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## WHAT IMPACT DOES TRUST HAVE ON CONSUMER INCLINATIONS? ECONOMIC IMPLICATIONS FROM A CASE STUDY OF THE XYLELLA EMERGENCY

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### Abstract

**Aim.** *The modern economic era is riven with issues that significantly affect day-to-day existence. Climate change and its effects are among the most crucial. In this regard, Xylella fastidiosa infection represents one of the most difficult challenges in Italy. The purpose of*

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this study is to propose decision-making insights that, beginning from the emotive information provided by the media, build a foundation for containing the negative economic effects of the *Xylella* phenomenon by involving the key actors in the agri-food supply chain.

**Design/methodology.** The study was composed in different consequent phases: an in-depth historical and literature analysis of the phenomenon; a sentiment analysis on the emotions mostly conveyed by the newspapers that covered the topic; and a PLS-SEM model in a case study of consumers. Measures were detected through a quantitative questionnaire.

**Findings.** The results suggest that the most frequently conveyed emotion was trust. The PLS-SEM mediation model highlighted that trust in farmers could have an indirect impact on willingness to buy olive oil through the perception of safety in the Italian market. Estimates were validated through bootstrap analysis.

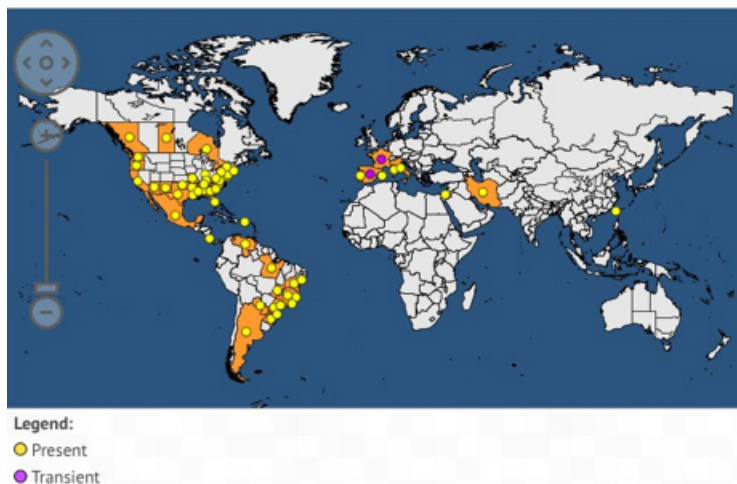
**Novelty.** The study aims to investigate a subject that has not yet been addressed, outside of a biological perspective, from a systemic point of view. Complementing the current biological and agronomic viewpoints with a different framework could represent a well-established element in assessing the relationship between trust in agri-food supply chain actors and consumer willingness to buy during critical events by offering crucial insights on economic engagement policies.

**Keywords:** *Xylella*, trust, policy, PLS-SEM, agri-food supply chain, sentiment analysis

**JEL CODES:** D12, D81, D91, Q13, Q54

## 1. Introduction

*Xylella fastidiosa* (hereinafter – *X. fastidiosa*) is one of the most dangerous insect-vector bacterial plant pathogens worldwide (Schneider et al., 2020). Insect vectors feed on the xylems of host plants (Cornara et al., 2018), leading them to marginal or total leaf necrosis, delayed growth, and the death of plants (Hopkins, 1989). The decline in the health of the host plant results, firstly, in the decrement of yields, and then in the reduction of fruit quality (Saponari et al., 2019). The host plants of *X. fastidiosa* are encompassed in a long list of 655 species present in European, Asian and American territories (European Food Safety Authority et al., 2022; Harvey & McMeekin, 2005). The countries affected by *X. fastidiosa* infection in March 2022 are marked in orange in Figure 1, in which the yellow circles highlight the presence of the infection and the purple circles the transient status of the infection.



**Figure 1.** Geographical distribution of the global spread of *X. fastidiosa* infection in March 2022

Source: EPPO Global Database (n.d.)

Italy was the first European country affected by *X. fastidiosa* infection, with the first event observed in October 2013 in olive trees in the Apulia region (Schneider et al., 2021). For centuries olives have been at the agronomical, cultural and culinary heart of the Mediterranean area (Vossen, 2007). Moreover, olive trees can grow for hundreds of years, contributing to the agro-ecological landscape and cultural heritage in the area (Rallo et al., 2014). A large part of the bulk of harvested olives is processed to create the iconic Mediterranean product: olive oil. The EU is the largest global producer of olive oil, accounting for around two thirds of worldwide production, and 95% of the olive trees in the world are cultivated in the Mediterranean region (Eurostat, 2020). Therefore, the potential effects of the disease persisting over many years in the same regional area (e.g., Apulia) eventually lead to very significant implications for national and international economies and agri-food companies. As stated by the European Commission<sup>2</sup>, *X. fastidiosa* “has the potential of causing in the EU, an annual production loss of 5.5 billion euros, affecting 70% of the EU production value of older olive trees (over 30 years old), and 35% value of younger ones [...]. This would put at risk nearly 300,000 jobs across Europe currently involved in that production. In addition to direct impacts on production, pests have significant indirect effects on upstream or downstream economic sectors.” For this reason, EU regulatory measures were enacted in response to the spread of the infection, encompassing: i) the establishment of an infected zone and a buffer zone; ii) the eradication of infected or symptomatic plants in the infected zone; iii) the establishment of

2 [https://ec.europa.eu/food/plants/plant-health-and-biosecurity/legislation/control-measures/xylella-fastidiosa\\_it](https://ec.europa.eu/food/plants/plant-health-and-biosecurity/legislation/control-measures/xylella-fastidiosa_it)

agricultural practices to prevent the presence of and reduce the vector population (e.g., removal of weeds, ploughing of the soil); iv) the planting of specific crops in the infected zone (i.e., *X. fastidiosa*-resistant species); and v) control over the movement of plants within and out of the demarcated zones. These government measures were observed by EU countries and translated into regional action plans. Specifically for the Apulia region, in March 2022 the Councilor for Agriculture, the Agri-Food Industry, Agri-Food Resources, Land Reform, Hunting and Fishing, and Forests approved the latest version of the “Action plan to combat the spread of *Xylella fastidiosa* in Puglia.”<sup>3</sup> This plan aimed to: i) eradicate the harmful olive trees to protect *X. fastidiosa*-free areas within the region and prevent the spread of *X. fastidiosa* in European Union territories; ii) prevent the spread of the organism by reducing the vector population; iii) and strengthen the communication and information campaign. Apulian agri-food companies which deal with olive production were called to align their own practices of intervention with this directive, sometimes against their willingness. There are several testimonies in this sense from single farmers, biologists, botanists, and researchers fighting to find alternative measures to eradication (Almeida, 2016). These individuals were backed by trade associations (e.g., Coldiretti) working at the regional level to safeguard small and medium enterprises in the sector (di Iacovo et al., 2006).

The first source of testimonies is the mass media, which has the power and the responsibility to provide information to society (Guglielmi, 2017). Regarding *X. fastidiosa* infection, from the first part of the 2014 a significant effort was made by national news organizations to divulge the extent of this phenomenon given its relevance for the Italian territory and its impact on businesses and the economy. An example news headline is shown in Figure 2.



**Figure 2.** Example of Italian national news headline during the *X. fastidiosa* outbreak

As argued in Section 2, the *X. fastidiosa* phenomenon has been deeply studied, thus triggering the interest of academics in searching both for its causes and for solutions to this problem. Indeed, the strong presence of studies that address the issue from the biological and agronomic viewpoints is evidenced. Therefore, a lack of studies focused on analyzing the impact that the diffusion of this pathogen has had on society, business

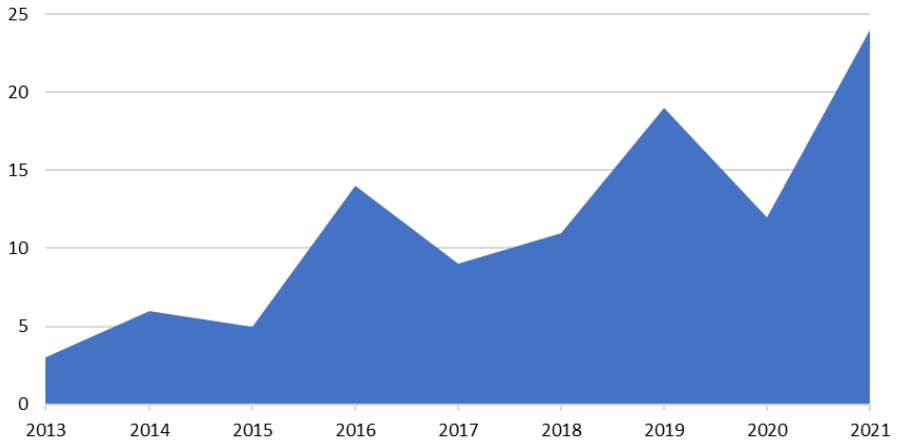
3 [http://cartografia.sit.puglia.it/doc/xylella/pda/DGR\\_343.pdf](http://cartografia.sit.puglia.it/doc/xylella/pda/DGR_343.pdf)

and consumers emerged in the process of researching the *X. fastidiosa* phenomenon. Moreover, considering the effect that the media have generated in society through socio-political debate on this topic, a frequent feeling of trust in the possibility of a decisive intervention by food system actors emerged.

Leveraging on this research premise, this paper aims to investigate the prevalent sentiment conveyed in the context of *X. fastidiosa* (RQ<sub>1</sub>) and the role that trust plays in influencing consumers' buying intentions (H<sub>1.5</sub>). To address this scope, and utilizing the model proposed by Yee et al. (2005), the conceptual framework of this study was established, and five hypotheses on the relationship between consumers' trust in food system actors and consumers' intention to purchase olive oil produced after the spread of *X. fastidiosa* in the Apulia region were proposed. A survey research method was applied on a sample of 56 Apulian consumers, and the established hypotheses were tested through Partial Least Squares Structural Equation Modelling. The findings of this study are discussed in this paper, highlighting the impacts that the *X. fastidiosa* phenomenon has generated in society, business and consumers. The research itself, practical implications, and limitations are then discussed, before the final section provides closing remarks and a follow-up.

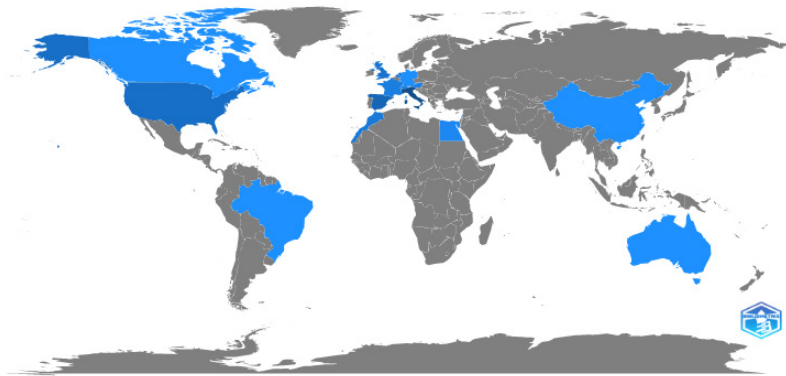
## 2. Building the research premise of the study: bibliographic and sentiment analyses

As mentioned in the introduction, the *X. fastidiosa* bacterium caused massive damage to the economy and the social structure of Apulian farmers. This issue devastated the entire sector, forcing farms to close, resulting in the eradication of thousands of centuries-old olive trees (Saponari et al., 2019), and even impacting the landscape of the region. Since it appeared, as well as its extreme practical effects on the economy and society of Salento, the lower area of the Apulian region (and therefore on Italy as a whole), the *X. fastidiosa* phenomenon has been deeply studied, thus triggering interest in both its causes and solutions. Confirming this, this section of the paper presents the results of a bibliographic analysis of the research stream performed by entering the following keywords into a Scopus query: “*Xylella*” AND “Puglia” OR “Apulia” (10 March 2022). Scopus, managed by Elsevier publishing, represents one of the most extensive and high-quality databases in the world (Jo Yong-Hak, 2019). The resulting analysis sample was composed of 104 manuscripts. As shown in Figure 3, scientific production began in 2013 (with 3 manuscripts) and constantly increased, reaching its peak in 2021 with 24 articles on this topic. The 70% increment of papers testifies to the relevance that this theme assumes on a global level, even though it arose from a problem with a defined territorial impact.



**Figure 3.** Annual scientific production on *X. fastidiosa* from 2013 to 2021

The country with the largest production on these issues was obviously Italy (81.9%), followed by Spain (6.8%) – both European territories in which the pathogen exists. These countries were followed by the United States (3.0%), as highlighted in Figure 4.



**Figure 4.** Most productive countries in terms of *X. fastidiosa* research

A total of 52 different sources were identified in the analysis sample. Among these, 21 journals published at least two studies (Figure 5).

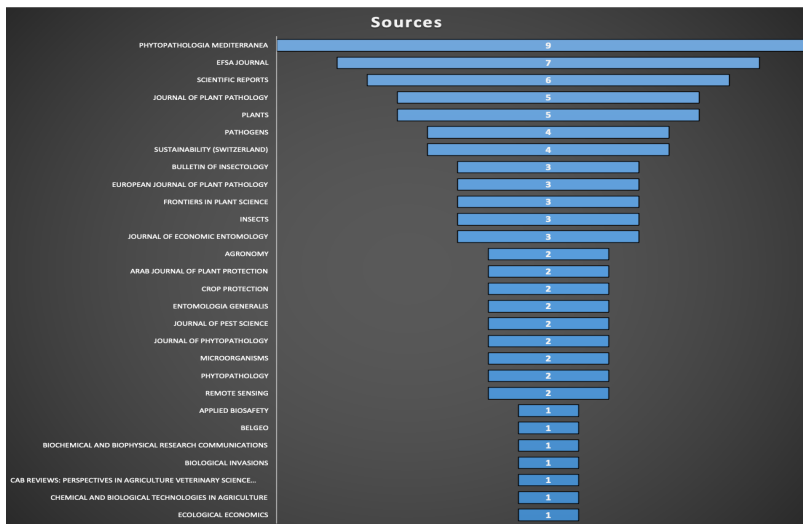


Figure 5. Principal sources of scientific articles on *X. fastidiosa*

The distribution of literature contributions among the several subject areas proposed by Scopus is shown in Figure 6. Agricultural and Biological Science was the most referenced (39.9%), followed by Environmental Science (15.0%), Immunology and Microbiology (9.8%), Biochemistry, Genetics and Molecular Biology (8.1%), and Medicine (5.8%). Therefore, this analysis suggests the strong presence of studies from biological and agronomic viewpoints. A clear lack of studies on the impact that the diffusion of *X. fastidiosa* generated on society, business and consumers is highlighted.

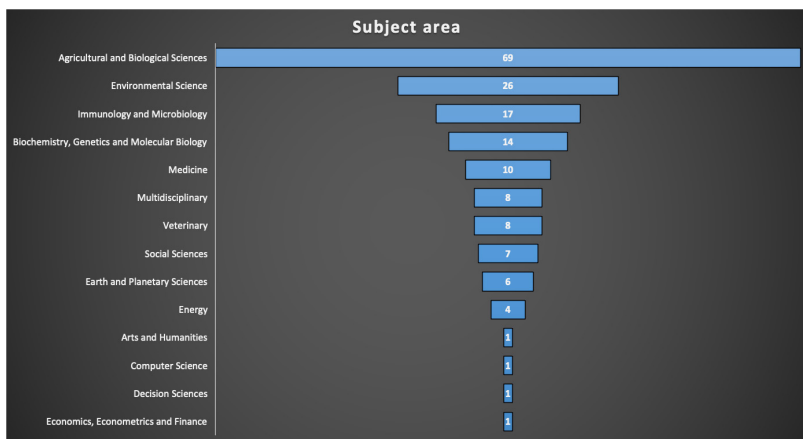
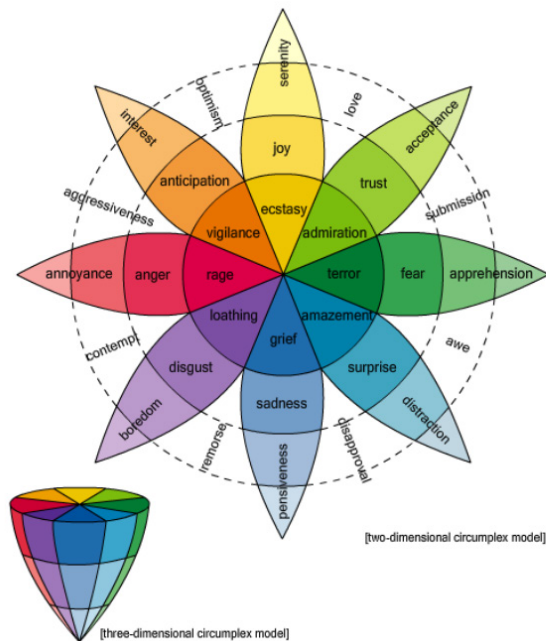


Figure 6. Scopus subject areas of *X. fastidiosa* papers

With the aim of identifying the prevailing sentiment when dealing with the topic of *X. fastidiosa* in the local context of Apulia, a sentiment analysis (Amoore & Piotukh, 2015) on a corpus of 18 newspaper articles from several Italian newspapers (such as *Corriere del mezzogiorno*, *Quotidiano*, *La gazzetta del mezzogiorno*, *La Repubblica*) was carried out, answering RQ<sub>1</sub> and providing the theoretical framework for addressing H<sub>1-5</sub>. According to (Singla et al., 2017), data from unstructured information, such as textual information, can provide more intelligent and informed decisions for different stakeholders, such as large industries and consumers. The functionality of such information is crucial, as it benefits consumers and manufacturers by suggesting the best strategies to be pursued to secure the economy, thereby affecting purchasing behavior. Sentiment analysis can be defined as language processing based on determining the type of attitude within a body of text from different sources (Cambria et al., 2017). Analyzing sentiment linked to a phenomenon can provide useful insights for subsequent analysis (Bilro et al., 2022; Khan et al., 2022). Analysis was performed using the *syuzhet* R Studio package (Jockers, 2017), providing important insights into the following eight emotions postulated by the model (Plutchik, 1980): anger, anticipation, disgust, fear, joy, sadness, surprise, and trust. Following a graphic approach, these emotions are represented within a circumplex Plutchik model, depicting a wheel in which the radius denotes strength (Figure 7).



**Figure 7.** *The Plutchik model (representation from Mohammad and Turney, 2013)*



According to the Plutchik model, the eight basic emotions constitute four opposing pairs: joy-sadness, anger-fear, trust-disgust, and anticipation-surprise (Plutchik, 1980). As reported by Mohammad and Turney (2013), the underlying reasons for this choice have well-established foundations in psychological, physiological and empirical research. Through a non-exclusive focus on predominantly negative emotions, sentiment analysis reveals the presence of predominant emotions within the analyzed text corpus. Figure 8 and Table 1 summarize the predominant sentiments and the frequencies of the concerned categories, respectively.

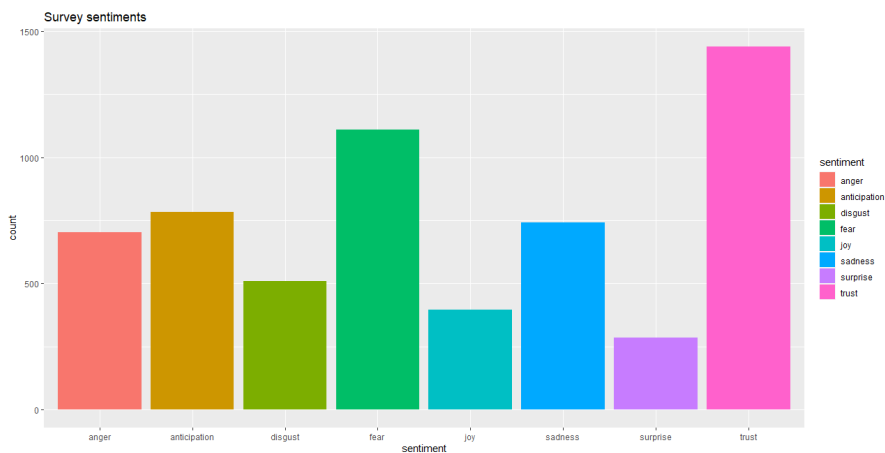


Figure 8. Sentiment analysis of *X. fastidiosa* newspaper articles

Table 1. Count and percentage of words indicating each sentiment

<b>Anger</b>	702	11.8%
<b>Anticipation</b>	783	13.1%
<b>Disgust</b>	510	8.5%
<b>Fear</b>	1,110	18.6%
<b>Joy</b>	396	6.6%
<b>Sadness</b>	743	12.5%
<b>Surprise</b>	284	4.8%
<b>Trust</b>	1,439	24.1%
	5,967	100.0%

The most frequent feeling in the newspaper articles was *trust*, which suggested that despite its harsh framing, the media intended to convey messages of hope and confidence in the possibility of solving the problem. Meanwhile, however, trust seemed to be the only positive emotion frequently mentioned in the analyzed texts. Besides this feeling, the most commonly expressed media themes were *fear* (18.6%), *sadness* (12.5%), *anti-*

pation (13.1%), and anger (11.8%). According to the overall view of the phenomenon and the knowledge of the authors regarding the history surrounding this issue, the critical problems that marked the *X. fastidiosa* emergency for the social actors involved were: the fear experienced by farmers involved in olive and olive oil production of losing their own cultivations (very often centuries-old trees); subsequent fear in the wider Italian food market of suffering economic damage resulting from the loss of production; as well as a generalized anger against government measures that proposed the eradication of olive trees as a strategy to contain the spread of the pathogen. Therefore, farmers, the Italian food market and the government were directly involved in the problem.

Furthermore, a literature analysis carried out on Scopus by entering “*Xylella*” and “Trust” as keywords (in the title and abstract fields) returned just two results (dated 2018 and 2020), only one of which presented an in-depth analysis of the issue in terms of communication. In the first study in which the concept of *Xylella* was associated with the concept of trust (Capua, 2018), the aim of the dissertation was to give greater importance to the credibility of science (i.e., the danger of the *X. fastidiosa* phenomenon) in a socio-political context that is increasingly oriented towards populism. In this case, therefore, *Xylella* becomes just one example of scientific truths being criticized by society. The second identified article (Monica, 2020) emphasizes that it is very common for health protection decisions to be made directly on the basis of scientific assessments that are not immediately understood, as highlighted in the example of *Xylella*. In this case, therefore, it is emphasized how good and appropriate communication strategies are needed to provide guidance to stakeholders on risk and behavior management.

Therefore, it is clear how a gap emerges in the influence that trust, already widely noted in the literature as a crucial determinant in purchasing processes, holds in the management of problematic emergency situations such as *Xylella*, particularly in the socio-political and economic contexts. In this regard, this research, based on the analysis of a context in which the sentiment most outlined in newspaper articles on *Xylella* in Apulia is trust, first aims to explore the relationship between *Xylella* and trust, deepening this aspect by including the most important social actors involved in the phenomenon. Starting from this research premise, the purpose statement of the study declared in the introduction section was defined.

### **3. Theoretical framework: the strategic role of trust in economic behavior**

The analysis in Section 2 allowed for the discovery of the most strongly conveyed sentiment in a sample of articles related to the *Xylella* phenomenon in Apulia. Therefore, starting from the assumption that the existing literature on *Xylella* focuses exclusively on a biological-agronomic framework, this study focused on the role of trust in influencing purchasing behavior during a period of emergency. This will provide useful indications to fill Layton’s macro-cross (Layton, 2011), suggesting economic and political decision-making plans (Iacobucci, 2019).

Trust is a concept with considerable polysemy in different domains, although there is common ground such that trust is placed within the context of positive expectations for the individual and is framed in conditions of uncertainty – both for the individual and the community (Giani, 2010). Trust can be perceived as a positive expectation that reassures one about another's actions and communications under conditions of uncertainty. One's trust in another is based on the expectation that the other's behavior will not be detrimental to one's own behavior. It follows that one should be truthful and not manipulate this communication (Giani, 2010; Prandini, 1998). Trust, in its many different meanings, has inspired various theoretical approaches to suggesting how it represents the basis for countless human actions (Aassve et al., 2021). Being a markedly interpersonal experience, hence tied to relations with others, whether individuals or institutions, different studies have led towards the belief that it could be promoted or minimized to steer political, economic and social choices (Chakraborty et al., 2022; Brice et al., 2020; Buck & Alwang, 2011; Evans & Krueger, 2009).

A nuanced understanding of trust rather implies that it ought to either be promoted or discouraged, as the context requires. Such an understanding needs to reflect the notion that both trust and distrust can and frequently do coexist. In most relationships, actors trust each other on some issues and yet fail to trust in others (Sekhon et al., 2014). The applications of how trust can affect people's behavior are plentiful, and concern several areas; some of this research focuses on the constituent characteristics of trust as it relates to interpersonal relationships with roles that are perceived to be at a higher hierarchical level, such as an employer (Zenger & Folkman, 2019). Following this perspective, and according to Zenger and Folkman (2019), trust is composed of three elements:

1. *Positive relationships* – when an individual is able to create functional interactions with other people or groups. This driver can enable a sense of trust to be instilled as there is a flourishing connection with the concerns of others, balancing the results of the concerns of others, generating cooperation, and resolving conflicts.
2. *Good judgement and expertise* – when a subject is well informed and constantly seeking opportunities to enrich their knowledge. Thus, it is possible to give the impression of understanding technical aspects and possessing adequate experience in dealing with problems. The fundamental aspect, therefore, is the perception of knowledge and expertise so as to provide an essential contribution to the achievement of results and to anticipate and respond efficiently to problems.
3. *Consistency* – when someone is able to influence the behavior of individuals by virtue of the trust they express. In particular, consistency must be represented as a model, which involves committing to actions and keeping promises.

These aspects, therefore, may represent prodromal signs of the feeling of trust. There is thus no doubt that trust plays a fundamental role in facilitating exchange relationships, which are central, for example, in the marketing, economic and consumer choice processes (Aljukhadar et al., 2017; Civera et al., 2018; Hobbs & Goddard, 2015). Numerous scholars have argued that commitment built on trust is essential to the effective functioning of marketing relationships, and that relationships cannot be created or managed without trust (Bilan et al., 2019; Chams-Anturi et al., 2020; de Jonge et al., 2008; Hobbs &

Goddard, 2015). By virtue of its importance in various domains, the issue of trust has received crucial attention in various studies, and it is considered to underlie many business (Bilan et al., 2019; Brenkert, 1998) and non-business interactions (Orth & Green, 2009). Therefore, the understanding of how trust affects different processes is well developed in the literature (Brice et al., 2020; Muringani, 2022).

In a broad sense, then, the trust-building process is vital in affecting how consumers build adequate confidence in a specific actor potentially perceived as having an influence on well-being (Carfora et al., 2019; King et al., 2019). According to a more focused approach centered on the consumption of agri-food products, the supply chain actors involved consequently have an influence (Aung & Chang, 2014; Lindgreen & Hingley, 2003) on the perception of food safety that is not merely material, but also and above all psychological (Ackerley et al., 2010; Behrens et al., 2010; Kotykova et al., 2021), and consequently affect consumer behavior (Evans & Krueger, 2009; Xie, 2015; Yee et al., 2005). Moreover, being a dynamic process, consumer confidence may be susceptible to sudden changes in situations of crisis or food hazards (Yee et al., 2005). Yee and Yeung (2002), for example, identified a list of factors necessary for the development of consumer confidence in farmers when conducting research in the context of emergency bovine growth hormone residue in milk. Furthermore, Phillips and Hallman (2013) provided insights on marketing in relation to this issue by exploring the risks of genetically modified food. Specifically, the five cognitive processes identified are: competence (e.g., the ability to vouch for raw materials with a healthy and safe profile in the supply chain, meeting consumers' concerns about their well-being and the environment); credibility (e.g., the trustworthiness of the activity); reliability (e.g., the range of actions available to address consumer concerns); integrity (e.g., positive and genuine behavior with the consumer); benevolence (e.g., the concern and interest expressed in acting in line with consumer needs); and information provision (e.g., the process of transmitting reliable feedback to ensure food safety). These were analyzed in this study according to the model proposed in Yee et al. (2005).

Whilst the previously mentioned theory deals with trust-building factors and the extent to which trust influences the probability of purchase, in our study the willingness to buy olive oil was considered as an outcome variable. Therefore, based on the focus on the *X. fastidiosa* emergency and its socio-economic implications, the key issue is not the determinants that contribute to developing functional consumer trust, but how trust in different actors in the agri-food system (Tsolakis et al., 2014) influences buying intentions (Carfora et al., 2019).

The role of trust, therefore, becomes crucial in the study of how to improve and implement the purchasing process. As highlighted by various studies, trust in the various actors in the food supply chain seems to have a direct effect on, for example, green purchasing behavior (Dong et al., 2022) and services (Zhani et al., 2022). In this regard, although many studies have focused on the role of trust in purchasing behavior (Kenning, 2008; Sahney et al., 2013; Tandon et al., 2020), especially in periods of extreme uncertainty such as during the COVID-19 pandemic (Faqih, 2022) (to the extent that trust was included as an integral element of the TBP model; Hamid et al., 2023), at present few

studies seem to have focused on its role in situations of natural disasters. These disasters can be caused either by events such as earthquakes or hurricanes or by the consequences of climate change, such as the proliferation of bacteria that are harmful to plant health. Moreover, since the *Xylella* phenomenon and the infection caused by it directly descend from climate change, it can be counted among the elements of strategic importance for case studies that can provide important elements for the correct management of situations, and can also be of use in an economic and marketing sense. Furthermore, according to Layton (2011), a flourishing body of literature exists in the fields of economics and marketing. A diagram depicts the main topics commonly discussed by scholars, suggesting a reflection on the nature of the most frequent studies in the literature. Within the macro-cross – i.e., the area where it is possible to identify topics that are still underexplored but remain important in a strategic sense as they can serve as a basis for new knowledge or for developing management plans for emerging problems (Iacobucci, 2019) – there are studies on the economic and managerial logic of natural disasters such as *Xylella*. Furthermore, until the present day, there have been no studies in the literature in which the role of trust and how it can act as a trigger for purchasing behavior during emergency situations, such as *Xylella* infection, has been explored.

### 3.1. Hypothesis development

Consistently with the research premise presented in Section 2, and in accordance with a theoretical perspective which accounts for the role of influences on trust exerted by different agri-food actors in determining purchase choices (Carfora et al., 2019; Tsolakis et al., 2014), this study aims to explore the following research hypotheses (Figure 9):

H<sub>1</sub>: as suggested by Wang et al. (2020), since perceived quality positively influences consumers' intention of buying certified food, trust in farmers (and consequently food quality) increases trust in the Italian food market;

H<sub>2</sub>: according to Anania & Nisticò (2004) and Hakim et al. (2020), we hypothesize that trust in the Italian food market will improve the willingness to buy Apulian olive oil produced after the spread of *X. fastidiosa*;

H<sub>3</sub>: trust in farmers influences the willingness to buy Apulian olive oil produced after spread of *X. fastidiosa*, as the studies of Lee et al. (2019) and Lazaroiu et al. (2019) suggested;

H<sub>4</sub>: trust in farmers enhances trust in government policies that deal with the *X. fastidiosa* emergency and its consequences, following the above-mentioned studies of Wang et al. (2020) and Stefani et al. (2008).

H<sub>5</sub>: by implementing the studies of Zagata & Lostak (2012) and Qiu et al. (2012), in which trust in the government increases trust in buying products, we hypothesize that trust in government policies boosts the willingness to buy Apulian olive oil produced after the spread of *X. fastidiosa*.

Specifically, consumers' choice of which agri-food actors to trust in solving the problems generated by *X. fastidiosa* focused on farmers, the government, and the Italian food market. This is because these three actors were directly involved in the problem, as outlined in Sections 1 and 2, and therefore were more involved in identifying a solution.

As a further hypothesis, in terms of mediation, confidence in the Italian food market and in government policy represent total mediators (Nitzl et al., 2016) in the relationship between trust in producers and the propensity to buy Apulian olive oil after the *X. fastidiosa* emergency.

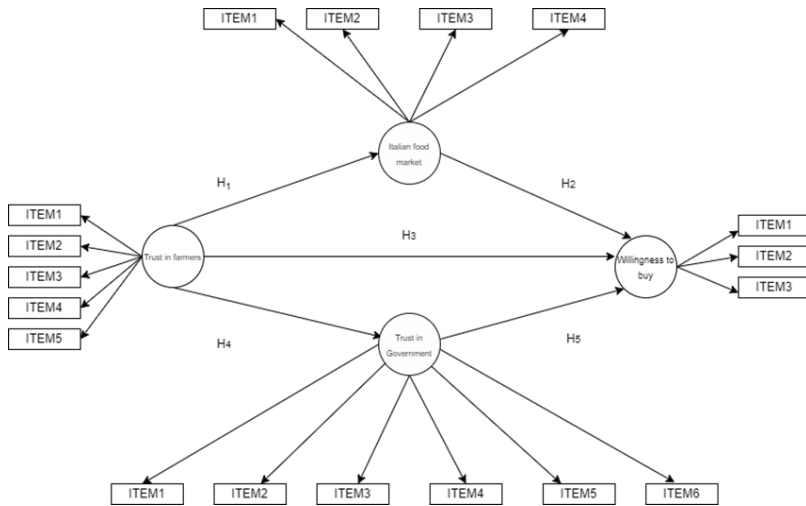


Figure 9. The proposed overall model

## 4. Methodology

### 4.1. Procedure

The analysis was carried out by means of a questionnaire prepared for the purpose of the survey, containing quantitative variables (measured with a Likert scale) and qualitative variables, with the aim of detecting the main socio-demographic characteristics of the sample (gender, age group). Subjects participating in the study were previously informed of the objectives and methods of the research; after this step, they were able to decide whether to participate voluntarily in the research without any compensation. Finally, subjects were guaranteed anonymity for the purposes of the survey and data were analyzed in an aggregated manner, with no possibility of tracing them back to the individual. In terms of analysis, data were explored using indices of normality of distribution (skewness and kurtosis). The quantitative measures included in the questionnaire were investigated for reliability (using Cronbach's  $\alpha$  and Jöreskog's  $\rho$ ) and validity (Average Variance Extracted – AVE). The characteristics of the sample, mainly as a function of numerosity, were directed towards a processing methodology using non-parametric structural equations (PLS-SEM – Hair et al., 2011; Sarstedt et al., 2022; Signore et al.,

2021; van der Merwe et al., 2017). The goodness of fit of the exploratory model was then assessed via a structural model (5000 bootstrap).

#### *4.2. Mediation analyses through PLS-SEM modeling*

Statistical analysis techniques enable complex phenomena to be modelled, increasing the possibility of predicting causal relationships between variables. There are different statistical methods, and among the most frequently used are the so-called second-generation techniques which involve more sophisticated procedures, such as Partial Least Squares Structural Equation Modeling (henceforth PLS-SEM, mainly exploratory) and Covariance Based Structural Equation Modeling (henceforth CB-SEM, typically confirmatory). Highly applicative in nature, these methodologies are typically used to confirm theories set a priori or to identify regularities, translated into statistical models, in data and relationships (Hair Jr et al., 2017). PLS-SEM and CB-SEM thus pertain to the more general framework of Structural Equation Models (SEMs), whereby hypotheses in studies might be tested through the incorporation of variables which are not explicitly observable (so-called latent variables), but can be indirectly measured by manifest indicators, such as questionnaire items. CB-SEM can be performed when certain criteria are met, such as the normal distribution of the data and a satisfactory sample size (Hair Jr et al., 2017; Iacobucci, 2010; Signore et al., 2019). When these cannot be ascertained, a viable alternative is the use of PLS-SEM, which is mainly used for theory development in exploratory research. PLS-SEM performs efficiently with small sample sizes and complex patterns, without assuming any assumptions about the underlying data distribution (Hair Jr et al., 2021). This technique allows researchers to investigate the relationship between certain latent variables in a sample of modest size. Furthermore, mediation analysis, based on running several regression models, enables the role of an intervening variable in the statistical relationship between an independent variable (X) and a dependent variable (Y) to be highlighted (Hayes, 2017; Nitzl et al., 2016). Mediation effects can be depicted by means of three models of regression equations:

1. Between a predictor variable (X) and an outcome variable (Y);
2. Between a predictor variable (X) and a mediator variable (M);
3. Between a mediator variable (M) and an outcome variable (Y).

Finally, to assess the mediation model, both the indirect effect ( $a \times b$ ) and the direct effect ( $c'$ ) must first be tested. Thereafter, the indirect effect ( $a \times b$ ) and the strength of the direct effect ( $c'$ ) must be analyzed to determine the size of the mediation. Lastly, the results must be validated through specific tests, such as bootstrapping (Hayes, 2017).

#### *4.3. Participants*

The analysis was performed on a sample of 56 individual olive oil consumers from Apulia. Participants were recruited through probability sampling by an external agency specializing in this purpose. Specifically, the subgroup was drawn from a larger sample of the Italian population interviewed in the March–June 2020 period with the aim of

investigating the media impact in a sample more aware of the problem because they had experienced it directly. The criteria for the representativeness of the general sample considered the socio-demographic characteristics of the Italian consumers in terms of age, educational qualification, region of origin and eating habits (regular oil consumers).

Therefore, the sample was mainly composed of female individuals (57.1%), while males constituted 42.9%. In terms of age, the majority of the sample were between 45 and 54 years old (28.6%), 23.2% between 35 and 44, 19.6% between 25 and 34, and 12.5% between 18 and 24. The other age groups were less frequent, with 8.9% between 65 and 75 years old and 7.1% between 55 and 64. The average age of respondents was around 42.4 years (SD = 14.2), and ages ranged between 19 and 75 years. All of the sample responded from the Apulia region, and stated that they habitually consumed Apulian olive oil.

#### 4.4. Measures

Measures were scored using 7-response Likert scales, with responses ranging from 1 = *Completely disagree* to 7 = *Completely agree*. Hypotheses were investigated by means of non-parametric structural equations (PLS-SEM; Mishra et al., 2022), with three latent variables measured by manifest indicators that were bound to the former through reflective (Cheah et al., 2019) relationships. Specifically, the latent dimensions and their respective indicators were:

1. Trust in farmers, a latent factor measured by 5 items adapted from de Jonge et al. (2008). The reliability of the measures was confirmed by Cronbach's and Joreskog's composite reliability indices of  $\alpha = 0.89$  and  $\rho = 0.95$ , respectively. Moreover, the discriminant validity (AVE = 0.71) was verified as it exceeded the threshold of 0.50, as suggested by Hair Jr et al. (2021). An example item: "*Farmers possess the knowledge to ensure the safety of agri-food products.*"
2. Italian food market security, identified by 4 items adapted from Chen (2017), with the reliability (Cronbach's  $\alpha = 0.78$ , Joreskog's  $\rho = 0.81$ ) and validity of the measures (AVE = 0.60) respected. An example item: "*Xylella legislation is effective.*"
3. Trust in government, a dimension identified by 6 items from the adaptation of the scale produced by de Jonge et al. (2008). Reliability (Cronbach's  $\alpha = 0.91$  and Joreskog's  $\rho = 0.95$ ) and validity (AVE = 0.67) were confirmed. An example item: "*The government really care about the safety of agri-food products.*"
4. Willingness to buy post-Xylella Apulian olive oil, measured by 3 items adapted from Armitage and Conner (1999). Reliability (Cronbach's  $\alpha = 0.99$  and Joreskog's  $\rho = 0.99$ ) and validity (AVE = 0.98) were verified. An example item: "*I plan to consume Apulian olive oil produced after the spread of Xylella.*"

## 5. Results

Prior to the implementation of the analytical model to exploratively examine the relationships between the constructs, enquiries were conducted to check the normality of the data distribution. Accordingly, not all latent dimensions fit within the ranges ( $\pm 1.96$ )



of skewness and kurtosis suggested by George (2011) (Table 2). For this reason, in addition to the small sample size, we proceeded to process the model using PLS-SEM (Pappa et al., 2018).

**Table 2.** Principal descriptive statistics of included variables

	Farmers	Italian food market	Government	WTB
Mean	5.49	4.62	5.13	6.15
Standard deviation	1.09	1.24	1.39	1.62
Skewness	-0.31	0.04	-0.66	-2.03
Kurtosis	-0.90	-0.75	0.27	3.10

Reliability and validity analysis prove that the employed measures were consistent and appropriate to the latent constructs postulated, as shown in Table 3.

**Table 3.** Reliability and validity measures of the latent variables

	Cronbach's $\alpha$		$\rho$		AVE	
	Original sample	Sample mean	Original sample	Sample mean	Original sample	Sample mean
Farmers	0.89	0.89	0.95	0.93	0.71	0.71
Italian food market	0.78	0.77	0.81	0.82	0.60	0.60
Government	0.91	0.90	0.95	0.93	0.67	0.66
WTB	0.99	0.99	0.99	0.99	0.98	0.98

**Table 4.** Correlation analyses (Spearman non-parametrical test)

	1	2	3	4
1. Farmers	—			
2. Italian food market	0.54***	—		
3. Government	0.50***	0.37**	—	
4. WTB	0.12	0.38**	0.06	—

Note: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

As evidenced by the results of the analysis, specifically in Table 4, trust in farmers correlates positively and significantly with trust in the Italian food market ( $r_1 = 0.54$ ,  $< 0.001$ ) and trust in the government ( $r_2 = 0.50$ ,  $< 0.001$ ). However, despite positively correlating with willingness to buy post-*Xylella* Apulian oil ( $r_3 = 0.12$ , *not significant* – hereafter *ns*), this relationship is not significant. Trust in the Italian food market, in turn, correlates positively and significantly with trust in the government ( $r_4 = 0.37$ ,  $< 0.01$ ) and the propensity to buy post-*Xylella* Apulian olive oil ( $r_5 = 0.38$ ,  $< 0.01$ ). Finally, trust in the government yielded an almost null and non-significant correlation with willingness to buy post-*Xylella* Apulian olive oil ( $r_6 = 0.06$ , *ns*).

**Table 5.** Measurement model outputs

	Original sample	Sample Mean	SD	p-value
Farmers1 $\leftarrow$ FARMERS	0.62	0.62	0.10	0.000
Farmers2 $\leftarrow$ FARMERS	0.83	0.83	0.05	0.000
Farmers3 $\leftarrow$ FARMERS	0.92	0.92	0.02	0.000
Farmers4 $\leftarrow$ FARMERS	0.93	0.93	0.02	0.000
Farmers5 $\leftarrow$ FARMERS	0.87	0.86	0.06	0.000
Italian food market1 $\leftarrow$ ITALIAN FOOD MARKET	0.88	0.88	0.04	0.000
Italian food market2 $\leftarrow$ ITALIAN FOOD MARKET	0.81	0.81	0.06	0.000
Italian food market3 $\leftarrow$ ITALIAN FOOD MARKET	0.75	0.74	0.13	0.000
Italian food market4 $\leftarrow$ ITALIAN FOOD MARKET	0.64	0.63	0.11	0.000
WTB1 $\leftarrow$ WTB	0.99	0.99	0.00	0.000
WTB2 $\leftarrow$ WTB	0.99	0.99	0.00	0.000
WTB3 $\leftarrow$ WTB	0.98	0.98	0.02	0.000
Government1 $\leftarrow$ GOVERNMENT	0.66	0.63	0.15	0.000
Government2 $\leftarrow$ GOVERNMENT	0.62	0.60	0.16	0.000
Government3 $\leftarrow$ GOVERNMENT	0.88	0.87	0.05	0.000
Government4 $\leftarrow$ GOVERNMENT	0.87	0.86	0.06	0.000
Government5 $\leftarrow$ GOVERNMENT	0.90	0.89	0.06	0.000
Government6 $\leftarrow$ GOVERNMENT	0.92	0.91	0.05	0.000

The outcomes of the measurement model suggested that the indicators performed well as proxies for latent variables (Table 5). Specifically, all loadings exceeded the cut-offs of 0.60 (Hair Jr et al., 2021), even after bootstrapping to 5000, and were significant. Notably, for the latent variable, trust in farmers, the range was [0.62;0.93]; for trust in the Italian food market [0.64;0.88]; for willingness to buy post-*Xylella* Apulian olive oil [0.98;0.99]; and for trust in the government [0.62;0.92].

**Table 6.** Structural relationships between latent variables

	Original sample	Sample Mean	SD	p.value
Farmers $\rightarrow$ Italian food market	0.51	0.52	0.08	0.000
Italian food market $\rightarrow$ WTB	0.53	0.54	0.18	0.003
Farmers $\rightarrow$ WTB	0.18	0.18	0.10	0.086
Farmers $\rightarrow$ Government	0.52	0.55	0.10	0.000
Government $\rightarrow$ WTB	-0.11	-0.10	0.10	0.284

Analysis of the structural model showed that there was no significant direct effect between trust in farmers and the willingness to buy post-*Xylella* Apulian olive oil ( $\beta_3 = 0.18$  [0.18], *ns*). Similarly, though, trust in farmers tended to increase trust in institutions and

organizations acting at a higher level, such as the Italian food market ( $\beta_1 = 0.51$  [0.52], 0.000) and the government ( $\beta_4 = 0.52$  [0.55], 0.000). Moreover, trust in the Italian food market appeared to have a significant and positive effect on the willingness to buy post-*Xylella* Apulian olive oil ( $\beta_2 = 0.53$  [0.54], 0.003). Conversely, trust in the government resulted in a negative and non-significant effect on the latter variable ( $\beta_5 = -0.11$  [-0.10], *ns*). In terms of indirect effect, therefore, the relationship connecting trust in producers to the willingness to buy post-*Xylella* Apulian olive oil via trust in the Italian food market leads to a complementary indirect mediation (0.27 [0.28], 0.012), as hypothesized by Nitzl et al. (2016). Finally, the incorporation of the trust in the government variable mediated (0.06 [0.06], *ns*), albeit hardly significantly. The aforementioned structural relationships prove to be significant after bootstrap resampling equal to 5,000 re-entries (Table 6).

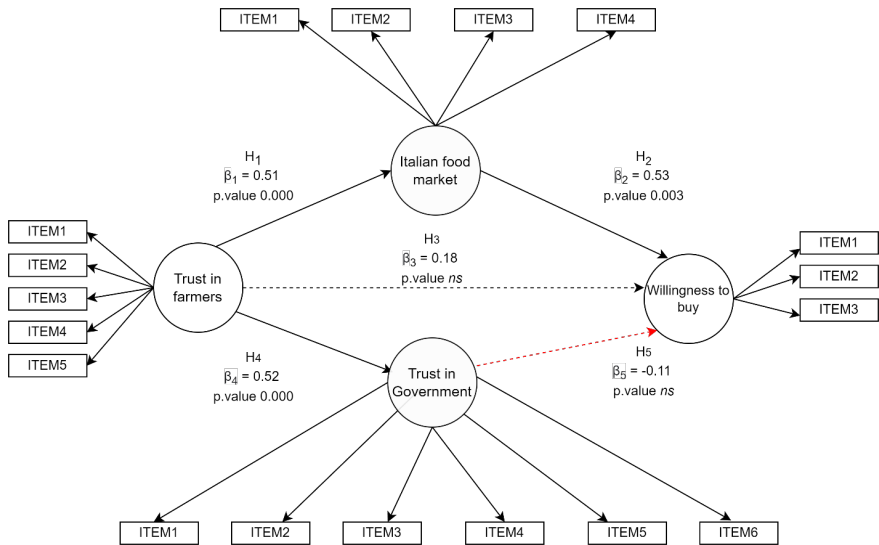


Figure 10. Model with path coefficients

## 6. Discussion and Implications

The obtained findings (Figure 10) reveal that, in Apulian consumers, trust in farmers does not have a significant and direct effect on willingness to buy post-*Xylella* olive oil ( $H_3$ ). This result fails to agree with the literature and specific applications on the issue, according to which trust in farmers is an important element in determining the willingness to buy agri-food products (Hamzaoui-Essoussi et al., 2013; Ladwein & Sánchez Romero, 2021). In the context of the *X. fastidiosa* emergency, this element assumes great significance since it could, if confirmed by further studies, be one of the most striking

consequences of the current situation. Moreover, it provides an important insight for the development of management policy (Vorobei, 2022). As previously debated, the construction of trust depends on certain characteristics, which can also be considered from a transversal viewpoint (Yee et al., 2005; Zenger & Folkman, 2019). A conceivable interpretation of this lack of significance in the statistical relationship, according to the required features for building trust, could be related to the failure of farmers to be perceived by consumers as being capable of handling the emergency with good judgement and experience, appearing, at the same time, inconsistent in solving the issue. Understanding the determinants of what prevented the appropriate trust-building process from occurring could thus ensure a more robust discussion of the ways in which the problem was addressed.

On the contrary, trust in farmers tends to increase trust in the Italian food market ( $H_1$ ). A possible explanation for this could lie in the fact that trusting the context (Bronfenbrenner, 2005) closest to the consumer – in this case the farmer – could have systemic effects (Andreasen, 2006) on other actors in the supply chain (Bachmann & Inkpen, 2011; L. A. Chen et al., 2019). In turn, perceiving the food market as safe in all its facets produces a positive and significant effect on the willingness to buy (Nocella et al., 2014) post-*Xylella* Apulian olive oil ( $H_2$ ). This outcome is aligned with other studies in which the relationship between trust in the food market and the willingness to buy a product was positively and significantly explored (Hamzaoui Essoussi & Zahaf, 2009; Sassatelli & Scott, 2001).

In terms of the effect of trust in farmers on trust in the government ( $H_4$ ), in this case the closest context assumes a crucial role in determining an increase in trust towards the general institution (Farrell & Knight, 2003). This is a sign that the role of farmers, although not directly influencing the propensity to buy oil, becomes strategic towards two central elements: the Italian food market and the government. Furthermore, as stated by Guo et al. (2022), consumers generally believe that detailed safety information can greatly increase their trust, which is crucial for making sustainable and well-informed choices. Therefore, as the above studies show, the effect of consumer confidence on the Italian food market could be described as cascading. Consumer confidence could be expressed in confidence in the quality of the product, and this also aligns with relative security vis-à-vis the food market because of perceived guarantees. Furthermore, as the study by Suhartanto et al. (2022) observed, trust could be part of a determinant that contributes to explaining food behavior, integrating both value and environmental aspects. As suggested by the authors, the role of trust could in fact be part of the strategic aspect consistent with the functional and social aspects, triggering systemic mechanisms capable of provoking effects from the micro (farmer) to the macro (the Italian food market and government) context.

Finally, the effect of trust in the government does not seem to have had a significant effect on the propensity to buy Apulian olive oil produced after the spread of *X. fastidiosa* ( $H_3$ ) – specifically, it tended to be negative. Therefore, in this study it is clear that government policies and the trust they can produce in the consumer are perceived as not influencing the choice to buy olive oil. This is in contrast to other studies (e.g., Moon &

Balasubramanian, 2004; Qiu et al., 2012), in which the role of trust in government and institutions was shown to play a fundamental role (Bottasso et al., 2022) even when the consumer experienced an objective lack of knowledge about a product or technology. Aligned with this perspective is the study produced by Aliasgharzadeh et al. (2023) which considered the determinants of the purchase of genetically modified foods: there, too, trust in control institutions (and thus also in government institutions) were a positive influence on willingness to buy. Trust in institutions, therefore, becomes one of the most important determinants of trust, contrary to what was identified in this study. In this regard, however, it should be borne in mind that the regional government was the body most involved in the management of the emergency, with often ambiguous and contradictory results regarding the main stakeholders. Therefore, the non-significance of this relationship, in addition to the highly exploratory nature of this study and the fact that it was based on a small number of observations, could be a direct cause of this situation. Once more, this result may be further interpreted as a function of the above-mentioned necessary attributes for the development of trust in order to further comprehend the failure to communicate safety and security signals in government.

### 6.1. Research and Practical Implications

Leveraging on the results of this study, this section discusses the research and practical implications.

From viewpoint of the implications of this research, to the best of the authors' knowledge, this study was the first to investigate the role that trust plays in influencing the consumers' willingness to buy Apulian olive oil after the spread of *Xylella*. Specifically, trust in the main actors that revolved around the *Xylella* emergency (farmers, the government and the Italian food market) was evaluated, considering a sample of consumers territorially involved in the emergency. This opens a new research route in the stream of studies focused on *X. fastidiosa*, and is capable of complementing the biological and agronomic viewpoints that are currently being investigated. Moreover, the proposed model could represent a well-established element to assess the relationship between trust in agri-food supply chain actors and consumer willingness to buy during phytosanitary emergencies, or more generally during critical events (e.g., pandemics, economic or political crises; Cárdenas, 2016).

Regarding practical implications, the lack of impact that trust in farmers had on consumers' willingness to buy Apulian olive oil produced after the spread of *X. fastidiosa* generated critical consequences for farmers – especially those who sell to final consumers (Park et al., 2014). The actions undertaken by these actors to try to solve or contain this emergency – such as the adoption of agricultural practices to prevent and reduce the infection or the diversification of production through the introduction of new species of olive trees resistant to the *X. fastidiosa* bacterium – were not sufficiently well-perceived by consumers. Therefore, the results of this study could help farmers to reinforce their businesses through a well-established communication strategy focused

on explaining the experimental cropping actions undertaken and the results obtained. This could generate a positive impact regarding consumers' trust in farmers, increasing their willingness to buy and consequently improving the economic sustainability of farmers and the entire Apulian olive oil sector. Moreover, considering that farmers play a strategic role in increasing consumers' trust in the Italian food market and the government, these actors could establish interventions capable of supporting farmers via better communication during a phytosanitary emergency. Specifically, governments could receive a two-fold effect from these types of actions, both improving consumers' perceived trust in them and helping to reinforce the economic sustainability of rural communities in their territory.

## 7. Conclusion: Closing Remarks and Limitations

This study investigated the capability of trust in farmers, the government and the Italian food market regarding its ability to influence the willingness to buy Apulian olive oil among consumers within the territory affected by the *X. fastidiosa* emergency. Specifically, the study tested five hypotheses, and the results were summarized in Table 7.

**Table 7.** *Synthesis of the results of hypotheses tests*

Hypotheses	Hypotheses' test
H <sub>1</sub> : trust in farmers increases trust in the Italian food market	Verified
H <sub>2</sub> : trust in the Italian food market improves the WTB Apulian OO produced after <i>X. fastidiosa</i>	Verified
H <sub>3</sub> : trust in farmers influenced the WTB Apulian OO produced after <i>X. fastidiosa</i>	Not verified
H <sub>4</sub> : trust in farmers enhanced trust in government policies that deal with the <i>X. fastidiosa</i> emergency and its consequences	Verified
H <sub>5</sub> : trust in government policies boosts the WTB Apulian OO produced after <i>X. fastidiosa</i>	Not verified

Although the present study offers several important insights for actors involved in the management of the *X. fastidiosa* emergency, different methodological and theoretical limitations must be considered. While PLS-SEM allows predictive models to infer even in the presence of a limited sample size, these techniques do not yet have a global measure of goodness of fit (Hair Jr et al., 2021). The small sample size imposes caution in generalizing the results. Further studies may or may not confirm the obtained results by enlarging the current sample. Moreover, the selected measures represent self-reports and therefore do not correspond to objective measures but to subjective perceptions of reality. Finally, the cross-sectional research design requires further longitudinal studies to establish more robust causal links between the identified variables.

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