasquale *et al.*, 2006); to delays in the distribution of aid by AGEA; to limited knowledge; to the absence of dissemination and to the limited ability to make system (Timpanaro *et al.*, 2013; Foti *et al.*, 2017).

At a regional level, the programming of risk management interventions financed under the RDPs is divided into Measures 1 ('Knowledge

transfer'), 2 ('Farm advisory and replacement services'), 5 ('Interventions for the prevention and restoration of damaged production potential'), 8 ('Investments in the development of forest areas and the improvement of forest profitability') and 16 ('Cooperation'). Considering, in particular, Sicily in Table 2, it appears that the regional government has activated a low number of measures (1, 2, and 5), even though the largest allocation has been for damage restoration interventions.

Table 2 - Planned public expenditure (€) by measure in the 2014-2020 RDPs in Sicily and Italy

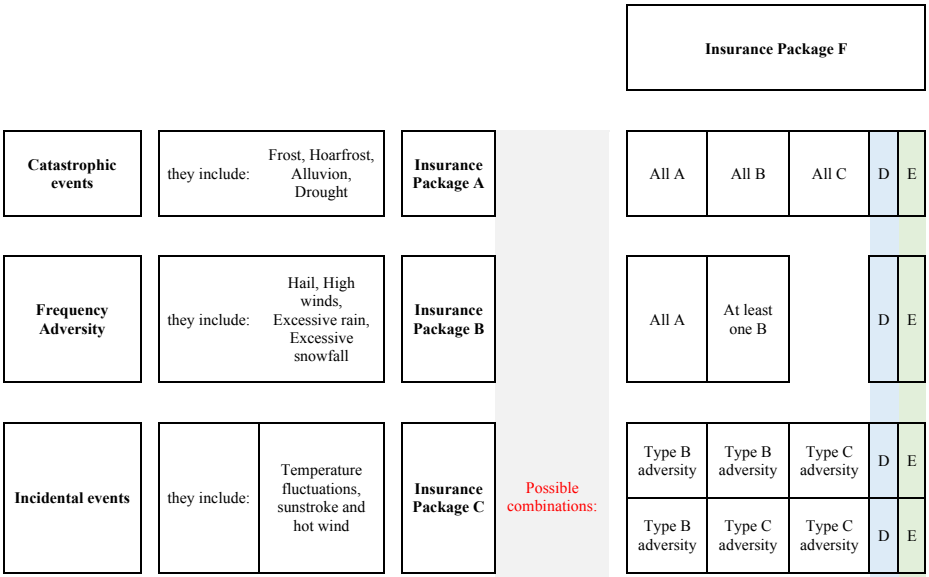
Area	Measure 1	Measure 2	Measure 5	Measure 8	Measure 16	Overall
Sicily	41,931	80,000	18,167,571	/	/	18,289,502
Italy	3,156,733	1,357,500	238,440,169	30,460,631	6,309,549	279,724,582
% Sicily / Italy	1.3	5.9	7.6	0	0	6.5

Source: ISMEA.

In the mid-term modulations, Measure 5 remained preferred with an increased allocation of resources due to the effects of climate change and the intensification of damage from adverse weather phenomena.

Concerning the insurance proposals created within the institutional support framework, farmers face several opportunities when preparing their insurance plans to access the support system (Figure 2). This system, on the one hand provides an incentive to offer insurance solutions but on the other hand does not always correspond to a possible increase in demand for insurance. Firstly, because different insurance needs emerge at the local level, which do not always correspond to national ones, and secondly, because without adequate territorial promotion activities, widespread information asymmetries cannot be overcome. Moreover, the availability of insurance solutions alone is not enough to overcome the delay in risk culture or the cost of policies. Agricultural insurance, even when subsidised, remains very expensive compared to other lines of risk. Therefore, a vicious circle is created, whereby only farms with a high probability of crop damage are insured and rates rise even higher. For this reason, there is increasing talk of parametric policies, to correlate the adverse event with the crop damage.

*Figure 2 - Subsidized insurance packages in agriculture in Italy**



* Our elaboration.

Concerning insurance policies, in Table 3, it is evident that there is regional interest in the so-called "Package F" proposals, whose average rate is considerably lower than the average cost of the other packages, signaling some fundamental market trends:

- need to contain insurance costs, and;
- reduction in the number of insured adverse events.

Table 3 - Types of policies taken out in Sicily and Italy (2019)

Area	Package A	Package B	Package C	Package D	Package F
	%	%	%	%	%
Sicily	1.8	3.5	12.6	0	82
Italy	14.6	20.6	54.9	1	8.8
Index Sicily / Italy	12	17	23	0	932

Source: ISMEA.

Turning to the production sectors, citrus and fruit-growing prevail in terms of regional spread and the growing concern of farms for the prevention of weather and climate risks of a catastrophic nature; also, in the wake of particularly negative experiences in the most recent insurance campaigns, as shown in Table 4.

Table 4 - Policies subscribed in Sicily by type of farming (2020)

Address	**Number of companies**	**Insured value (€)**
Oranges	519	33,228
Peaches	265	11,108
Wine grapes	206	8,221
Nectarines	162	5,866
Apricots	174	4,827
Table grapes	70	4,306
Prickly pears	54	3,745
Pears	72	3,537
Lemons	39	2,681
Peppers	17	1,395

Source: ISMEA.

2.2. *Socioeconomic profile of participants*

Table 5 shows the descriptive statistics of the study, which indicate that most of the Sicilian entrepreneurs interviewed (97%) were male and aged between 31 and 50 years (68%), while only 6% of the respondents were younger than 30 years. Most respondents (59%) had completed their education with a minimum of a three-year degree. In comparison, only 5% had completed primary education, and 28% had finished their studies with a diploma.

Concerning production, it can be seen that the conventional method prevails with 74% of respondents, while only 26% operate organically. Interestingly, the data on the interviewees' experience in the agricultural sector is interesting, with 63% answering that they have been operating in the sector for less than 15 years and only 4% for more than 30 years; this figure is in line with the answers regarding the age group.

Finally, the last figure described in Table 5 was whether or not the respondent had inherited the management of the farm from parents or

other relatives. For this data, we have a very balanced result, 51% of the respondents stated that they had inherited the farm from relatives, and the remainder (48%) answered in the negative.

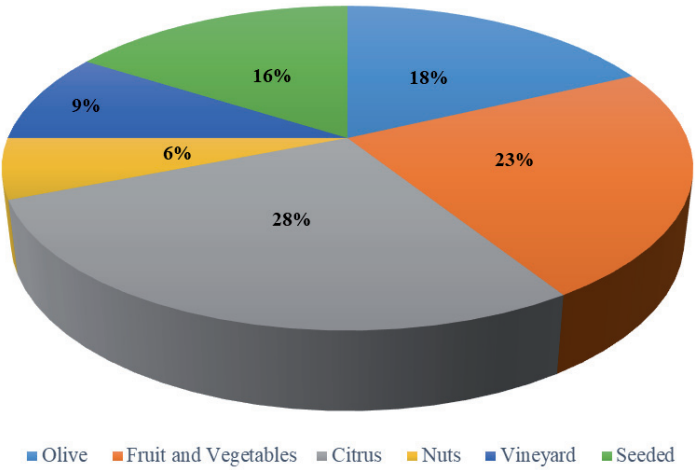
*Table 5 - Socioeconomic characteristics of enterpreneurs**

Variables	Description	Frequency
Gender	Male	97
	Female	3
Age	< 30	6
	31-50	68
	> 51	26
Educational level	Primary school license	5
	Secondary school certificate	5
	High school diploma	28
	Degree	59
	Post Degree	3
Production specifications	Conventional	74
	Organic	26
Experience (years) in agriculture of the entrepreneur	< 15	63
	16-30	33
	> 30	4
Have you taken over the running of the business from a parent?	Yes	51
	No	49

* Our elaboration.

Figure 3 shows the type of farming for the 100 companies surveyed. The results, in this case, are an expression of the territorial reality investigated, with citrus farming prevailing with a percentage of 28%, followed by horticulture (23%) and olive growing (18%), and then gradually by the others.

*Figure 3 - Type of farming for the surveyed companies**



* Our elaboration.

2.3. *Latent variables and extended model measurements*

To extract latent variables from the questionnaire items, exploratory factor analysis (EFA) was used. The validity of the TPB extension, which includes five latent factors indicating intention, attitude, subjective norm, PBC, and risk factors, was assessed through KMO and Bartlett's test. The results show a good fit of the model (Kaiser-Meyer-Olkin measure of sampling adequacy = 0.82, Bartlett's test of sphericity with Sign < 0.001).

Table 6 shows the number of items considered for extracting each latent factor and their standardized factor loadings. Each item is a response to a questionnaire question that was evaluated by entering a single scale from 1 to 7, with each question being differentiated by a distinct scale. Items with item factor loadings less than 0.50 were excluded from the analysis. The study calculated Cronbach's alpha coefficients for each factor to evaluate the scale's internal consistency and reliability (Selvaggi *et al.*, 2021), and considering that Cronbach's alpha to assess internal consistency can be classified as excellent ($\alpha \geq 0.9$), good ($0.7 \leq \alpha < 0.9$), acceptable ($0.6 \leq \alpha < 0.7$), poor ($0.5 \leq \alpha < 0.6$), and unacceptable ($\alpha < 0.5$) (George, 2016). The results show an adequate internal consistency of the scale items, as Cronbach's alpha coefficients range from 0.73 to 0.97.

Descriptive item analyses were conducted, and the table shows the mean and standard deviation, with the highest mean value for risk factors (RISK) and the lowest for perceived behavioral control (PBC).

*Table 6 - Reliability, factor loading, mean, and S.D.**

Variables	Observed items	α	Factor Loading	Mean	Standard deviation
Intention	3	0.977	0.967	3.14	1.110
			0.949	3.20	1.172
			0.987	3.15	1.077
Attitude	7	0.739	0.870	3.22	1.177
			0.919	3.14	1.181
			0.721	4.78	1.079
			0.701	4.42	1.165
			0.953	4.45	1.123
			0.856	2.98	1.263
			0.901	2.93	1.249
Subjective norm	4	0.938	0.887	3.13	0.991
			0.878	3.05	1.067
			0.926	2.96	0.974
			0.867	2.87	1.012
Perceived behavior control	7	0.912	0.556	3.14	1.073
			0.826	3.22	1.133
			0.881	3.11	1.154
			0.798	2.84	1.042
			0.920	1.81	1.161
			0.755	2.07	1.047
			0.960	1.81	1.152
Risk factors	7	0.850	0.936	4.91	1.074
			0.650	4.58	1.007
			0.843	4.66	0.890
			0.771	4.56	1.065
			0.885	4.22	0.894
			0.813	4.23	0.908
			0.876	4.18	0.845

* Our elaboration.

2.4. *Correlations between variables*

The results of the Pearson correlation coefficient test between the variables are shown in Table 7, which reveals significantly positive correlations between intention and all the other variables in the model except for risk factors. In particular, attitude and subjective norms appear to be the variables most correlated with intention. There is also a good correlation between the

variables, with attitude being the most correlated. Risk factors (RISK) appear to be the most problematic factor as it has no significant correlations with any variable except attitude.

*Table 7 - Correlation matrix**

	INT	**ATT**	**SN**	**PBC**	**RISK**
INT	–				
ATT	,848**	–			
S.N.	,827**	,820**	–		
PBC	,236*	,408**	,366**	–	
RISK	,109	,114*	,145	-0,005	–

* Our elaboration.
** Correlation is significant at the 0.01 level (two-tailed).
* Correlation is significant at the 0.05 level (two-tailed).

Notes: Int: Intention, Att.: Attitude, S.N.: Subjective norm, PBC: Perceived behavior control, RISK: Risk factors.

2.5. *Entrepreneurial behavior in risk management*

Three different linear regressions were conducted to test the general relationships between the variables and thus answer the assumptions made. With intention as the dependent variable, a hierarchical regression analysis was performed using the TPB constructs as independent variables in the first stage. Secondly, the hierarchical regression analysis included an additional construct with TPB variables. Finally, the interviewed farms' farming type was included with the ETPB constructs. The three regressions were performed to understand which TPB variables most affect the intention to ensure and to assess whether adding additional factors would increase the model's predictive accuracy.

Concerning the first regression, the ANOVA table shows a significance level p of < 0.001. The regression model, therefore, fitted well. Table 8 shows that the R^2 has a value of 0.78, indicating that 78% of the variance of intention can be explained by attitude (ATT), subjective norm (S.N.), and perceived behavioral control (PBC). These results show that intention is strongly determined by attitude (ATT) and subjective norm (S.N.), which are found to be the most important variables influencing behavior (B: 0.568, significance level p < 0.001; B: 0.416, significance level p < 0.001). Perceived behavioral control (PBC) shows a good influence on

intention but less than the first two constructs (B: 0.148, significance level p = 0.005).

In the second stage, characterized by the addition of a new construct (RISK), attitude (ATT) retained the most significant influence, followed by subjective norm (S.N.), PBC, and finally, risk factors (RISK), which did not show any particular correlation with intention (B: 0.017, significance level p = 0.714). Therefore, the additional factor was shown to be statistically non-significant.

Similarly, step 3, characterized by the addition of the type of farming, showed that this additional variable did not influence farmers' intention to adopt insurance, as neither type of farming proved to be statistically significant.

*Table 8 - Regression coefficients**

	Non-standardized coefficients		Standardized coefficients	t	Sign.
	B	Standard error	Beta		
Stage 1:					
ATT	0.578	0.085	0.568	6.820	<0.001
SN	0.425	0.083	0.416	5.094	<0.001
PBC	0.146	0.050	0.148	–2.891	0.005
Stage 2:					
ATT	0.579	0.085	0.568	6.791	<0.001
SN	0.428	0.084	0.419	5.083	<0.001
PBC	0.147	0.051	0.149	–2.895	0.005
RISK	0.018	0.050	0.017	–0.368	0.714
Stage 3:					
ATT	0.580	0.092	0.569	6.320	<0.001
SN	0.418	0.090	0.410	4.668	<0.001
PBC	–0.148	0.059	0.150	–2.525	0.001
RISK	–0.024	0.053	0.023	–0.457	0.649
Olives	–0.020	0.140	0.008	–0.141	0.801
Fruit and Vegetables	0.050	0.133	0.022	0.373	0.590
Citrus	0.053	0.131	0.026	0.403	0.557
Nuts	–0.105	0.499	–0.011	–0.211	0.770
Seeded	–0.043	0.143	0.017	–0.300	0.660
Vineyard	0.120	0.203	0.035	0.589	0.638

* Our elaboration.

3. Discussion

Agricultural risk management policy seems to have reached its decisive stage, considering both the evolution of CAP measures and what seems to be impending climate change, which is expected to have significant effects in terms of frequency and intensity of adverse events. In this scenario, insurance is a necessary innovation to be adopted in the farm to ensure adequate risk coverage.

This research contributes to exploring farmers' behavioral intentions toward purchasing insurance. The study aims to verify the predictive validity of an extended TPB framework, which considers not only the classical three variables but also risk factors concerning the adoption of insurance in agriculture and adds the farm type of farming.

The result of the hierarchical regression indicates that the additional factors included in the model (RISK and type of farming) are not statistically significant in explaining farmers' intention to adopt insurance. Attitude, subjective norms, and perceived behavioral control were found to influence intention significantly, thus supporting Hypotheses 1, 2, and 3. At the same time, risk factors (RISK) do not directly influence the intention to adopt insurance. Therefore, Hypothesis 4 is not significant and is rejected. Furthermore, the type of farming was also found not statistically significant in explaining farmers' intention to purchase insurance, thus rejecting Hypothesis 5.

The direct positive and significant impact of attitude on intention shows that farmers' evaluation of insurance adoption influenced their behavioral intentions. The more positively farmers evaluated the adoption of insurance, the greater their intention to apply it. Lalani *et al.* (2016) discovered that Attitude has the highest positive and significant effects on intention compared to other constructs. Other previous studies also found a significant positive relationship between direct attitude and behavioral intention (Bagheri *et al.*, 2019; Borges *et al.*, 2014; Maleksaeidi and Keshavarz, 2019). The significant direct effects of the subjective norm (S.N.) on intention indicate that perceived social pressure influences farmers' intentions. A higher perceived social pressure corresponds to a stronger intention to adopt insurance. Therefore, family members, neighbors, and the community can actively improve farmers' intentions (Bagheri *et al.*, 2019; Lalani *et al.*, 2016; Maleksaeidi and Keshavarz, 2019). Perceived behavioral control significantly impacts intention, confirming that farmers' perceived ability also influences behavioral intention (Bagheri *et al.*, 2019; Borges *et al.*, 2014; Bruijnis *et al.*, 2013). However, in their work, Maleksaeidi and Keshavarz (2019) found that PBC has a non-significant impact on the intention to conserve on-farm biodiversity because farmers do not perceive sufficient control to engage in

biodiversity conservation practices. It should be noted that the attention given by advisory services (operators of insurance, trade associations, agronomists, etc.) and media reports on the frequency of extreme weather events have significantly impacted the perception and behavior of individuals.

The two additional variables (RISK and type of farming) were found to be non-significant in explaining farmers' behavior. This indicates that the identification of risk factors and the type of farming do not impact farmers' decision to adopt insurance based on the model applied. However, data that emerged by area of interest show a correlation between the net income obtainable from crops and the intention to insure. One of the most critical obstacles to risk management today is the cost; insurance premiums, in absolute terms, peaked last year at 610.8 million euros. The sectors that show a greater propensity to insure are Fruit and Vegetables, Citrus, and Vineyards, characterized by the possibility of obtaining a margin that can at least cover the insurance cost. Crops such as seeds and nuts generally have little added value in Sicily and are among the sectors with a low predisposition to insurance.

The results indicate critical implications for policy: focus on cooperation and increasing knowledge about insurance. Subjective norms (S.N.) are essential, as they were found to have a positive and significant effect on farmers' intentions. Therefore, government policies and programs should focus on promoting cooperation (as demonstrated by the experience of Northern Italy) through the creation of consortia, producer associations, and similar, which effectively share experience, knowledge, and information on the functioning of the insurance system. Attitude has been found to have the highest direct effect on farmers'intentions. Policy interventions, including specialized education and awareness programs, could prove helpful and positively influence farmers' attitudes towards intentions. The insurance market in Southern Italy is not yet responding effectively. Therefore further communication efforts are needed to transfer to farms not only the specifics of insurance contracts but also a broader knowledge of the advantages to be gained from a developed economic-financial system.

Analysis of the initial results shows that the research has limitations due to the inclusion of other (unconsidered) factors that may influence the actual behavior between the time the intention is formed and its translation into practice. This study assessed the intention to adopt insurance instead of the actual behavior of the farmer. Therefore, future studies could seek to discover whether the farmers' intentions can be translated into practice. The results of this study can serve as a reference for these observations and analyses. However, as mentioned above, the additional factors included in the model (RISK and type of farming) were found not to be statistically significant, so the addition of other factors, such as Knowledge (Bagheri *et al.*, 2019;

Maleksaeidi and Keshavarz, 2019) and Experience (Soorani and Ahmadvand, 2019) could increase the validity of the model and better explain farmers' intentions. Furthermore, the approach proposed in this study did not consider farmers' emotions (e.g., fear/threat, positive or negative feelings).

Despite the limitations, the study is believed to contribute to the development of a line of research based on intentions for insurance adoption in agriculture assessed through psychological factors of farmers since a good part of the literature has investigated insurance adoption by considering socioeconomic factors (Ghosh *et al.*, 2022; Abraham *et al.*, 2013), risk preferences (Moschini and Hennessy, 2005; King and Singh, 2020), and previous experience in insurance purchase (Sujarwo *et al.*, 2017; Ghosh *et al.*, 2022). The study can help formulate future research work that combines psychological and socioeconomic factors in understanding the dynamics of insurance adoption by farmers.

Conclusions

The Italian agricultural insurance market is evolving and becoming increasingly important, and it is expected that this relevance will rise as the agri-food sector's exposition to various risks increases. The possibility of receiving subsidies for subscribed insurance offers an opportunity for entrepreneurs in the sector. Despite this, the diffusion of the insurance instrument is still limited, especially in the southern regions of Italy. Therefore, it is fundamental to understand which factors may influence the adoption of insurance by farmers.

This study contributes to the existing scientific literature by analyzing factors influencing farmers' intentions toward insurance adoption based on an extended TPB framework. The results demonstrate that the constructs of the TPB can explain farmers' behavioral intentions toward insurance. However, adding another construct (RISK) and farm type does not increase the theory's predictive force, as these factors are statistically insignificant.

The analysis confirmed that the positive attitude of entrepreneurs towards insurance directly increases the intention to apply it, being a significant predictor of intention. This result contrasts with reality, which today reveals a limited insurance adoption. Therefore, policymakers should emphasize that this practice favors farmers to increase their insurance choices. Furthermore, subjective norms influence farmers' intentions since they do not operate independently of cultural and societal influences but refer their behavior to essential referents. Therefore, society can actively increase farmers' intention to adopt insurance by prompting them to use this innovation.

A simplification of risk management procedures will condition the future of insurance in terms of policy costs and procedures. This starting step should be accompanied by support from institutions to facilitate the introduction of innovation into farm management. Therefore, insurance may assume a strategic function for managing farms concerning their multi-functionality. Insurance could assume a guarantor function for activities such as tourism, maintenance of the landscape, and social communities concerning the multiple risks to which the farm of the future is subject.

Future research will focus on defense consortia for the mediating role that they play on the demand side, in promoting the aggregation and qualification of insurance demand, and on the supply side, in proposing insurance packages in line with the indications of the national insurance plan and the needs of the territory in which they operate.

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