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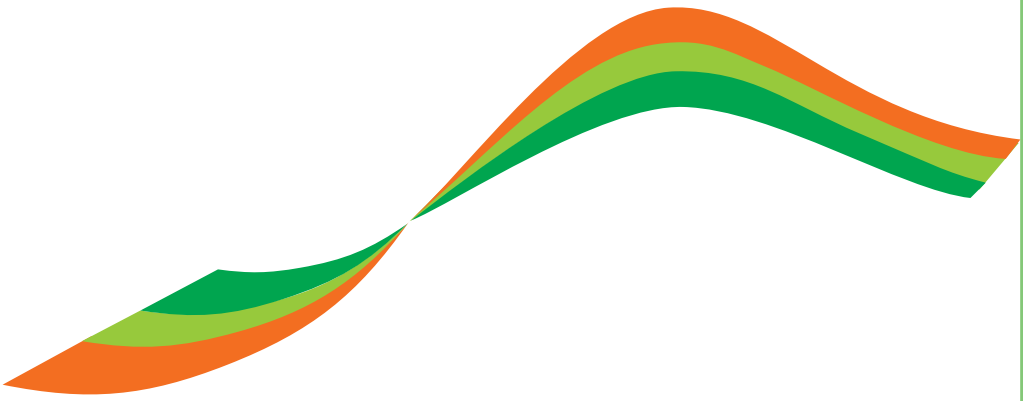

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ECONOMIA AGRO-ALIMENTARE
Food Economy

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Sommario

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Editorial

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We are happy to introduce our journal's first issue of volume 26. This issue contains five regular articles and one note, all written in English. The articles mainly cover issues related to the cultural and social dimensions of agriculture, investment strategies in the agri-food sector, the economic potential of geographic indications, social innovation in farming, technological advancements for food security, and the professional landscape of organic farming support.

The articles cover various topics related to the agri-food sector, spanning geographical areas in Europe (Italy), South America (Colombia), Africa (Ethiopia) and Asia (Indonesia, Taiwan).

The authors are affiliated with Institutions based in Colombia, Indonesia, Italy, Thailand, Taiwan, and Ethiopia.

The article by Mauricio Alzate Gómez, Humberto Thomé-Ortiz "What happened to the subjects? Questions about mezcal" explores the cultural and social dimensions of mezcal production and consumption, examining how these aspects have evolved over time and their implications for local communities and markets. The research uncovers the deep-rooted traditions and contemporary challenges facing mezcal producers, highlighting the need for policies that support sustainable practices and cultural preservation. The

findings suggest that recognising and protecting mezcal's cultural heritage can enhance its market appeal and economic potential.

The article by Song Soo Lim, Dae Eui Kim "Determinants of Agri-food Investment from Fund Managers' Viewpoint", provides insights into the financial strategies and criteria that drive investment in this critical sector. The study highlights the importance of corporate-like management practices and commercialisation readiness in attracting venture investments. Results indicate that a supportive regulatory environment and targeted incentives can significantly boost investment flows into the agri-food sector, fostering innovation and growth.

The article by Christian Franco Crespo, Henry Nuñez, Sandra Baldeon-Baez "Unearthing Unique Value: Exploring the Potential of Protected Designation of Origin on the Tangerine Industry of Patate, Tungurahua" emphasises the role of local climatic conditions, unique soil characteristics, and traditional cultivation techniques in determining the fruit's unique properties, supporting its potential PDO status to enhance market value and economic benefits for local farmers. The results show that PDO status could lead to increased recognition and higher prices for Patate tangerines, encouraging sustainable agricultural practices and boosting local economies.

The article by Annapia Ferrara "Understanding tourism in social farming as a form of social innovation", presents a literature review to frame tourism in social farming as an innovative social practice, revealing how it addresses societal challenges, enhances social actors' agency, and fosters new relationships among them. The paper proposes a comprehensive framework to understand these dynamics. The results show that social farming can significantly contribute to community development and social cohesion, offering a sustainable model for rural tourism.

The article by Thomas Soseco, Isnawati Hidayah, Nila Cahayati, Fajar Try Leksono "Access to Technology to Increase Food Resilience in Rural Households in Indonesia", emphasises the role of internet penetration and technological adoption in enhancing food security and household well-being. The study provides valuable insights into the strategies to improve food resilience through better access to technology. The findings suggest that enhancing digital infrastructure and education can significantly improve food resilience, reducing vulnerability to food shortages and economic shocks.

Finally, the note "Advisors and inspectors for the development of organic agriculture in Italy", authored by Roberta Milardo and Aldo Bertazzoli,

investigates the working conditions and job satisfaction levels among these professionals, highlighting their critical role in supporting the organic sector and suggesting strategies for improvement. The results indicate that improving training and resources for advisors and inspectors can enhance the effectiveness of organic agriculture promotion, leading to greater adoption of organic practices and improved sustainability in the sector.

We welcome the new members of the Scientific Advisory Board (SAB), namely Alessandro Bonadonna (Università degli Studi di Torino, Italy), Ignazio Cabras (University of Northumbria in Newcastle, UK), Roberta Capitello (Università degli Studi di Verona, Italy), Shaosheng Jin (Zhejiang University, P.R. of China), Dulekha Kasturiratne (University of Plymouth, UK), Keijiro Otsuka (Kobe University, Japan), Maria Angela Perito (Università degli Studi di Teramo, Italy), and Rosanna Salvia (Università degli Studi della Basilicata, Italy). We are grateful for their availability to join us and help us reviewing, suggesting reviewers, and evaluating papers for the "Best Paper Award" in the previous year. The updated list of 48 Scientific Advisory Board (SAB) members for the year 2024 can be found in the preliminary section of the journal as well as on the journal's website, https://economiaagroalimentare.it. Our current SAB is composed of scholars associated with diverse institutions in Italy (13), USA (7), Germany and the UK (4), France and Greece (3), Brazil (2), Albania, Australia, Austria, Belgium, Hungary, the Netherlands, Norway, Poland, the Republic of Korea, and Sweden (1), as well as 2 international institutions. The Editor-in-Chief and the Editorial Board welcome the new members and anticipate fruitful collaboration with all SAB members.

There have been no other changes to the journal's Editorial Board. We seize this opportunity to thank the SIEA Presidential Board for renewing their trust in the Editor-in-Chief and Associate Editors. We are thankful for the continued support from the scholarly community represented by SIEA, and we pledge to uphold the highest standards of academic excellence in all our editorial decisions.

Finally, we are happy to announce that *Economia Agro-alimentare/Food Economy* has passed the editorial evaluation and is now eligible for inclusion in the Web of Science Core Collection. The journal has met the selection criteria for inclusion in the Emerging Sources Citation Index provided by Clarivate. Full acceptance and inclusion are pending the submission of journal content in a format that meets the technical requirements for indexing. Once accepted, a formal acceptance letter will be issued. This milestone achievement is due to the hard work and dedication of our editorial

team, reviewers, authors, publisher, and supporters. We recognise and appreciate the continued support of our community of authors, reviewers, and readers for their contributions to the success of our journal. Particularly, we are thankful for the irreplaceable input of the reviewers, who have a vital role in ensuring the quality and significance of the manuscripts we publish. Their insightful feedback and expertise are highly esteemed.

Lastly, we sincerely thank FrancoAngeli Edizioni's staff for their exceptional work in editing and publishing the journal. Their unwavering dedication to maintaining the elevated standards of our publication is praiseworthy, and we look forward to continued collaboration with them in the upcoming year.

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What happened to the subjects? Questions about mezcal

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Abstract

Mezcal is a Mexican agave spirit that has helped to create a sense of authenticity among global consumers, significantly increasing its presence on the world market. This has led to a great expansion of the production areas included in the Denomination of Origin, changing its artisanal forms of production and creating an ambiguous position for the subjects that produce this drink. The aim of this essay is to contribute a new theoretical perspective to the academic debate on the patrimonialisation of mezcal, incorporating analyses that focus on the issues behind the production of this emblematic beverage. It discusses the need to understand the productive dynamics of this predominantly rural beverage, based on an understanding of the relationships between subjects at different levels of the production chain. We have opted for a classical theoretical framework that dares to consider mezcal producers as peasants and that affirms the explanatory potential of revising the classics of peasant social theory in order to offer new insights into the problem of dispossession through the appropriation of the biocultural knowledge that underlies the production of mezcal.

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Introduction

Mezcal is a spirit that originated in Mexico and is made from the agave plant. It is obtained by fermenting the juice from the head or heart (stem) of the plant, commonly known as pineapple, or from the leaves, which is then distilled and rectified to obtain a clear or yellowish liquid that preserves the aroma of the raw material (DOF, 1994).

The origin of the production of this drink is due to a syncretic encounter between colonisers and indigenous peoples, who had the plant, fermentation and consumption techniques combined with distillation techniques that arrived on the continent from Europe (Plascencia de la Torre & Peralta-Gordon, 2018). Therefore, its historicity is linked to the social transformation of the territories.

Among the types of mezcals, Tequila can be easily identified as a beverage that is produced, in its generality, from *Agave Tequilana* Weber, commonly known as blue agave, and takes its name from the region of Tequila in the state of Jalisco, which obtains its denomination of origin, published in the Official Journal of the Federation on 13 October 1977 (DOF, 2000) this after a marked economic success and a particular need to shield and protect the productive exclusivity of the beverage.

With regard to the denomination of origin, both WIPO (1958) and the Federal Law on Industrial Protection (DOF, 2020), in the Mexican case, emphasise that a denomination of origin is linked to a geographical area and that both natural and human factors are the expression of the same in the product: the natural factors would be the relationships established for the extraction, production or manufacture of the products, determined by the raw materials, climatic, topographical and/or geomorphological conditions, which give a quality identity to the product to be protected. The human factors would be the links with culture, knowledge and know-how that characterise the techniques that unite the area to produce a quality product that is unique and exclusive to the area. At the same time, it is a legal expression of the protection and guarantee of quality, regulating the product and the production of related products (WIPO, 1958; DOF, 2020).

In 1994, the Denomination of Origin for Mezcal was published in the Official Gazette of the Federation, with the states of Guerrero, Oaxaca, Durango, San Luis Potosí and Zacatecas as the first beneficiaries (DOF, 1994), with subsequent modifications. In 2001, the General Declaration of Protection was modified to include the municipality of San Felipe, State of Guanajuato (DOF, 2001); in 2003, 11 municipalities in the State of Tamaulipas were added to the protected area (DOF, 2003); later, in 2012, a new modification was published to include 29 municipalities in the State of Michoacán (DOF, 2012). In 2015, another modification was made to include

the municipality of San Luis de la Paz in the state of Guanajuato (DOF, 2015A); in addition to the previous modifications, many municipalities in the state of Puebla were added in 2015, for a total of 115 municipalities (DOF, 2015B).

In 2018, after 24 years of legal operation in the country, the largest number of denominations of origin were modified, including 7 municipalities in the State of Aguascalientes (DOF, 2018A), 15 in the State of Mexico (DOF, 2018B), 23 in the State of Morelos (DOF, 2018C) and, finally, the municipality of Xochiltepec in the State of Puebla (DOF, 2018D). Similarly, at the end of this research, the last amendment published in the Official Gazette of the Federation was in 2021, for the inclusion of 4 municipalities in the State of Sinaloa (DOF, 2021).

However, these changes have been the subject of much controversy among stakeholders, with the aim of limiting the extension of the protected area. In this regard, Domínguez-Arista (2021) notes that "there are forces within the Denomination of Origin of Mezcal that contest the control of the Denomination, either from a legal or commercial point of view. This is clearly seen in the opposition of the mezcal industry, which appears every time a change is made. Different narratives are interwoven in the certification process, undermining the possibilities of democratising the instrument and highlighting it as an appropriate tool for rural development. The exclusion and marginalisation of small producers becomes a systematic constant.

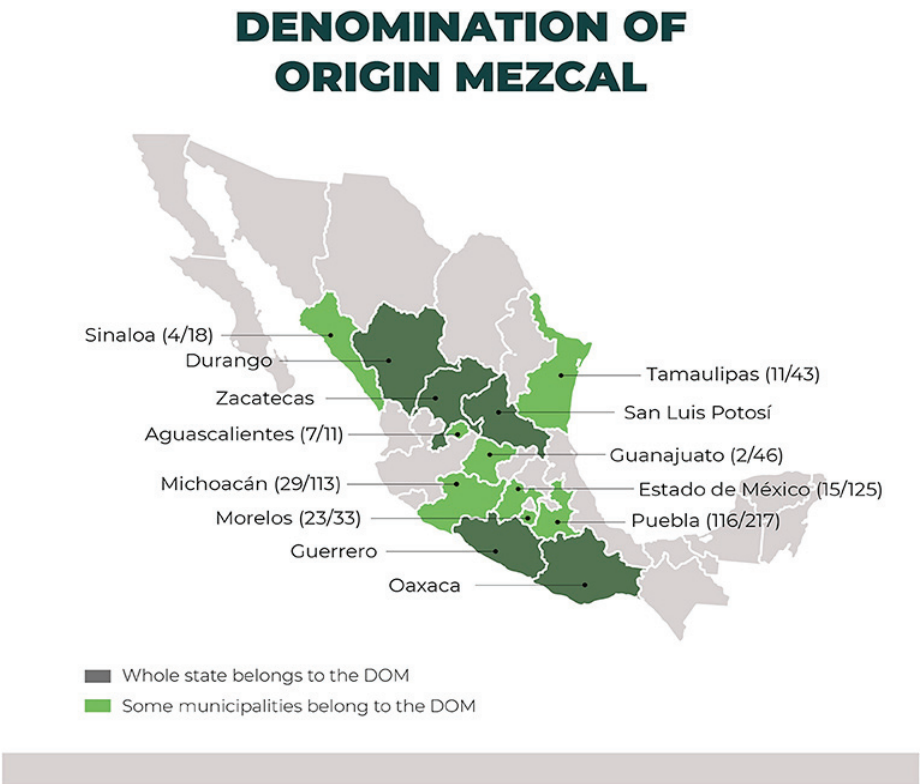
> […] by the regulatory bodies and the most influential players in the system, which seeks to undermine small-scale production that does not meet the conditions set by the DOM regulations. In this way, areas outside the DOM with a great mezcal tradition find themselves excluded from the traditional markets for the drink. Moreover, in the same areas where the D.O. exists, non-certified producers may also be excluded (Camacho-Vera, Vargas-Canales and Durán-Ferman, 2021. p. 189).

Beyond being expressed as a discursive element within the productive dynamics of mezcal, it becomes a pragmatism that represents a tendency towards the industrialisation of tradition, linked to the logic of late capitalism.

In the last decade, academic literature has generally studied the subject of mezcal from the point of view of the needs of a productive sector that is growing at an accelerated rate and is financially integrated into the country's economic framework.

However, as has been pointed out, the DO has two essential foundations: natural factors and human factors. Most of the arguments summarised in the above-mentioned amendments and the controversies that have arisen revolve around the extension of the geographical area, but the human factor appears in a diffuse form.

Illustration 1 - Map of the geographical area for the DOM

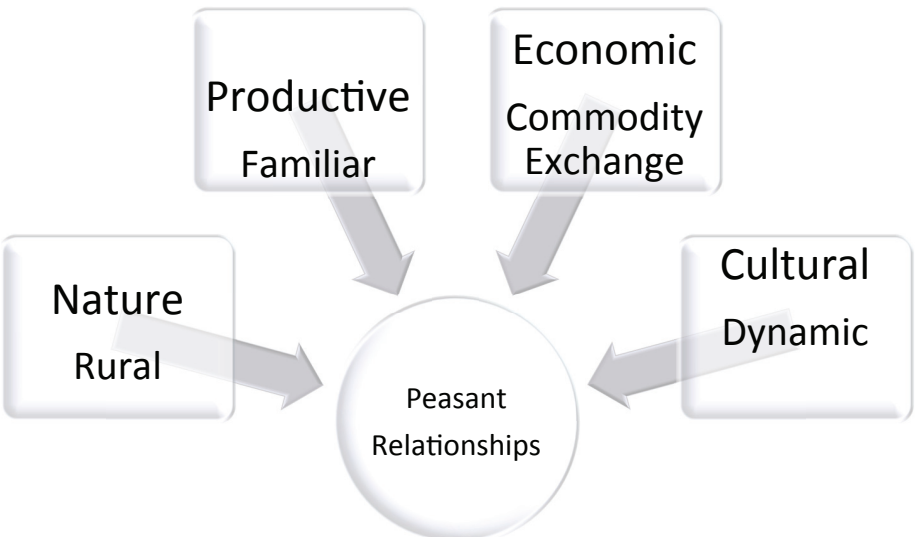


Source: From Arellano-Plaza, M., Paez-Lerma, J.B., Soto-Cruz, N.O., Kirchmayr, M.R., & Gschaedler, M.A. (2022).

To capture this factor, we propose the peasant perspective, based on the peasant concept used in this manuscript to discuss the place of subjects in the production of mezcal, in a context of productive normalisation (DO). This concept has been debated on numerous occasions by rural scholars, as it has been considered an outdated concept (Debenedetti, 2016) due to its inability to adapt to rural transformations. However, the UN General Assembly (2013) defines the peasant as a human being who has a direct relationship with nature through agricultural production, who is autonomous, family-based and works on a small scale. This includes animal husbandry, transhumance, crafts related to agriculture or other activities in rural areas. It also includes indigenous people who work the land in rural areas, as well as landless farmers, nomads or rural workers, among others.

Although the UN definition broadens the scope of the concept, it should be noted that this is due to the relationships that exist in rural areas. These relationships are of 4 types: i.) it establishes a permanent relationship with nature, that is, as an immediate rural subject (Perez, 1993); ii.) it establishes dynamic cultural relationships with other subjects that inhabit the rural environment, what Wolf (1971) would call the ceremonial background, and with other external cultures (Kroeber, 1948; Redfield, 1956); iii.) it establishes an internal productive relationship based on the internal functioning of the family as a production-consumption unit in search of equilibrium (Wolf, 1966; Shanin, 1971; Chayanov, 1979); iv.) it establishes an economic relationship through the sale of commodities that allows connection with the rest of society. In short, it is these relationships that distinguish the peasant from other subjects living and producing in rural areas (Krantz, 1977).

Illustration 2 - Peasant Relationships



These relationships go beyond the naturalisation of the peasant as a rural, agricultural and static subject, that is, one is not born a peasant. The peasant relationship, as a set of relationships, is a condition that is expressed in a certain way of life, and as such, what emerges from it bears the imprint of all its relationships, as in this case, mezcal.

In this sense, the text begins with a contextualisation of the current mezcal process, the way in which mezcal is certified and the argumentation of how

these categories annul the subject that produces. It then looks at how mezcal studies have evaluated economic issues and largely described cases. Finally, the Materials and Methods section explains the hermeneutic approach to the 33 texts that met the inclusion criteria.

In relation to the results, three main groups of research are found, to be discussed later in what we have called the peasant perspective. Finally, this paper concludes that the studies on mezcal lack a theoretical apparatus that allows the particularisation of the analyses and where the peasant perspective can be a reference to mark the differences in the commercial phases, as opposed to the categories offered by the DOM.

The aim of this essay is to provide a critical theoretical perspective to understand the socio-cultural implications of artisanal mezcal producers in the patrimonialisation of this spirit, through the constant expansion of the rural territories included in the Denomination of Origin. This expansion is due to the imperatives of the international agave distillates market, which generates socio-economic restructuring in the producing territories.

1. Materials and methods

This essay uses as a theoretical corpus the materials obtained through a systematic review of the literature in specialised databases such as Science Direct and Google Scholar, from which different texts were selected from Scopus, Springerlink, Taylor & Francis and Wiley. An interpretive documentary research was carried out (Gómez, 2011), with the aim of understanding the meaning of the texts analysed, placing them in the context of the treatment they give to the subjects of mezcal production, through a hermeneutic operation. In this sense, a methodological route was followed, divided into information gathering and information analysis, in order to answer the main question: where are the subjects in the global academic production of mezcal? (Gómez, 2011).

In terms of gathering information, we started by defining the subject of mezcal, the problem of the absence of subjects that produce mezcal, which, although mentioned in a few occasions, do not appear in the law; and from there the question arose: Who produces mezcal?

Academic products published between 2009 and 2021 were included, a period in which there is a higher concentration of academic production on mezcal. Priority was given to scientific articles in indexed and peer-reviewed journals to unify the quality criteria of the documents used. The manuscripts retrieved were classified as social science papers and those published in English and Spanish were selected. Some academic products, such as

dissertations and books, were also included to complete the bibliographical analysis of this essay, since they contribute significantly to the understanding of the producing subjects in relation to the processes of valorisation of mezcal through its denomination of origin. The texts were selected on the basis of their qualitative methodological perspective, the reputation of the authors, the inclusion of artisanal mezcal production in their central themes, and the availability of the materials on open access platforms or in institutional repositories. Texts that reviewed previously cited materials, those that moved away from a social perspective on mezcal production, those outside the defined time period and those published in journals that did not guarantee rigorous peer review were discarded.

Regarding the definition of categories and words for the search, we chose to search for Mezcal as the main word and Mezcal Artisanal as a specific segment.

Table 1 - Ratio of the number of items per search filter

Data base	**Element quantization filter. 1**	**Element quantification filter. 2**
SpringerLink	7	3
Taylor & Francis	14	3
Scopus	20	15
Wiley	15	12
Total	56	33

In the second stage, a hermeneutic analysis (Mardonez and Ursua, 2007; Cárcamo, 2005; Baeza, 2002) was carried out on the 33 articles, using the technique of deep reading, in order to understand if, in addition to talking about the generality of mezcal, we could extract some categorisation about the artisanal aspect of mezcal and the themes that generate it.

A total of 21 articles were obtained, supplemented by information from other databases, with the aim of covering the descriptive and technical panorama of academic production on mezcal, and recording them in an analytical matrix. From these inputs, a discussion is generated with the classical positions (Kroeber, 1948; Redfield, 1956; Wolf, 1966; Shanin, 1971; Chayanov, 1979) on the social theory of the peasantry, which is presented in the following sections.

Table 2 - Selected articles

Code	Authors	Year	Language
1	González-Seguí *et al.*	2020	Spanish
2	Martínez-Gutiérrez *et al.*	2013	Spanish
3	Perez *et al.*	2013	Spanish
4	López-Nava *et al.*	2014	Spanish
5	Bowen, and Valenzuela	2009	English
6	Gaytan	2018	English
7	Gaytan	2019	English
8	Sanchez-Soto	2016	Spanish
9	Plascencia de la Torre, and Peralta-Gordon	2018	Spanish
10	Hernandez-Lopez	2018	Spanish
11	Garcia-Garza	2021	Spanish
12	Fonseca-Varela and Chalita-Tovar	2021	Spanish
13	Dominguez-Gaspar	2020	Spanish
14	Camacho-Vera *et al.*	2021	Spanish
15	Bautista *et al.*	2015	Spanish
16	Vargas-Ponce *et al.*	2009	English
17	Tetreault *et al.*	2021	English
18	Valenzuela	2010	English
19	Vaccaro, and Ortiz-Diaz	2021	English
20	Bowen	2010	English
21	Valiente-Banuet, and Verdú	2013	English

The selection of articles was divided into three groups, from which the analysis of the literature on mezcal was condensed. On the one hand, those dedicated to the description of production processes; on the other hand, those that discuss the quality of mezcal and geographical indications, and those that present an alternative vision of mezcal that breaks with mere production and geographical indications.

Given that the invisibility of the subjects who produce artisanal mezcal in rural areas is linked to the expansion of the geographical scope of the Denomination of Origin, driven by international market interests, we believe that the literature that constitutes the corpus for this essay should be framed within the sphere of international academic debate.

Table 3 - Distribution of Articles by Group

Group	Name Group	Codes	Number of articles
A	Mezcal production aspects	(2) (3) (4) (8) (10)(16) (18)	8
B	Quality and geographical indications	(5) (6) (7) (9) (11)	5
C	Other views of Mezcal	(12) (13) (14) (15) (17)	5

In this sense, priority has been given to the use of materials available in global databases, being aware that this methodological choice leaves out a number of valuable materials produced in universities and research centres. However, the aim of this essay is to develop a general reflection on how the production of artisanal mezcal and the people who produce it have been conceptualised and analysed in academic products with wide circulation and international visibility. This is due to the need to limit the selected texts for reasons of space and the way in which the argument of this essay has been constructed. In future reflections, it may be possible to analyse how artisanal producers have been approached from more local perspectives.

2. Results

2.1. *Group A. Mezcal production aspects: in search of the subjects*

With regard to the first group of articles, the way in which they refer to the artisanal process and, secondly, to the subject behind the production, this was only done in a narrative form.

Some articles recognise the artisanal and refer to it as a productive condition given by its derivation from traditional actions that are maintained in production. With regard to the second, the rural subjects, they are often presented as agricultural producers or peasants, without looking at how these terms have a specific origin and how their relations become specific and give a concrete meaning to production, both in its scope and its operation.

In this sense, we found that discussions on the production process showed the need to address the technical aspects of production. For example, González-Seguí, Hernández-López and Hendrik (2020) analyse methanol levels and how they pose a problem for producers. They argue that most producers do not certify their production because their methanol levels are above the norm. This could lead to a loss of quality in the product, in

Table 4 - Group A. References Mezcal, Artisanal Mezcal, and Subject

Code	Ref. Mezcal	Ref. Artisanal Mezcal	Ref. Subject
1	Yes	Yes	Yes* no peasant
2	Yes	Yes	Yes* no peasant
3	Yes	No	No
4	Yes	Yes*	Yes* no peasant
8	No	No	Yes* no peasant
10	Yes	Yes	Yes**
16	Yes	No* traditional	Yes* farmers
18	Yes	No* traditional	No

addition to its characteristic flavour, which could affect other distillations. This is a reflection of the quality of the drink and the tendency to industrialise production.

The authors present the subject as a producer in a generic way **(code 1)**, without giving elements to understand if it is of rural origin. Likewise, when referring to mezcal, they refer to its physico-chemical characteristics and only mention the different categories recognised in the DOM.

Continuing with the theme of production, when asked about waste in mezcal production, Martínez-Gutiérrez et al (2013) mention the existence of areas of opportunity in the management of bagasse from mezcal production. They argue that if left untreated, it becomes a pollutant that can cause damage to water tributaries. As in the previous study, when referring to the subjects behind the production of mezcal, they refer to them as mezcal producers **(code 2)**, which also does not allow us to understand the relationships woven for the achievement of the beverage. It should be noted that the focus of the research and the article clearly raised a relevant discussion for the sector and, in particular, to achieve sustainability criteria.

Continuing the discussion on the production process of mezcal, Pérez *et al*. (2013) communicated the results of experiments with new strains to improve the fermentation process, aspects that contribute to the acceleration and control of the production processes desired from an industrial point of view. In this text, the producer was not directly mentioned **(code 3)**, since his activity is aimed at improving the physico-chemical quality of the drink and the production process.

Similarly, Valenzuela (2011) raises the possibility that the genus Agavaceae will have to be used in the production of biofuels, given the opportunities

offered by the production processes of the genus and the high demand and alternative uses that can be given to the plant. It should be noted that although the pressure on ecological systems is quite high, as demand increases, the competition between tequila and mezcal production, and the demand for biofuels and fructose, may increase the ecological risk and sustainability of the territories. Thus, the people behind the production **(code 18)** are not discussed as one of the main elements of production.

These technical approaches, at least in the discursive element and its narrative, denote an approach to the methods used in production, but not to who implements these mechanisms. Similarly, the approach of NOM-070-SCFI-2016 (2016) follows this argumentative pattern, where the beverage is important for its physicochemical and technological components, downplaying the importance of the subjects behind them.

Despite the above, Sánchez-Soto (2016) raises the need for information on the part of producers from a technical dimension. However, even if there is an approach to the subject, it is interesting to note the way in which the producer is conceptualised, mainly as a farmer **(code 8)**, since it does not have the depth to allow a conceptual theoretical discussion of the approach and is undoubtedly at a descriptive and technical level, that is, it does not allow us to see the multiple relationships that are synthesised in the subject and its specific characteristics that differentiate it from the homogeneity of the concept of farmer.

In this context, Vargas-Ponce, *et al.* (2009) raise an important discussion on the conservation of the genetic diversity of agaves, specifically of *A. angustifolia* from traditional management, allowing its survival over time to be sustainable, as opposed to the intensive practices of commercial monoculture models that degrade and suppress the genetic diversity of the plant. Specifically and appropriately, they refer to the category of "farmers" **(code 16)** to refer to small farmers. However, they speak of small plots of land managed and cultivated by subjects rooted in traditional milpa systems combined with low-intensity livestock grazing, which clearly identifies them as directly rural subjects.

From a different perspective, López-Nava *et al.* (2014) focused on the problems of the mezcal production chain, production processes and the technologisation of mezcal production systems. However, the authors did not have the notion of the subjects behind the production as a main or peripheral axis of discussion; therefore, the indicators presented are economic and productive. There is no fixed reference to the farmers in terms of those who produce the mezcal and those who produce the plant **(code 4)**. This is an interesting situation, because there is a lack of popular and peasant knowledge in the face of the impending technologisation of the production of mezcal, which is based on this knowledge, on management techniques and their conservation, creating a symbiosis between man and nature.

Finally, Hernández-López (2018) reflects on the functioning of the DOM and the categories of artisanal and ancestral mezcal, postulating the "social and historical traceability" of the products, seeking a closer link between the territory and what is produced, in line with what is proposed by the denomination of origin.

With regard to the subject of mezcal production, the existence of family production units with multiple activities that differentiate the production process was mentioned, but the figure of the "Maestro Mezcalero" **(code 10)** is particularly important, since he is mentioned as the intellectual owner of the knowledge that shapes the drink.

2.2. *Group B. Quality and geographical indications: elements that go beyond the productive aspect*

As has been well expressed in the case of "mezcals", to include the case of Tequila, its financial success is due to the protection strategy based on the Denomination of Origin, which at the same time becomes a paradigm of quality by which mezcals are measured. It is precisely this second group of studies that has led to discussions that go beyond the productive analysis of mezcal.

Like the previous group, which focused on production, this group is closer to the notion of subjects, with several issues of particular relevance: the identification of the multiple actors that produce or are inscribed in the mezcal production chain, its derivation from family work and the subject called to represent production, the maestro mezcalero, when mentioned, is posed more as an enunciation than an analysis of the subjects and their relationships, that is, their involvement in the production of the identity that is then transferred to mezcal.

Table 5 - Group B. References Mezcal, Artisanal Mezcal, and Subject

Code	Ref. Mezcal	Ref. Artisanal Mezcal	Ref. Subject
5	No*	No* traditional	Yes* no peasant
6	Yes	Yes	Yes* other actors
7	Yes	Yes	Yes* familiar
9	Yes	Yes	Yes* no peasant
11	Yes	Yes	Yes* Mezcalero Master

For example, Bowen and Valenzuela (2009), using the case of tequila, first propose a contextual discussion of GIs and terroir. They argue that this is an

unsustainable situation, given the weight of the large producing companies in production, in this case in determining prices and their supply, to the virtual exclusion of the region's producers. Although the latter are aware of the problem, they are so overwhelmed that it is difficult for them to remain active. This document problematises an aspect that is of particular interest to us in the study of GIs, in that it basically asks about this mechanism without its people **(code 5)**, from which we could conclude that they are excusing themselves in the GI at the expense of the biocultural and popular knowledge of the people who are subsequently excluded from the process.

Faced with this problem, Gaytán (2018) reflects on the dispute over the control of mezcal's authenticity, searching for quality parameters. Among them, legality overrides the concept of authenticity, which is reduced to certification, suggesting that an industry has been built around mezcal based on the biocultural and popular knowledge of the peasants, but without them **(code 6)**. A narrative of rurality that includes mezcal, but at the same time excludes the subjects, and in the end it is other actors who establish themselves as producers and bearers of knowledge.

The new narratives that link the exotic, the rural and the industry as a mechanism for concealing its people, Gaytán (2019) discusses the maintenance of the 'artisanal' ideal as a criterion of authenticity. The author argues how a kind of mezcal celebrity has been constructed out of a performative process in which knowledge is only displayed in one person, the Maestro Mezcalero **(code 7)**. As in other articles, the condition of the actors is discussed, which represents a break with the literature that stages a harmonious, unusual relationship between local actors, whether they are called mezcal producers, and extra-local actors, called industrialists.

It is worth highlighting the figure of commercial intermediation and the importance of the export market, where the aesthetic dimension, very typical of restaurant and drink critics, is interesting, but it seems that this fact is argued as a messianic form that brings the solution to the problems of the communities, very much in the style of prescriptive approaches to development.

Similarly, García-Garza (2021) identifies four historical processes through which mezcal has passed, from indigenous and colonial syncretism to "traditional mezcal" or fourth generation mezcal, guided by technical assistance processes that have transformed production. In this sense, this traditional epithet is embodied in a performative and aesthetic way that is perceived in the drink, but not necessarily through a link between man and nature. In other words, it is more about what the commodity appears to be than what it really is or can become. In the same way, this modernisation combines the concepts of artisan and ancestral, with a strong charge of exoticism that gives it a special place in the global market of commodities, where the *Maestro Mezcalero* **(code 11)** appears as a central subject in the

performance that gives mezcal a notion of authenticity, ignoring the diversity of subjects that participate in other complementary rural productive activities; whose conformation as a collective subject emerges from the relationships built in the context of the productive fabrics of which they are part.

Delving into these processes in which narrative and performance strategies have taken a position in the mezcal industry, Plascencia de la Torre and Peralta Gordon (2018) proposed some current notions to understand the concept of fetishisation or performance, where the great beneficiaries are industries. In this sense, if we understand these categories, we can conclude that the protective figures, either GI or DO, that have become popular for mezcal, in their commercial form, promote the exploitation and expropriation of popular knowledge. They also express a historical dimension of production and how the constant changes in production have led both the government and the industry to use these mechanisms to progressively exclude the producers **(code 9)** of the past, creating a highly profitable but culturally and environmentally disastrous business.

2.3. *Group C. Other views of Mezcal*

This research group has focused on other discussions, approaches and views of mezcal as a commercial, identity and reproductive way of life.

Table 6 - Group C. References Mezcal, Artisanal Mezcal, and Subject

Code	Ref. Mezcal	Ref. Artisanal Mezcal	Ref. Subject
12	Yes	No	Yes* no peasant
13	Yes	Yes*	Yes* nature peasant
14	Yes	Yes	Yes
15	Yes	Yes	Yes* nature peasant
17	Yes	Yes*	Yes* rural worker

Although financial evaluations can be included in the group of researches focused on production, they fall more in the segment of other visions, since their approach focuses on understanding the financial dynamics of the sector. In this sense, Fonseca-Varela and Chalita-Tovar (2021) proposed an evaluation of the profitability of mezcal in a specific case in the state of Puebla. Beyond measuring the financial feasibility indicators of the mezcal project, they stated that "[…] this agribusiness would be financially profitable in scenarios

where the price of its main raw materials: agave pineapples and bottles for packaging, increases its costs by 20%. However, its indicators could be reduced by up to 50%" (p. 272). However, the indicators do not take into account the various problems that arise after the establishment of this crop and its production in the territories. With regard to the subjects that produce, the treatment given is that of the producer **(code 12)**, in this sense it seems that the relationships that they establish in order to make a living and those that are imposed on them are not taken into account, for example before the certification processes and the dynamics of the other actors that make up the production chain.

From another point of view, Domínguez-Gaspar (2020) tries to understand the production process of mezcal from a feminist perspective, highlighting and making visible the role of women **(code 13)**. From this perspective, the importance of food processing is seen as a fundamental task, without which there can be no production process.

Turning now to the scenario of artisanal mezcal production, Bautista, Orozco-Cirilo and Terán (2015) addressed the situation of production in Matatlán, Oaxaca, focusing as a norm on the techniques and technologies used. It is highlighted that the discussion suffers from the cultural and social situation that entails and/or determines the use of these practices. In this text, there is already a descriptive parameter in the field of what would be an artisanal mezcal, as one of the ways in which the NOM-070-SCFI-2016 is implemented. Regarding the peasant condition **(code 15)**, although there is a reference, the article does not really talk about what it is or what it refers to. The authors took this condition as an assumption, apparently related to the habitability of the rural area and agricultural production.

Continuing this double relationship between subject and artisanal production, Camacho-Vera, Vargas-Canales and Durán-Ferman (2021) proposed a notion of proximity of mezcal production from an economic/social perspective. In the artisanal and peasant component **(code 14)**, the article is anchored in a rural process that involves the social, cultural and productive spheres that are synthesized in a particular rural economy that keeps proportions with the structurality of other expressions of the rural economy.

Finally, from a different perspective, Tetreault, McCulligh and Lucio (2021), based on the discussion of the concept of agro-extractivism and the case of tequila, raised a broad problematic situation regarding the dynamics of relations between the different actors in the production chain, demonstrating in the case of tequila the configuration of an oligopoly responding to the international dynamics of the liquor trade. They identified five negative environmental and social consequences of excessive growth and industrial dynamism: displacement of traditional crops, marginalisation of small producers, loss of genetic biodiversity, intensive use of agrochemicals

and soil erosion **(code 17)**. A practice called "reverse leasing arrangements" was also added, which implies the externalisation of environmental impacts and exacerbates the decomposition of the social fabric through the transformation of subjects.

3. Discussion

Mezcal production systems in Mexico are diverse and complex, resulting in the coexistence of multiple actors at different scales including industrial, artisanal and ancestral forms of production. Most rural mezcal producers best fit the definition of artisanal mezcal.

According to NOM-070-SCFI-2016, artisanal mezcal has the following characteristics: it is cooked in earthen ovens, it is ground with wooden mallets, it is fermented in wooden vats, and it is distilled in clay or copper stills. As can be seen, this characterisation alludes to peasant techniques and artefacts, but never to specific social subjects who produce mezcal and are the custodians of its heritage. On the other hand, there are certain variations that can be accepted in the norm, depending on the resources and needs of each producer.

A large part of the academic production around mezcal and agave has neglected the conceptualisation and characterisation of the subjects behind the production, an aspect that is difficult to understand because the problems addressed are evolving.

It can be said that there are major problems that the literature reviewed has dealt with, the general sustainability and the sustainability of production, the direct impact of the territories in environmental, ecological and social terms. Nevertheless, as we have seen, there has been no systematic study of the condition of the subjects involved in the production of mezcal, and it has not been possible to identify the specific and structural relationships that it establishes and that constitute it as a subject.

Although in some texts the subject is identified as a peasant or an indigenous, this does not go beyond a condition that he takes for granted, that is, as a criterion of identification of his belonging to the rural territory, generally with a small property, thus leaving a blurred boundary between what kind of subjects they are.

The problem that we have traced in relation to the subjects behind the production deepens when we analyse the treatment that the authors give them, where they generally appear as producers, that is, from the development of the activity. This does not allow us to understand any of the relationships, since it is linked to an activity that could be carried out by anyone.

In this sense, although the subjects mentioned in the papers are undoubtedly producers, i.e. they carry out a productive activity in mezcal, neither the standard nor the studies themselves give any importance to understanding the origin of the subject, which is presented as a depersonalisation of the subject. This does not contribute to the operability of the categories of the drink in the appellation of origin, since it excludes the subject as a central element and only valorises technology, land and the drink as a commodity, like most goods and products in the capitalocene, which in its fetishistic dynamics alienates the producer. In other words, mezcal takes body and soul for itself and is produced at an increasing distance from the hands that conceived it (Schaffhauser, 2020; Marx, 2014).

With regard to the denomination of origin, which, as we have said, is a protection of the product, the geographical origin of the raw materials, the production processes, the natural factors and the human factors (DOF, 2020), its categorisation excludes the "human factors" from the equation, because there is no interest in identifying the subject that produces and from which comes the preservation and historical transmission of the knowledge of the production of mezcal. In short, not identifying the type of subject that produces mezcal means breaking with the denomination of origin by postulating a generic producer that has little or nothing to do with the drink as the subject that carries out the productive activity.

In the same perspective, the work of Lira, Robson and Klooster (2022) maintains a discursive line where, beyond the drink itself, in the amalgamation of territory and raw materials, it bears the imprint of the relations of subjects who, in their rural dynamics, can face a peasant relationship. It presents us with a scenario in which the peasant condition determines the specificity of the drink and distinguishes it from the rest of the subjects who inhabit the rural space, on the one hand, and from those who produce mezcal, on the other.

In this dimension, it is necessary to think about a new typology of mezcal, in which the identification of the subject and the way in which its relationships are constructed are highlighted, leading us to understand that by following the subject and its relationships, together with the other factors raised in the denomination of origin, we can bring the theoretical and normative postulate closer to the concrete reality of the territories.

In the case of the artisanal category, most of the articles present the subjects as rural producers and, to a lesser extent, as peasants and indigenous people. It is also stated that they produce on a small scale and that the presence of family labour is indispensable. Although this approach is clearly made from a hermeneutic perspective, the peasant perspective is used to interpret and identify the subjects.

In this sense, mezcal producers can be identified as peasants, since their production and habitat are in the rural environment (Perez, 1993), where

the presence and use of family labour is indispensable (Shanin, 1971; Shanin, 1976).

Although mezcal is a beverage that is anchored in commercialisation processes, the dynamics are a form of subsistence. Although in some cases it is a complementary activity, when it becomes the main activity due to the high demand, the life of these producers is compromised and tied to commercial success. This aspect needs to be clarified in the designation of origin; according to the postulate of Krantz (1977), when showing the difference between capitalist and peasant agriculture, there is the need to achieve profits beyond survival.

The above makes a significant difference to what needs to be protected when this mechanism (DO) refers to territorial development and when it aims to protect history, tradition, culture and territory, even from an economic point of view.

It is necessary to highlight the character of the family composition and the division of labour in the production unit. It is essential to understand its internal functioning. Irrespective of the number of people living there, it is necessary to pay attention to the roles that are shown to bring production to fruition. Firstly, the role played by the transformation of the cultivated products of nature, food, as the basis of the productive act. In the words of Chayanov (1974): "The consumption-labour balance is therefore the basic regulating principle of the activity of the family farm unit. The economic organisation of the farm results from a complex interactive process of adjustments until the equilibrium is reached" (p. 56).

In the production of mezcal, it is possible to understand the relationship between the family and the product as the sum of the needs, skills and efforts directed towards the production and reproduction of the family, a specific feature of the peasant economy, which includes the family economy.

With regard to the cultural dynamics of mezcal producers, it is necessary to show the interactive processes that give rise to the form of production. Peasant life is linked to agricultural and livestock structures (Sevilla and Pérez, 1976). The specific forms in which their technology is configured imply a factual knowledge of the territorial conditions in which they are found, which unfolds a highly particularised culture.

Likewise, the implicit orientation of the productive process has led producers to enter into constant processes of negotiation with internal and external actors in the territory (Wolf, 1971; Wolf, 1977). Their survival is a sign of cultural adaptation and readjustment in cultural negotiation.

In this sense, we agree with the analysis made by Zamora-Reyna (2021) in relation to the success and fame of the mezcals produced in Sola de Vega, Oaxaca, which are directly related to the composition of the productive relations and the peasant imprint given to the beverage, given the type of

subject that carries out the productive work, In other words, over and above the consolidation of mezcal as a commodity on the market, it is also an expression of the identity of the people and communities that produce it, which clearly shows that quality is closely linked to the territory and, above all, to the people who carry out the work, who have learned it orally and from generation to generation.

This issue is also raised by Diaz de la Vega Nuñez (2020) when he discusses the situation in the town of Logoche, Miahuatlán, Oaxaca, where he highlights the familial and essentially peasant character of production, postulating that the category of artisan, in line with our approach, does not capture the productive essence and leaves out the subjects who make it, This reinforces the postulate of the need to create new typologies that correspond to the subjects that produce mezcal, in short, to the relationships that make the continuity of this artisanal distillate viable.

Similarly, we agree with Damián-Reyes's (2011) thesis, which links the productive and reproductive process of mezcal as a popular culture rooted in rural subjects, especially peasants, where this drink acquires value and accounts for processes of rural popular inheritance that are in constant negotiation and cultural adaptation with other subjects outside the territory. The point of convergence helps us to see the need to address the dimension of the subject and its relations, since in this case there are three specific cases that serve to exemplify the approach highlighted in this research, where the importance of the identification of producers is particularly relevant for the consolidation of agro-food quality processes, social and economic justice and parity in economic processes linked to sectors that are emerging on the world market scene, but which are tied to people and territories.

Conclusions

This text began with the following questions What has happened to the subjects? Where are they? There is nothing left to say but: there they are! This is why mezcal has been supported over time. As is well known, studies on mezcal have been structured around the description of production processes, quality and geographical indications, as well as what are called other views of mezcal, which, although important, lack a critical theoretical apparatus that would allow the analysis to be more specific and offer explanatory, analytical panoramas and innovation processes in line with the objective reality of the drink.

For this reason, it is important at this time to re-read the peasant perspective, since, as has been argued, the low-intensity production processes associated with traditional production systems are a productive alternative

that does not significantly affect the social, environmental and ecological balance of the regions. This alternative of conceptualising the mezcal producer as a peasant, i.e. as a subject bound in multiple relationships, is a viable and plausible option to make a difference to the industrial processes they have adopted, based on narratives of tradition and craftsmanship, for a drink that has an eminently rural and imminently peasant character.

Consequently, the peasant perspective focuses on the subjects, not on consumption, which would allow the policies, regulations and instruments of territorial development to necessarily include the human being, his economy and culture, in relation to nature and the territory that surrounds him, as the main object of his work, and not just the commodity, which is increasingly far from what was conceived in the DOM, raising the need to identify strategies that allow them to differentiate themselves from other actors producing mezcal and offer protection to this segment of the rural population.

In relation to NOM-070-SCFI-2016, there is a prescriptive and normative way of understanding the artisanal, since the assertion that the categorical character is indicated by the use of tools and, in short, one or another type of distiller, gives rise to interpretations that it is any subject that produces, it is at this point that the subject itself disappears or is hidden in the process. The use of tools and/or technologies corresponds to biocultural processes, and to assume this in a prescriptive way (techniques, technologies and tools, inputs) ignores the levels of subjectivity and consequently leaves out a myriad of relationships that allow the reproduction and indication of craftsmanship, which is endowed with peasant characteristics and normalises production. To summarise, the omission of the subject and, in particular, the absence of the peasant in the DOM, is to deny that those who are the bearers of tradition, culture, techniques and technologies, in short, of the biocultural knowledge that gives rise to protection, are an example of the appropriation of knowledge in favour of the commercialisation of rural areas.

It should be noted that this essay has limitations; it is based on a reading of a small amount of literature on the subject of mezcal, since the interests are clearly placed in the improvement of productivity and the design of business models linked to the denomination of origin. Being an essay, its possibilities of contrasting and directly operating the peasant perspective will be the framework of discussion for future research; this paper proposes a starting point for academic discussion that will provide interpretative panoramas of transcendence for the lives of producers. For this field of research, it is necessary to conceptualise the subject and its different relationships in order to understand the specificity of its work and to influence the correspondence between reality and the regulated categories. It is necessary to develop deeper perspectives on the relationship between producers and appellations of origin, which can be achieved by addressing the local visions contained in the work

of universities and research centres, which, paradoxically, are often invisible in the global channels of scientific communication. A better articulation between academia, policy-makers and producers is needed to produce better normative schemes and heritage policies that put people at the centre. This essay opens the way to an understanding of artisanal mezcal producers in the context of the implementation of the Denomination of Origin as a tool for the valorisation of agri-food products of global interest, such as artisanal mezcal.

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Determinants of Agri-food Investment from Fund Managers' Viewpoint

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Abstract

A more welcoming investment environment for the agri-food sector is envisioned as a result of the 2020 Venture Investment Promotion Act and the subsequently revised Act on Creation and Operation of Agricultural, Fisheries, and Food Investment Funds in South Korea. This study seeks to identify strategies to encourage venture investment for agri-food entrepreneurs by relying on these new legal environments. This study uses the Analytic Hierarchy Process to assess factors that facilitate investing based on a survey of fund managers and investment analysts who have invested in agri-food products. The findings indicate that the readiness of agri-food enterprises to adopt corporate-like management practices and their willingness to pursue commercialization are the primary determinants of investment facilitation. Deregulated investment environments and enhanced investor incentive systems rank as the second and third most significant determinants, respectively. The results offer insights into strategic policy initiatives aimed at increasing investment for startups, young entrepreneurs and venture farmers.

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Introduction

When it comes to venture capital investments, the legal environment is crucial, especially in light of the government's efforts to encourage the creation of concrete support for early-stage entrepreneurs, small enterprises, and emerging companies with significant growth potential. The Venture Investment Promotion Act (VIPA) of South Korea has been in force since August 2020 with the aim of creating such an investment ecosystem[1]. The subsequent revision of the Act on Formation and Operation of Agricultural, Fisheries and Food Investment Funds (AAFFIF) was made to allow venture capital to invest in the fund's assets and newly accredited accelerators to take part in the fund as venture managers[2]. Notwithstanding the passive aspects of the AAFFIF amendment, it provides a legal framework for creating an environment that attracts investment into the agri-food sectors.

More specifically, since 2010, the AAFFIF has expanded traditional funding instruments that rely on loans and government subsidies into investment forms by providing the investment capital needed to support the growth of agri-food enterprises (AFEs) and startups[3]. Although capital allocations to AFEs have yielded returns in line with projections, empirical evidence suggests that the performance and return on investment for agricultural ventures have not matched the robust figures observed in the food and processing sectors (Park *et al.*, 2017; APFS, 2020). Notwithstanding these achievements and limitations, the AAFFIF is projected to facilitate private capital influx by promoting investment flexibility via deregulatory measures and amplifying the role of investors. Recent significant enhancements in this domain include the elevated status of accelerators as investors and a Simple Agreement for Future Equity (SAFE), providing startups with a viable mechanism for capital acquisition during initial funding stages (Bell *et al.*, 2016)[4].

1. The VIPA aims to promote investments in venture businesses and contribute to balanced development of the economy through the establishment of infrastructure for romust growth of venture companies (VIPA Article 1; https://elaw.klri.re.kr/kor_service/lawView.do?hseq=63084&lang=KOR; Access on Nov. 1, 2023).

2. The AAFFIF aim to "contribute to the balanced development of the national economy by promoting investments in the agricultural, fisheries and food industry and laying the foundation for sound growth of agricultural, fisheries and food enterprises" (AAFFIF Article 1; https://elaw.klri.re.kr/kor_service/lawView.do?hseq=47924&lang=ENG; Access on Nov. 1, 2023).

3. AFEs include agricultural and fishery enterprises, food business operators, and companies manufacturing materials of agriculture, fisheries and foods (AAFFIF Article 3).

4. The SAFE is an investment contract between a startup and its investors. When the startup raises a future round of funding, the capital provided by the investor is exchanged for the right to preferred shares. The SAFE sets out terms and circumstances under which the capital will turn into equity. A SAFE has no maturity date or interest accrual,

The crucial question is whether these investment-friendly regulatory changes would genuinely help to revive investment in the agri-food sector. However, existing research regarding the influence of legal and regulatory changes on venture investment is insufficient, and moreover, there are few studies specializing in AFEs (Kim and Kim, 2019; Koo, 2022).

A few aspects that are pertinent to this study should be taken into consideration among the numerous others that contribute to investors' lack of enthusiasm for agri-food investments. First, it is related to an innate investment limitation in agriculture. While investors seek marketability and stability based on short-term economic success, agri-food investments have a strong public aspect, such as long-term growth potential and social value, which may have spillover effects on all of society. Second, because AFEs have distinct corporate structures, venture capital investment methods including purchasing stocks are limited. Even while AFEs have a lot of room to expand and develop in the long run, fund managers usually prioritize short-term stability and profitability over large returns with little risk.

A primary driving force behind this study is to examine the possible impacts of regulatory changes on fund managers' investment decisions for intrinsically disadvantaged AFEs in attracting venture capital. A hierarchy of criteria and options connected to investments is created by breaking down investment decisions using the Analytic Hierarchy Process (AHP). It is anticipated that AHP results would shed light on how AFEs are enhancing their efforts to attract investment.

2. Literature review

Research on laws and regulations pertaining to venture investments has mostly focused on newly introduced financial instruments and their possible effects. For instance, in the nation's intricate venture investment system, Choi and Kim (2018) projected that the VIPA and the establishment of special purpose acquisition companies (SPACs) would provide a more predictable and efficient investment mechanism for venture capital[5].

in contrast to a convertible note (Westaway, 2023). Since its launch by "Y Combinator" (a US firm) in late 2013, the SAFE has gained enormous popularity in the startup community due to its efficiency, simplicity, and founder-friendliness (de Crescenzo, 2018; Perry *et al*., 2022).

5. A SPAC is a company with no active commercial operations, established exclusively to raise funds via an initial public offering (IPO). The sole objective of a SPAC is to acquire or merge with a pre-existing company.

Regarding the SAFE, which the VIPA recognizes as a novel venture investment vehicle, a few studies contend that, in accordance with securities legalism, its legal standing needs to be reinforced to safeguard investors' interests (Park, 2018; Park and Cheon, 2018; Yang, 2019; Seong, 2022). Oh and Jeong (2022) commend the application of SAFE to the security-type crowdfunding system for addressing the issue of overvaluing corporation values and supporting market recovery.

According to an empirical analysis by Lee and Cho (2020), redeemable convertible preferred shares (RCPS) are preferred over SAFE in startup cases collected from 2015 to 2019[6]. The same study also emphasized the necessity of striking a balance between ensuring startup profitability and reducing investment risk.

In addition, according to Lee (2019), Korea Venture Investment Corp. (KVIC) should efficiently supervise the company's operations, function, and scope from the standpoint of venture investment management, because KVIC is the nation's leading investment manager and fund-of-funds specialist. AFPS is its equivalent in agri-food investment. Based on the observation that the government finances roughly one-third of established venture investment funds, Nam (2022) makes several recommendations, including revitalizing the private market, privatizing public fund-of-funds, strengthening the capacities and knowledge of organizations that specialize in management, and dissolving funds that are distinct from liquidation.

Numerous studies have been conducted about venture investment decision-making. However, as was previously indicated, not many of these studies have focused on AFEs or relevant changes in legal framework that might facilitate investment.

Table 1 illustrates how venture capitalists make investment decisions based on a variety of characteristics and criteria, including the qualities of entrepreneurs and management team, product and service attributes, market sizes and scopes, financial characteristics, and others. Entrepreneurs' skills and experience, the rate of return, and product/market environments rank among the top investment criteria that are frequently mentioned in the literature (Lee, 2019; Koo, 2022).

6. RCPS combines features of both debt and equity. It is a preferred share because its dividend must be paid before that of common shareholders. It is convertible because the preferred shares can be converted into common shares. It is redeemable because, after a certain period, the issuing company may buy back the shares at a predetermined price.

Table 1 - Selected studies on venture investment decision-making criteria

Characteristics	Criteria	Study
Entrepreneur and management team	Management skills Industry experience Startup experience Degree of commitment Track record Technical qualification Business qualification	MacMillan *et al.* (1987) Franke *et al.* (2006) Cassar (2014)
Product and service	Innovativeness Patentability Product superiority	Wells (1974) Rah *et al.* (1994) Kollmann and Kuckertz (2010)
Market	Market volume Market growth Market acceptance New market	Tyebjee and Bruno (1984) Mason and Stark (2004) Vinig and de Haan (2008)
Finance	Fit to investment strategy Return on investment Exit possibilities	Narayanasamy *et al.* (2012) Lahr and Mina (2016) Gomper *et al.* (2021)
Others	Geographic location Network Alliance capital	Boocock and Woods (1997) Baum and Silverman (2004) Wuebker *et al.* (2015)

Note: Although each study may have several criteria or characteristics, for the sake of simplicity, just one of the criteria is displayed and matched to each study.

Source: Authors.

3. AHP method and data

Hierarchy of investment decisions

The passage of the VIPA and the subsequent revision of the AFFIF provided a legal framework for AFEs, which have traditionally relied on government loans or subsidies, to actively engage in market-friendly investments. The creation of many special purpose funds for primary industries like agriculture and fishery is positive. Fund managers who wish to participate and enterprises with high investment value must be linked in order to create and run a feeder fund. Nonetheless, there is still a perceptual barrier between fund managers and enterprises when it comes to pushing investing.

The three hierarchy criteria that outline the key factors influencing fund managers' investment choices were provided in this study. Four alternatives that are crucial to the hierarchy aim make up each criterion.

These decision-making alternatives and hierarchy criteria were chosen after extensive conversations with fund managers, investment analysts, government departments, AFEs, and the Agricultural Policy Insurance & Finance Service (APFS), as well as research into related literature.

The criteria and hierarchy alternatives for fund managers' investments in agri-food are shown in Table 2. By defining the relative importance of the investment determinants, decision making aims to make investment easier for AFEs. Enhancing AFE capabilities, reducing investment constraints, and strengthening fund manager incentives are established as the top three levels for investment revitalization from the perspective of fund managers.

Table 2 - Criteria and alternatives of hierarchy by fund managers

Criteria	Alternatives
Enhancing AFEs' capabilities	Having agri-food products with potential for commercialization and growth
	Showing corporate-like managerial abilities
	Having farmland and other assets with economies of scale
	Setting up facilities for production, storage, and distribution
Easing the investment environment	Lowering the obligatory investment percentage of feeder funds to improve discretion in fund management
	Lowering the annual obligatory investment percentage to ensure investment liquidity
	Increasing fund-of-funds investment percentage to ease the strain on other investors
	Increasing management fees to ensure fund managers' management stability
Increasing fund manager incentives	Extending incentives to encourage early investment
	Increasing special purpose fund incentives to encourage investment
	Evaluating the incentive programs at KVIC
	Raising performance compensation to encourage risk-taking venture investing

Source: Authors.

The first criterion for enhancing AFE capabilities represents the potential and competitiveness of the investment goal. Commercialized agri-food products, corporate-like managerial abilities, capital sizes, and facilities

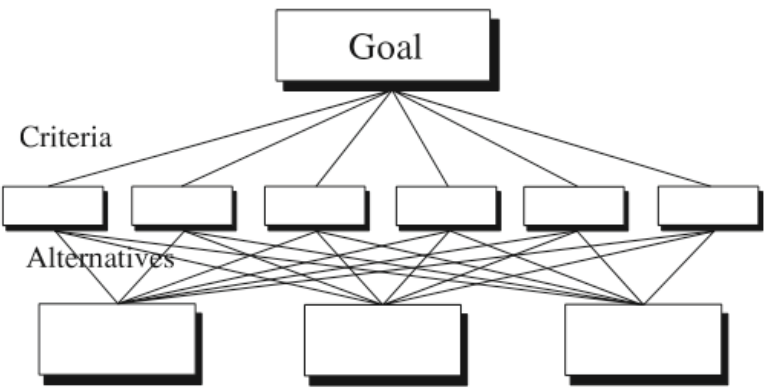
are alternatives that fit the criterion. The second criterion for easing the investment environment comprises of decreasing the mandatory investment ratios of a feeder fund and yearly investment requirements, raising the mandatory investment ratio by fund-of-funds, and increasing management fees, allowing fund managers to actively participate in investing. The third criterion for enhancing fund manager incentives includes extending incentives to encourage early investment, special purpose funds, aggressive venture investing, and benchmarks for similar organizations.

Methods

The AHP, one of decision-making approaches, establishes the hierarchy among the many decision-making elements, including the main goal, criteria, and alternatives. This procedure enables an eventually optimal choice when there are conflicting criteria, incomplete information, or limited resources (Saaty, 1980; 1982). The AHP methodology is widely used for identifying and prioritizing factors that affect venture capitalists' investment decision-making process (Dhochak and Sharma, 2016; Koo, 2022).

The AHP structure in Figure 1 is represented by a three-level hierarchy. An inclusive decision-making process is indicated by level one or goal. This study's main goal is to encourage investment in the agri-food sector. Different criteria and alternatives are provided in more detail at lower levels as one proceeds down the decision-making process.

Figure 1 - A three-level hierarchy



Source: Saaty and Vargas (2012)

A decision maker assigns a weight vector to the set of alternatives, $X = \{x_1, \dots, x_n\}$,

$$w = \{w_1, \dots, w_n\}^T \tag{1}$$

where w_i stands for the alternative x_i's priorities or weights. An effective way to evaluate several alternatives is to consider two alternatives at a time. The so-called pairwise comparison matrix is where these pairwise comparisons are gathered (Saaty, 1982).

$$A = (a_{ij})_{n\times n} = \begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{pmatrix} \tag{2}$$

where $a_{ij} > 0$ indicates the preference rating of x_i over x_j. The ratios between weights are then expressed by each entry of the matrix A.

$$A = \left({}^{w_i}\!/_{w_j}\right)_{n\times n} = \begin{pmatrix} {}^{w_1}\!/_{w_1} & \cdots & {}^{w_1}\!/_{w_n} \\ \vdots & \ddots & \vdots \\ {}^{w_n}\!/_{w_1} & \cdots & {}^{w_n}\!/_{w_n} \end{pmatrix} \tag{3}$$

The matrix A can be recast as follows since equations (2) and (3) take into account $a_{ij} = {}^{1}\!/_{a_{ji}}, \forall i, j$, a condition of multiplicative reciprocity.

$$A = \begin{pmatrix} 1 & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ {}^{1}\!/_{a_{1n}} & \cdots & 1 \end{pmatrix} \tag{4}$$

As can be seen from this matrix A's simplified structure, if $a_{1n} = 3$, then alternative x_1 is 3 times better than x_n with $w_1 = 3w_n$ (Min, 2015; Lim *et al.*, 2020).

One should use other methods to estimate the priority vector if the decision maker is not perfectly rational and cannot provide exact entries as ratios between weights. The most typical approach makes use of the matrix A's A's principal eigenvector. Equation (3) multiplied by w results in,

$$Aw = \begin{pmatrix} {}^{w_1}\!/_{w_1} & \cdots & {}^{w_1}\!/_{w_n} \\ \vdots & \ddots & \vdots \\ {}^{w_n}\!/_{w_1} & \cdots & {}^{w_n}\!/_{w_n} \end{pmatrix} \begin{pmatrix} w_1 \\ \vdots \\ w_n \end{pmatrix} = \begin{pmatrix} nw_1 \\ \vdots \\ nw_n \end{pmatrix} = nw \tag{5}$$

where n and w refer to an eigenvalue and an eigenvector of the matrix A, respectively. Since the other eigenvalue of A is 0 and it has multiplicity $(n - 1)$,

n is the largest eigenvalue of A. As a result, the following equations can be used to determine the priority vector w's solution.

$$\begin{cases} Aw = \lambda_{max} w \\ w^T 1 = 1 \end{cases} \tag{6}$$

where λ_{max} is the largest or principal eigenvalue of A and $1 = \{1, \ldots, 1\}^T$.

Finally, one may include consistency conditions since it is uncommon to be consistent in stating pairwise preferences due to a variety of factors. The Consistency Index for the matrix A or $CI(A)$ is defined in accordance with Saaty and Vargas (2012).

$$CI(A) = \frac{\lambda_{max} - n}{n-1} \tag{7}$$

This equation states λ_{max} is equal to [illegible] if and only if the matrix A is consistent and greater than [illegible] otherwise. To compare matrices of different orders, the Consistency Ratio (CR) should be considered.

$$CR(A) = \frac{CI(A)}{RI_n} \tag{8}$$

where RI_n is a real number obtained from a large enough set of randomly generated matrices of size n. Table 3 shows the values of RI_n.

Table 3 - Values of RI_n

n	1	2	3	4	5	6	7	8	9	10
RI_n	0	0	0.5247	0.8816	1.1086	1.2479	1.3417	1.4057	1.4499	1.4854

Source: Saaty and Vargas (2012).

The matrix [illegible] should be accepted if the values are $CR < 0.1$ and rejected otherwise. The judgements are 10% less consistent than they would be if they were distributed randomly, according to the standard of $CR < 0.1$.

Data

A total of 232 professionals with expertise administering feeder funds, including fund managers and investment analysts, were surveyed for this study using an arbitrary sample technique. Surveys were sent out through

email from January 25 to February 5 in 2021, and the data was compiled. A total of 35 questionnaires were collected, and 31 of them – with an overall effective response rate of 14 percent – were accepted for analysis after passing consistency verification.

The summary statistics for the sample are shown in Table 4. The respondents' average age was 47, and they had an average of 13 years of investment experience. These traits suggest that fund managers and investment analysts are in a strong position to voice their opinions on agri-food investment practices and legislative initiatives.

Table 4 - A summary statistics

Element	Average	Minimum	Maximum	Standard deviation
Age	47.4	30	59	8.18
Experience in years	13.2	11	28	7.68

Source: Authors.

In order to guarantee the consistency of the survey data, CR values are calculated and refluxed in accordance with a benchmark of CR < 0.1. However, this study permits the survey respondents who are unfamiliar with the AHP method to be included up until CR < 0.2 (Saaty and Keams, 1985; Shin *et al*., 2005). The computed CR values for the survey findings are displayed in Table 5.

The response rate for all responders, 87%, is over the CR < 0.2 threshold. The fulfillment response rates are 87%, 94%, and 87%, respectively, based on the criteria. In the case of respondents that did not meet the consistency criteria of CR < 0.2, they were re-surveyed, and only data that finally met the consistency criteria were used for analysis.

Table 5 - Computed Consistency Ratio (CR) values (%)

Benchmark	Overall	Criteria		
		Enhancing the capabilities of AFEs	Easing investment conditions	Improving incentives for fund managers
CR < 0.1	35	52	42	45
CR < 0.2	87	87	94	87

Source: Authors.

4. Analytical results

The relative weights and rankings of the suggested criteria are shown in Table 6. Enhancing AFE capabilities is the most crucial factor in driving agri-food investment out of the three criteria. This finding suggests that potential profitability and managerial aptitude are necessary components of any successful investment in fund managers' perspective. With 0.320, easing investment conditions is given second emphasis. Interestingly, fund managers rank enhancing their own incentives as having the lowest importance, with 0.127.

Table 6 - Relative importance and ranks by criteria

	Criteria		
	Enhancing the capabilities of AFEs	**Easing investment conditions**	**Improving incentives for fund managers**
Relative importance	0.553	0.320	0.127
Ranks	1	2	3

Source: Authors.

Table 7 shows the details of relative importance and ranks among alternatives.

Within the criterion of AFEs capabilities, the readiness for corporate-like management and competency is the most important factor with 0.374, followed by the condition of having marketable products. With less than the half ratings of the first alternative, owing farmland and other assets and equipping various facilities are ranked third and fourth, respectively. As for the criteria of easing investment conditions, lowering the investment burden of fund managers through an increase in the ratio of fund-of-funds investment ranks the first with relative importance of 0.461. Other alternatives within the criterion get less than 0.2 point, which indicates a low relative importance in the facilitation of investment. Increase in performance compensation and incentive expansion for special purpose funds get high relative importance among the alternatives fitting the reinforced incentive criteria, with 0.332 and 0.323, respectively. Fund managers have shown less preference for early investing and KVIC benchmark metrics.

The composite weights, which represent the overall priority, are calculated by adding the weights of the three criteria and the 12 alternatives. The

Table 7 - Relative importance(RI) and ranks by alternatives

Criteria	Alternatives	RI	Rank within criteria	Composite weight	Overall rank
Enhancing the capabilities of AFEs	Having agri-food	0.330	2	0.182	2
	Having management skills	0.374	1	0.207	1
	Having farmland assets	0.151	3	0.084	4
	Equipping production facilities	0.145	4	0.080	5
Easing investment conditions	Reducing the investment ratio	0.199	2	0.064	6
	Ensuring investment liquidity	0.185	3	0.059	7
	Increasing fund-of-funds	0.461	1	0.148	3
	Increasing management fees	0.156	4	0.050	8
Improving incentives for fund managers	Encouraging early investment	0.153	4	0.019	12
	Expanding special purpose funds	0.323	2	0.041	10
	Benchmarks for KVIC systems	0.191	3	0.024	11
	Increasing performance compensation	0.332	1	0.042	9

Source: Authors.

alternative that corresponds to AFEs' readiness for adopting corporate-like management and willingness to pursue commercialization has the highest rank by the composite weight. This shows that, from the standpoint of investors, the capabilities of AFEs in terms of corporate credentials and commercialization potential are the key to maximizing investment success. Second and fourth place, respectively, go to other alternatives relating to the AFE's capabilities, including whether the AFE has marketable agri-food products. The first alternative says that a company's capacity to grow and successfully promote its products is closely related to how well it invests. The latter alternative demonstrates the significance of achieving industrial economies of scale supported by farmland and other capital assets.

The sole alternative other than the criteria of AFEs capabilities is noted as an increase in the ratio of investment by fund-of-funds to alleviate the load on other investors among the top five composite weights. This top-priority alternative highlights the significance of increased involvement and role-playing by fund-of-funds as an indicator of public interest.

5. Conclusions and policy implications

The passage of the AAFFIF in 2010 was a milestone that broadened the use of conventional policy financing instruments including government subsidies and loans for investment (Park *et al.*, 2017). The agri-food fund-of-funds, which was established to bring together private investors and the government in an investment ecosystem, has acted as a catalyst for venture entrepreneurship and innovation in what was previously thought to be a failing industry (APFS, 2020). Due to their strong reliance on agricultural policies, many AFEs have benefited from or favored the advantages of governmental subsidies or loans, therefore investing is likely to be a relatively new financial tool for the AFEs.

The typical financing hierarchy for AFEs usually prioritizes self-financing or subsidies first, followed by debt or loans, and then stock or investment options (Myers and Majluf, 1984). Since the cost of financing tends to rise with the degree of asymmetric information increases, it is challenging for AFEs to independently access private financial markets (Son, 2013). In fact, there are more than 400 public loan programs for AFEs in the country, most of which offer only tiny sums (Kim and Yoon, 2019). They include the Comprehensive Agricultural Fund (CAF), funds for buying farm equipment, funds for fostering succeeding farmers, and funds for returning locals who establish farms and buy houses in rural areas[7,8]. On top of the tradeoffs between traditional financing tools and investment, AFEs' independent management and cautious decision-making style make it difficult to accept involvement in management by outside investors or share business interests.

For startups, young entrepreneurs, and venture farmers, however, investment by fund-of-funds can be a beneficial tool because they do not require farmland or other assets as collateral and can lessen the loan load by sharing investment risks. Additionally, the VIPA is anticipated to have a beneficial ripple effect on the operation and performance of agri-food funds by easing regulations on individual specialized investment, enhancing the role of accelerators, and permitting market-oriented tools like SAFE (Choi and Kim, 2018; Lee, 2019).

It is too soon to gauge how the growth of the investment ecosystem will impact investment in the agri-food sector given the short time between the

7. The National Agricultural Cooperative Federation Bank (NACFB) runs the CAF, a governmental lending program. When a farmer requests for a loan, the NACFB gives operating, renovation, agricultural machine, or facility funds after evaluating the farm's viability as a business and managing the operation.

8. Chung *et al.* (2023) provides historical evolution of agricultural finance in Korea and Kim and Kim (2015) suggests potential ways improve the exiting agricultural financial system in the country.

VIPA's passage and the amendment of the AAFFIF that followed. However, since then, encouraging developments in the creation of numerous investment funds have been seen. For instance, the Young Farmers Fund was formed in 2020 and 2021, which invests less than 500 million won in young startups or successors under the age of 49. The Micro Fund also launched investment associations for AFEs that are in the preparation stage of their business or have less than five years of experience. Additionally, a Secondary Fund was established in 2021 to purchase freshly invested assets or a stake in a feeder fund that was invested by agri-food funds. The Business Incubation Fund has begun supporting AFEs with under seven years of experience.

Although the trend so far is positive, more AFEs must be prepared to serve investors' needs in order to promote investment. The AHP analysis suggests AFEs should enhance the management capabilities, and the government and the APFS should ease the requirements for fund-of-funds investments and expand incentives for fund managers. Besides, more legislative attention and support should be given to small-scale AFEs as venture companies with technology and innovation. Strengthening the function of accelerators or further revising the AAFFIF Enforcement Decree that permits the use of Limited Partners Secondary Funds are both desirable in terms of legal restrictions. It is also crucial to increase business and academic collaboration and communication in order to spread awareness of the agri-food fund-of-funds.

Finally, the study's limitations include the relatively small sample size resulting from the survey's focus on fund managers with experience in agri-food investment and the low CR values in the survey's initial round.

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Unearthing Unique Value: Exploring the Potential of Protected Designation of Origin on the Tangerine Industry of Patate, Tungurahua

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Abstract

The purpose of this study is to analyze the potential of the Tangerine of Patate (*Citrus x* clementina) to obtain a Protected Designation of Origin (PDO). The study emphasizes the crucial role of local climatic conditions, unique soil characteristics, and traditional cultivation techniques in determining the fruit's organoleptic properties. The methodology consists of applying two stages of the virtuous circle proposed by Vandecandelaere: (1) Identification and (2) Proposal of Qualification. Information on cultural practices and post-harvest techniques was gathered through surveys. Qualitative data from surveys were processed using the MAXQDA software. Tangerine and other samples were analyzed with normalized physicochemical analyses in the lab. The first data were compared with samples from two different cantons to validate the intrinsic value of Patate's tangerine. Results demonstrate that the tangerine exhibits differentiated characteristics in terms of aroma, color, and flavor, as well as a traditional inherited practice that is part of the attributes supporting its potential DO status. It is concluded that the mandarin meets the requirements to obtain a Protected Designation of Origin based on specific conditions of production and harvest, as well as is a potential economic aspect to consider increasing farmers' incomes.

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Introduction

Over the last two decades, the global food market has undergone remarkable transformations, influenced by consumers' escalating demand for fresh and authentically regional products (Grunert, 2005). The concept of food origin has developed beyond a mere product attribute, becoming a distinct brand element that adds a unique value proposition (Rangnekar, 2004).

The consumer preference for products with a traditional regional association (Sforzi & Mancini, 2015) has been amplified by an increasing interest in the traditional methods of production and processing. According to Moreno *et al*. (2019), elements such as tradition, the production process, and rural development within a specific region play key roles in product differentiation and enhanced quality.

In this context, geographical indications (GIs) have gained prominence. As defined by the World Intellectual Property Organization (WIPO, 2017), GIs are labels that identify products with a specific geographical origin. Protected Designations of Origin (PDO), a special category of GIs, refers to products that are known for their high quality and have earned recognition from consumers. PDOs place rigorous requirements on producers, demanding the entire production process occur within the designated territory, thus offering a higher degree of protection compared to GIs (Granados, 2004).

The importance of PDOs can be seen through various lenses, with the benefits extending well beyond simple product differentiation. Traditionally, PDOs have been frequently applied in competitive product sectors such as wines and cheeses, especially within the European Union (Tsakiridou *et al*., 2011). This use has not been arbitrary, but rather a strategic method for producers to elevate their products and compete in saturated markets.

This study focuses on tangerines, specifically a variety of Clementine (*Citrus reticulata* Blanco) cultivated in the Sierra region of Ecuador. While global tangerine production is dominated by major players like China, Spain, and Japan, with Brazil and Peru leading in the South American market (FAO, 2016), Ecuador has carved out its niche. In 2017, tangerine production in the country reached 42,560 tons (ESPAC, 2017), with the province of Tungurahua notably excelling in tangerine cultivation. In particular, the "Tangerine of Patate", grown on approximately 390 hectares in the canton of Patate, has gained local market recognition.

1. Background

DOs play a pivotal role in safeguarding the uniqueness of products. In an era of mass production and commoditization, products that carry a PDO are imbued with an authentic story, associated with a specific region, and

bound by traditional methods of production (Barham, 2003). This not only helps preserve cultural heritage and biodiversity but also adds a unique value proposition that sets these products apart from their generic counterparts. A clear example of this value proposition is seen in the market dynamics of the "Zagorin" apple, which is cultivated in the village of Zagora and holds a PDO status (Zagorin, 2019).

More than just a marker of authenticity, PDOs can significantly enhance the economic viability of producers. By recognizing and enhancing the value of unique regional products, PDOs can help farmers obtain a price premium, thus improving their economic returns (Belletti *et al.*, 2015).

Moreover, PDOs can be a powerful marketing tool. They can offer consumers assurance about the quality and origin of products, which can be a significant competitive advantage in markets where consumers value authenticity, tradition, and quality (Teuber, 2011). In more recent years, PDO has proven to be a substantial factor in the fruit industry (Benedetto, 2007). The case of Ecuador, with five registered PDOs across a variety of manufactured and agricultural products, illustrates the role of PDOs in protecting endangered varieties against displacement by new alternatives (Quintana & Aguilar, 2018).

The study of PDO products, closely tied to GIs is of paramount scientific importance in the realm of international trade and product authenticity. According to the World Intellectual Property Organization (WIPO), PDOs operate as a signifier for products that highlight specific characteristics related to local culture and traditions. Scientifically analyzing these products ensures that their distinct attributes are genuinely tied to their place of production, thereby establishing a clear and verifiable link between the product and its original place of production. Such studies provide a robust framework for producers to protect their products against misuse by third parties (Millán *et al.*, 2016). Beyond meager product differentiation, these studies play a crucial role in preserving cultural heritage, promoting sustainable rural development, and ensuring that consumers receive genuine, high-quality products. In essence, scientific investigations into PDOs and GIs delve deep into the intricate relationship between products, their geographical origins, and the unique attributes they derive from these origins (WIPO, 2023).

For smaller regions, acquiring PDO status can lead to profound economic transformations. It provides a unique selling proposition, differentiating products in the marketplace. This differentiation often translates to increased demand and allows for premium pricing, benefiting local producers (Skuras & Vakrou, 2002). Moreover, regions with products holding PDO can experience an upsurge in tourism, as consumers and tourists are increasingly interested in authentic regional experiences related to origin-specific products (Bramley *et al.*, 2009).

Beyond the immediate economic advantages, PDO can foster local entrepreneurship and stimulate investments in sectors such as marketing, packaging, and transportation. Moreover, it can serve as a protective measure for traditional practices, ensuring the preservation of both biodiversity and cultural practices (Belletti, 1999).

However, the rewards of PDO are not automatic. Effective implementation, stringent quality control, and efficient promotional efforts are crucial. Failing to uphold these standards might lead to missed economic opportunities or even potentially harm the reputation of the product and the region (Mancini & Arfini, 2018).

The primary aim of this research is to evaluate the potential of the Tangerine of Patate (*Citrus x* clementina) for acquiring PDO condition. The study seeks to explore the unique cultivation traditions, production techniques, and post-harvest practices in the Tungurahua province, nestled in the central Sierra region of Ecuador. This objective is pursued using a virtuous circle methodology, drawing insights from the analysis of farms growing the Tangerine of Patate in the Puñapi parish of the Pelileo canton.

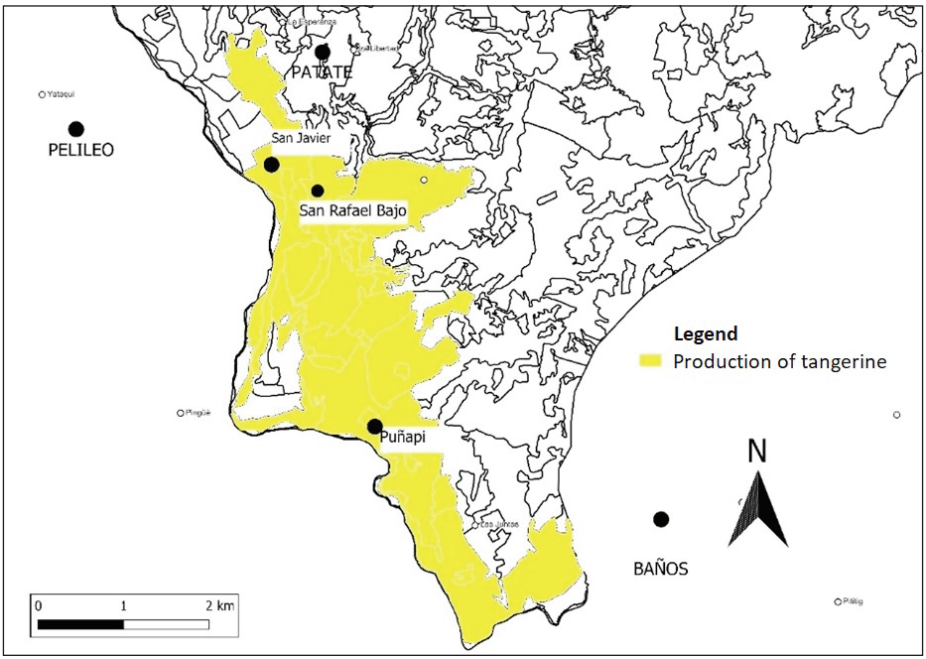
2. Materials and Methods

The methodology of this study was designed to systematically analyze and characterize the specific cultivar of tangerine (*Citrus reticulata*. Blanco) from the canton of Patate in Ecuador, to support its eligibility for Protected Designation of Origin (PDO) status. Primary data were collected via open-ended surveys with local farmers, an approach mirroring the work with the strategy applied by Bowen and Zapata (2009) for engaging the farmers' participation after a workshop with the information of the study goals. This integrated approach combining social, environmental, and biological research allowed for a holistic understanding of the distinctive nature of the Patate tangerines.

Geographic Area Description

This study was conducted in the Patate canton, located in the Tungurahua province in the central Andean region of Ecuador (Lavín *et al.*, 2017). The region boasts a temperate-dry climate, which is well-suited for citrus cultivation, as well as legumes and vegetables (Correa & Granda, 2013).

Figure 1 - Location of producers in the tangerine production area



Tangerine production rises during the months of June and August when temperatures tend to decrease and relative humidity increases (min. 12.4°C and max. 24°C). Topographically, the study area presents moderate slopes ranging from 14% to 55%.

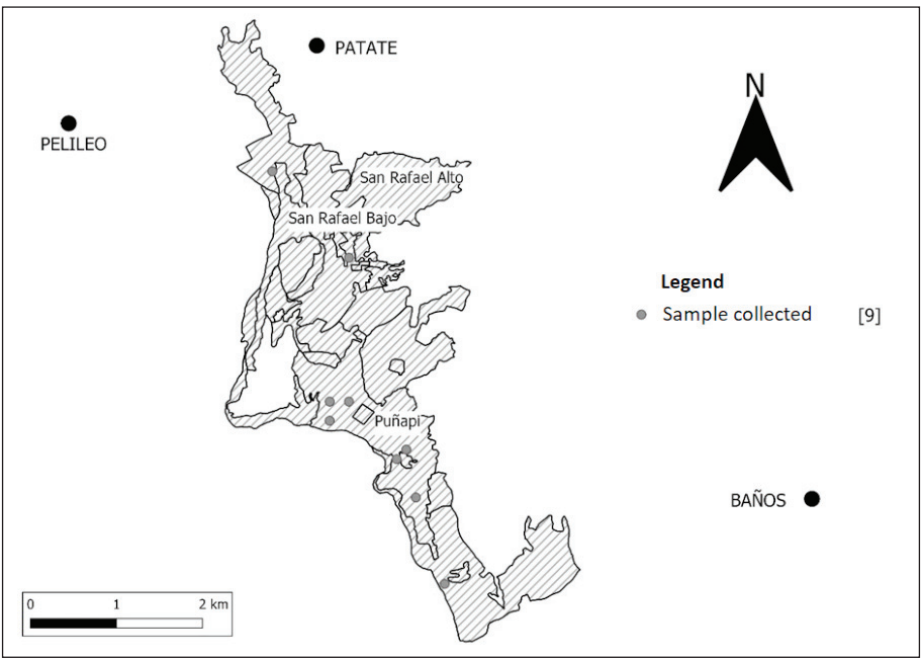
The farms are situated at altitudes ranging between 1,896 and 2,155 meters above sea level. Tangerine samples were collected during the months of March-May 2019. The geographic delineation of the study area followed the approach proposed by Vandecandelaere *et al.* (2010). For this, a Garmin for Global Positioning System (GPS) was utilized. Data derived from the composition analysis of the tangerines were compared with the food composition table of Ecuador (Ramírez *et al.*, 2017) (see Figure 2). A comprehensive soil analysis was conducted, coupled with climate data collection to understand the unique environmental conditions influencing the fruit's properties.

The relative humidity of the environment ranges between 73.2% and 90.4% (PACT, 2012). The annual precipitation in the Patate Valley zone fluctuates between 350 and 1000 mm.

Data collection

To delineate the study area, data on production and farmers' census provided by the local agricultural department were utilized. Primary data was collected through open-ended surveys with local farmers, and members of the association, who provided insights into traditional cultivation techniques, agricultural practices, and local knowledge. The interview applied to the producers was unstructured with open questions, taking Bernal's (2010) methodology for structured questions with a common language adapted to the farmers' comprehension. The validation of the instrument was conducted by experts. In total, nine surveys were established, equivalent to 70% of the members of ASOPUÑAÑI, selected at random.

Figure 2 - Sampling was collected in a random selection of farms



Surveys were conducted in the Puñapi community (including Puñapi, San Javier, and San Rafael Bajo communities) between April and July of 2019 in the farms. The period corresponds to the first cycle of production of the year. Harvest and farm managers were part of the sample analyzed. The georeferenced points signify the locations of tangerine-producing

farms involved in the survey (See Figure 1). Participation in this study was voluntary after the researchers communicated the goals and intentions to the farmers' organization in Puñapi. Farmers' knowledge of tangerine production and post-harvest practices were the focus of this study, to understand the common activities that are identified by PDOs. All the surveys were applied in situ to corroborate activities and practices used in tangerine production.

The fruit was obtained in the farms that are part of the Association of Agricultural Production Fine Tangerine of Aroma "ASOPUÑAPI". The harvest was done manually, keeping the peduncle in the fruit. During the harvest, the absence of dew or fog is sought. The containers used in the collection were plastic drawers. The sample was replicated three times and gathered from each farm under identical conditions – manually while preserving the peduncle, with producer assistance, and stored in plastic crates (see table 1). The experiment considered a design of repetition of the analysis to validate the data obtained from each sample.

Furthermore, for the comparison process, the study compiled, following the same procedure, from the neighboring cantons of Pelileo and Baños. The proposal is based on finding differences/similarities in the composition of the fruit between the samples. Tangerine samples were coded based on their origin and stored in breathable bags. They were placed in suitable containers and stored at a temperature of 4°C.

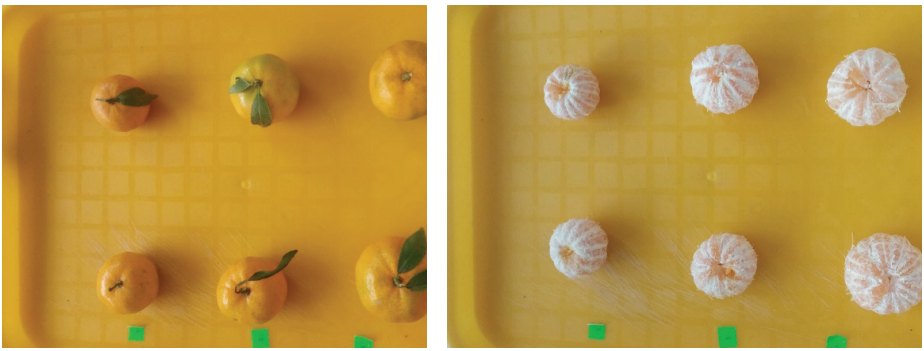
Completely, soil samples involve random collection on the tangerine zone studied, ensuring unbiased representation. Concurrently, temperature and humidity measurements are taken at these random points to capture a comprehensive snapshot of the environmental conditions. Soil analysis was conducted using the FIARG chemical analysis method. The methods employed in soil analysis included the pH/conductivity meter Orión 550A (Electrochemical), Bouyoucos Blender (Bouyoucos), Gravimetric, Kjeldahl, and Olsen Mod methods.

Sample analysis

The tangerines' organoleptic qualities such as color, aroma, taste, and size were evaluated through laboratory analysis. Furthermore, quantitative measures like the fruit's juice content, maturity index, and soluble solids content were assessed following the standards set by the Codex Alimentarius Commission.

The fruit samples were classified to discard those with bumps, bruises, insect damage, or foreign odors and then washed and classified according to current standards (FAO, 1999; NTE-INEN-1930, 1992) (see Figure 3).

Figure 3 - Classification of collected tangerine samples



The number of soluble solids present in the tangerine juice was assessed using a HANNA digital refractometer with a range of 0-85°Brix at room temperature (20°C). Subsequently, the pH of the juice was determined using a Mettler Toledo Seven Compact digital potentiometer, and acidity was measured using a Mettler Toledo G-20 Compact potentiometric titrator. The fruit's maturity index was estimated using the ratio of soluble solids to acidity (Arias & Toledo, 2007). The fruit's moisture content was determined using an MRC MB50 digital moisture balance with an approximation of ±0.0001g, utilizing the infrared light method. For this, 5g of homogenous, seed-free sample was weighed, adhering to the procedure outlined in the standard (NMX-F-428, 1982).

The fruit's weight was recorded using an analytical balance with an approximation of ±0.001g. The polar and equatorial diameter measurements were made using a Vernier caliper. The color index was determined by sampling five points on the fruit, thereby obtaining the CIELab parameters (L*, a*, b*) (Villalba *et al.*, 2017). Physical properties such as volume were analyzed using the water displacement method (Alvarado, 1996). The physical and chemical characteristics of the fruits were classified into first, second, and third classes, considering the fruit's diameter and weight. The classification was done according to the current NTE-INEN 1930 standard for fresh fruits, the Codex Alimentarius-FFV-14 standard, and the CEPE standard for citrus fruits.

Virtuous Circle

For this study, two stages of the Virtuous Circle proposed by Vandecandelaere *et al.* (2010) were implemented: (1) Identification and (2) Proposal for Qualification, as they represent the study phase in the methodology

of PDO labels. This methodology is based on the phases of the virtuous circle of quality, linked to origin. Within each phase, specific activities are developed that allow producers to appreciate a product's potential for achieving a PDO.

The study focused on the method where it is observed a unique blend of a region's natural resources and the inherent human skills and traditions, leading to the production of distinctive items. These products, due to their unique attributes, gradually establish a market reputation. As their reputation solidifies, they attain a higher market value, with consumers more inclined to pay a premium for their unique qualities. The ensuing economic benefits encourage producers to further invest in maintaining the product's distinctiveness, emphasizing its quality and deep-rooted traditions.

Data systematization

The study employed a meticulous systematization methodology, as outlined by Kothari (2004). This approach began with a thorough data collection phase, utilizing open-ended surveys and comparative sample analyses. The gathered data was then systematically organized into structured matrices and tables, facilitating ease of interpretation and comparison. This structured data was subsequently analyzed to discern patterns and insights, with a particular emphasis on the nuances of tangerine production and the significance of PDO and Geographical Indications. To ensure the study's robustness, we integrated pertinent references, including insights from the Ecuadorian national institution of normalization.

Qualitative Data Analysis

Excel was used for data handling, and the MAXQDA 2018 software was employed for analyzing discourses derived from semi-structured surveys. Through this, qualitative data analysis was conducted, employing a system of codes and subcodes by the research hypothesis. The results were then graphed, and their similarities were evaluated.

A Garmin brand GPS was used to identify georeferenced sampling points. The QGIS Desktop 2.17 software was used to develop the maps.

3. Results

Information from open-ended surveys and similarities in agricultural practices were discerned, particularly in the domain of fruit harvesting. Furthermore, a comparative analysis was conducted between samples

from two distinct sectors, Patate (study area) and Pelileo-Baños (counterexample), to determine differences and similarities in the fruit's composition. This analysis encompassed parameters such as humidity, fat content, fiber, ash, and color index. The subsequent results section delves into the detailed findings from these evaluations, presenting a matrix of similarities, compositional analyses, and physicochemical characteristics of the tangerines, offering insights into the nuances of tangerine production and its inherent qualities.

Cultural Practices

As for agricultural practices for tangerine production, similarity in discourse was assessed through open-ended surveys. (See Table 1). The results indicate a strong correlation in the responses of the different producers. A value greater than 0.7 agrees with producers regarding the harvesting and post-harvest practices.

Table 1 - Results of qualitative data from farmers' surveys

Producer	P001	P002-P003	P004	P005	P006	P007-P008	P009
P001	1	0,79	0,77	0,71	0,81	0,69	0,7
P002-P003	0,79	1	0,72	0,85	0,84	0,78	0,72
P004	0,77	0,72	1	0,76	0,77	0,76	0,67
P005	0,71	0,85	0,76	1	0,83	0,81	0,73
P006	0,81	0,84	0,77	0,83	1	0,76	0,7
P007-P008	0,69	0,78	0,76	0,81	0,76	1	0,69
P009	0,7	0,72	0,67	0,73	0,7	0,69	1
Average	0,75	0,78	0,74	0,78	0,79	0,75	0,7

* P00* represents a code for each survey.

Table 1 shows the degree of similarity in crop maintenance techniques, especially focusing on fruit harvesting practices, among the different producers (P001 to P009). The values represented a range from 0.67 to 0.85, with an average similarity score of 0.75, well above the 0.7 threshold. This suggests a substantial agreement among producers, reflecting a shared knowledge and practice concerning tangerine production in the area.

In particular, the most significant similarity is found between producers P003 and P005, with a score of 0.85. This high similarity score implies that these producers employ highly comparable practices and techniques in their tangerine cultivation.

Conversely, the lowest similarity score, 0.67, is between P004 and P009, suggesting slightly more divergence in their practices compared to others. Nonetheless, it is important to note that even this lowest score is close to the overall average, indicating that a common base of knowledge and procedures exists across the interviewed producers.

Soil

Regarding soil conditions, the area is dominated by Mollisols and Inceptisols classes, with a sandy texture, including Sandy Loam and Loamy Sand. The soil pH should ideally be close to neutral, but the range typically falls between 7.38 and 8.16. The soil analysis (PM006-L1 and PM007-L1) indicates the presence of Inceptisol soils. Furthermore, soils with loamy textures are identified. For the samples taken at point PM006-L1, there is organic matter – OM (2.1% OM), which compared to PM007-L1 has a high variation (37.1% OM). Likewise, the soil pH is within a range of 7.5 to 8.5 pH. For the nitrogen analysis for PM006-L1, the content is 16 ppm, whereas the average nitrogen content in the PM007-L1 sample is 37.1 ppm.

Sensory characteristics

The proposed analysis establishes the comparison of samples from two sectors (Patate – study area and Pelileo – counterexample). The content of fat, fiber, and ash show significant differences ($p<0.05$) between the two cultivars analyzed, the composition of the fruit varies according to environmental and agronomic factors. In the same way, they are higher than those reported for fruits Clementines: Fat 0.4%, Fiber 2%, and Ash 0.31%.

Table 2 - Composition analysis in Tangerine

Parameters	**Sample**	**Witness**
Humidity (%)	85,25 ± 0,36a	85,60 ± 0,17a
Fat (%)	0,91 ± 0,04a	0,74 ± 0,07b
Fiber (%)	5,51 ± 0,35a	8,04 ± 0,69b
Ash (%)	0,61 ± 0,05a	0,71 ± 0,02b

* Different superscripts indicate significant differences between samples.

Humidity

The humidity in the samples does not present significant differences ($p>0.05$). The value obtained is similar to that reported in the food composition table, where a water content for tangerine of 85.17% is presented (Fabroni *et al.,* 2016).

Color

Fruit color evaluation shows, according to the data presented in Table 3, a significant difference was observed in the coordinates a* and b* ($p < 0.05$). These correspond to variations in the yellow-orange hue of the fruit (intense yellow), related to its degree of maturity.

Table 3 - Determination of Color Index in Tangerines

Parameters	Sample	Witness
L*	61,46 ± 2,33a	63,15 ± 0,45a
a*	15,37 ± 5,52a	22,88 ± 3,69b
b*	60,24 ± 4,27a	69,71 ± 2,13b
Color Index (100×a*/L*×b*)	0,41 ± 0,13a	0,52 ± 0,10a

* Different superscripts indicate significant differences between samples.

The results obtained present a Color Index – CI: 0.41±0.13, which represents a yellowish hue in its bark because it is in the first quadrant with a HUE angle greater than 60°. These results are comparable with those presented by Fabroni *et al.* (2016) for clementine fruits, especially in subtropical areas. For the volume of the samples, a significant difference was observed in its similarity to the canton Pelileo ($p<0.05$).

Physicochemical evaluation

Table 4 shows the physicochemical evaluation where the weight presents significant differences ($p<0.05$) for its similars, obtaining a value of 70.57±10.38 g, this value is similar to that reported by other authors for Clementine.

Table 4 - Physicochemical characteristics evaluated in tangerines

Parameters	Sample	Witness zone 1	Witness zone 2
Physicists			
Weight (g)	70,57 ± 10,38a	96.90 ± 12.1b	98 ± 1,23
Equatorial diameter (cm)	5,50 ± 0,27a	6,27 ± 0,23b	5,0 ± 0,44
Volume (cm^3)	72,40 ± 10,06a	103,33 ± 13,66b	96,3 ± 12
Juice content (%)	44,79 ± 4,85a	45,83 ± 4.68a	–
Shell (%)	25,75 ± 3,84a	27,07 ± 3,82a	22,6 ± 3,7
Chemists			
pH	3,84 ± 0,17a	4,05 ± 0,17b	4,97 ± 0,04
SST (°Brix)	12,02 ± 1,16a	10,97 ± 0,87a	6 ± 0,2
Titratable total acidity (%)	1,18 ± 0,25a	0,79 ± 0,12b	0,9 ± 0,23
Maturity Index (OSH/ATT)	10,64 ± 2,67a 6:1	13,94 ± 2,14a 7,5:1	9,52 5:1

* Different superscripts indicate significant differences between samples.

Due to the existing variability in both shape and size, the tangerine weighs 70-100 g with a size that varies from medium to small. The pH value presents significant differences ($p < 0.05$) between the two samples of tangerines analyzed; the highest value was obtained for the fruit from the Pelileo canton. Moreover, °Brix, and SST/AAT degrees, no significant difference was found in the samples. (see table 4). Regarding the percentage of total titratable acidity, it can be observed that there are significant differences ($p < 0.05$), finding higher content in the fruit of the Patate canton. This variation is due to several factors that directly affect the acidity of the fruit, among them the use of fertilizers, the growing season, the choice of the graft holder, environmental factors such as temperature, the brightness of the day, the climatic season, or even the irrigation water.

Evaluation of the Virtuous Circle

Based on the interview findings, it is identified the practices employed in the sampled agricultural sites. The plantations are, on average, four years old, with two harvests per year. Pruning and maintenance activities are manual, as is the application of fertilizers and pest control measures, which adhere to the Good Agricultural Practices (GAP) guidelines established by the Ministry of Agriculture. The evaluation is presented in Table 5.

Table 5 - Virtuous circle analysis for the Patate's tangerine

Virtuous Circle Factors	Analysis
Natural and Human Factors	• Unique Soil Conditions: Dominance of Mollisols and Inceptisols classes, specific pH ranges, organic matter percentages, and nitrogen content. • Shared Knowledge Base: Strong consistency in tangerine production practices across different producers indicating shared tradition and knowledge (see Table 1). • Traditional Techniques: Use of specific grafting options based on soil conditions, manual pruning and maintenance, adherence to Good Agricultural Practices (GAP) guidelines, and distinct irrigation systems.
Product Characteristics	• Distinctive Sensory Properties: Unique color, aroma, taste, and high juice content of Patate tangerine. • Physicochemical Characteristics: Parameters like pH value, °Brix, SST/AAT degrees, and percentage of total titratable acidity highlight the fruit's superior quality and the influence of various factors such as soil condition, cultivation practices, and environmental variables. • Compliance with Standards: Satisfaction and exceeding of the Codex Alimentarius Commission's standards, making it a prime candidate for differentiation in the market.
Reputation	• Distinctive Branding: The presence of a distinctive brand, logo, and packaging emphasizing the fruit's origin and unique qualities. • Identity Preservation: Emphasis on labels like "Fine Aromatic Mandarin" ensures consumer trust and authenticity of the product.
Economic Value	• Premium Quality: The unique characteristics and rigorous standards adhered to for the fruit ensure it can command a higher price in the market. • Packaging Strategies: Use of specific packaging dimensions, logos, and labels emphasizing the origin "Patate" ensures that the fruit's identity and quality are communicated effectively to consumers, further supporting its economic value.
Reinvestment	• Commitment to Quality: The strong consistency in cultivation practices, marketing strategies, and commitment to quality among Patate mandarin producers indicates a dedication to maintaining and further enriching the product's quality. • Preservation of Traditions: The emphasis on traditional cultivation methods and adherence to local guidelines ensures that local traditions and practices are upheld and further invested in.

Table 5 - continued

Virtuous Circle Factors	Analysis
Enhanced Natural and Human Factors	• Continuous Improvement: The cycle of investment and reinvestment in both natural and human factors, from soil quality to cultivation practices, ensures the continuous enhancement of the Patate quality. • Sustainable Growth: By upholding and investing in traditional practices and local resources, there's a sustainable growth trajectory, ensuring its continuous quality and reinforcing its potential for achieving a PDO status.

The analysis reveals that Patate's tangerine has an origin from plantations 40 years old. During the harvest, farmers rely on parameters such as color, the presence of peduncles, and the necessity to avoid damage to the fruit caused by rainfall or physical impact. The fruits are sorted into six classes based on size and quality and then packed into boxes weighing 20 pounds. The fruit is marketed directly from the farms at current market prices.

Cultivation techniques

It includes the use of tools such as hoes or spades for weed clearance. The planting density for tangerine varies from 5×5 to 6×6, depending on the terrain's slope. The plants and grafts used must be free from pests or diseases. Organic fertilizers such as biol, compost, cattle manure, and chicken manure are used to enhance the soil's physical, chemical, and nutritional properties. Depending on the soil conditions, grafting options include lime for poorly drained soils, lemon-tangerine for sandy soils, or bitter orange or sweet lemon.

A vigorous rootstock and a tangerine bud with more than a year's production are selected. Pruning is performed after the tangerine tree's second year of production when the plant is young. In plants with a good fruiting period, it is performed annually to eliminate dead or diseased branches. Irrigation is conducted weekly, with each farmer having a distinct irrigation system, either flood or focused. The area relies on underground springs for its water supply.

During the harvest, ripe tangerines with the appropriate commercial maturity level are picked. The fruit should be at least one-third yellow and harvested with a peduncle. Scissors are typically used to avoid pulling on the branch and causing the fruit's skin to peel off, with a cut made 1 to 2 centimeters from the peduncle.

Commercialization

The sampled farms have a brand and product logo. The logo carries the name of the origin for identification and differentiation, with representative colors based on orange and green. To maintain its origin identification, the fruit must be sold in corrugated cardboard containers, each weighing approximately 20 pounds. The containers' dimensions are 19 cm high, 30 cm long, and 23 cm wide. The external part of the packaging must bear the name "Tangerine" and the origin "Patate", along with the corresponding distinctive seal. The label authorized by the appropriate regulatory entity must state "Protected Designation of Origin" and the distinctive name "Fine Aromatic Tangerine" or "Patate Tangerine".

Overall, this comprehensive evaluation of the "Virtuous Circle" underscores the strong consistency in cultivation practices, marketing strategies, and commitment to quality and origin recognition among Patate tangerine producers. It thus provides robust evidence of the potential for a successful PDO status for these exceptional fruits.

Fruit Quality Characteristics

The Patate tangerine exhibits an optimal Maturity Index (MI) of 10. The results suggest that the soluble solids content is high, and the MI fluctuates in a range exceeding 10. Both mature and immature fruits maintain a satisfactory quality level and pleasing organoleptic characteristics.

According to the CX-FFV-14 standard (Codex Alimentarius Commission. CEPE Standard for Citrus Fruits FFV-14, 1998), the juice content should exceed 40%, manually extracted through pressing. The Patate tangerine boasts a juice content higher than 45%.

The fruit exhibits a color range from immature (greenish) to intense yellow, without reaching the typical orange color of citrus fruits from tropical regions. This parameter is measured using colorimetry as the Color Index (CI). Moreover, the fruit exhibits an aroma that producers categorize as "Fine". Beyond being fine or soft, the aroma is deep, a characteristic distinctive to the Patate tangerine. Similarly, the taste is classified as sub-acidic, which is characteristic of this tangerine variety. The acidic taste is tempered by the fruit's sweetness, making it a preferred choice as a snack.

The exceptional organoleptic properties of Patate's tangerines, characterized by their unique color, aroma, taste, and high juice content, contribute significantly to their high-quality status. These attributes not only satisfy the standards established by the Codex Alimentarius Commission but also offer

a unique and enjoyable sensory experience to consumers. This bolsters the case for the recognition of Patate tangerines as a high-quality, distinctive fruit, reinforcing their potential for a PDO status.

Table 6 - Optimal months of fine aroma tangerine production

Season	**Production period**
Loud	February-August
Optimal	June
Casualty	September-January

4. Discussion

The effectiveness of PDO transcends mere market differentiation and encompasses broader dimensions of environmental sustainability and territorial development. From a market perspective, PDO provides products with a competitive edge, often leading to premium pricing and enhanced consumer trust, as evidenced by Skuras and Vakrou (2002) in their study on origin-labeled wine. Environmentally, PDO can promote sustainable agricultural practices, as products must adhere to specific regional practices to attain and maintain the designation, which often means preserving traditional methods that are environmentally benign (Belletti *et al*., 2015). Furthermore, from a territorial development viewpoint, PDO can stimulate local economies by boosting tourism, fostering entrepreneurship, and preserving cultural heritage, creating a holistic growth model that integrates economic, environmental, and social pillars, as underscored by Bramley *et al*. (2009) in his evaluation of the economic impact of PDO status on regions.

Agricultural practices and related research from various regions highlight the intricate interplay of natural and human factors in shaping the unique attributes of agricultural products. In Mexico region (Rodríguez, 2007), there have been other studies that delve into agricultural practices and their implications on the local community. For instance, a study aimed at characterizing agricultural practices in the community in Oaxaca mentioned a phenomenon of multi-activity among producers (López, 2018), where agricultural activities are combined with other forms of work, which is key to sustaining agricultural labor in the region.

The examination of agricultural practices for tangerine production revealed a strong correlation in the methodologies employed by different producers. The similarity matrix (Table 1) underscores a shared knowledge base among the producers. With an average similarity score of 0.75, the findings suggest a

cohesive approach to tangerine cultivation. This cohesion is further evidenced by the high similarity scores between certain producers, such as P003 and P005, pointing towards highly analogous practices. These findings resonate with other studies, highlighting the importance of standardized practices in enhancing product quality and consistency, crucial prerequisites for PDO status (Jones *et al.*, 2005). This is in line with studies on other citrus fruits, suggesting that soil type, combined with other environmental factors, plays a pivotal role in determining the fruit's quality and distinctiveness (van Leeuwen *et al.*, 2018). Moreover, the presence of organic matter and variations in pH within the studied range further underscores the unique soil conditions favorable to Patate tangerine cultivation.

The Patate tangerine's distinct organoleptic properties, characterized by its unique aroma, taste, and color, place it in a favorable position for PDO recognition. This reinforces the notion that the Patate tangerine offers a unique sensory experience, distinguishing it from other citrus fruits. David *et al.* (2019) observed similar unique organoleptic characteristics in fruits from specific regions, further emphasizing the role of terroir in shaping these properties. Furthermore, results show a profile of the tangerine which information is similar to studies on citrus fruits from other regions that have similarly emphasized the role of terroir in shaping their unique organoleptic properties (van Leeuwen *et al.*, 2020). Thus, considering the amassed evidence from our study and the benchmarks set by similar research, the Patate Tangerine appears well-positioned to achieve PDO status, offering it protection and differentiation in the global market.

Such recognition of a PDO as a primary product not only elevates its market value, often allowing producers to command premium prices but also incentivizes reinvestment into local traditions and resources, thus perpetuating a virtuous circle of continuous product quality and regional development (Lou *et al.*, 2023). As observed in the case study, the interplay between natural and human factors, product characteristics, reputation, and reinvestment play a pivotal role in driving economic prosperity for the Andean region of Ecuador (Grijalva, 2020).

Conclusions

Comprehensive research showcases that the Patate tangerine variety (*Citrus reticulata*. Blanco) distinctively meets the criteria for PDO status, setting it apart from other citrus cultivars in the Tungurahua province. The fruit's unique attributes, deeply rooted in Patate's climatic and soil conditions combined with traditional agricultural practices, emphasize its potential for PDO recognition. Advocating for its acknowledgment under the "Mandarina

Patateña" label not only stresses the fruit's distinctiveness but also underlines the importance of preserving the region's agroecological traditions and enhancing the local farming community's socioeconomic prospects.

However, while the study underscores the Patate tangerine's potential for PDO recognition and the associated economic benefits, it also highlights certain limitations. The emphasis on traditional agricultural practices might pose challenges to scaling production to meet potential increased demand. Furthermore, a broader study scope could unveil additional factors influencing the fruit's characteristics within the Tungurahua province.

For future research can focus on merging sustainable farming practices with technological interventions to maintain the fruit's unique qualities while expanding production. Additionally, a deeper socio-economic analysis and comparative studies with other citrus varieties can offer further insights into the Patate tangerine's distinctiveness and its position in the global market.

Data Availability Statement

The data are available from the corresponding author.

Conflict of interest

The authors declare that there are no conflicts of interest in this study.

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Understanding tourism in social farming as a form of social innovation

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Abstract

Tourism in social farming contexts has important implications for the inclusive development of rural areas. However, current literature on the topic is still scarce and many organizational aspects of this activity are still unexplored. To provide a systematic understanding of the phenomenon, this study presents a literature review to identify tourism in social farming as a form of social innovation. The results of this research reveal how tourism in social farming responds to specific societal challenges, how it fosters social actors' agency and which kind of relationships it stimulates among them. In the end, a comprehensive framework is proposed. Conclusions will detail the theoretical and practical implications of this study while leaving room for reflection on future research.

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Introduction

Creating inclusive societies requires more socially innovative practices (Howaldt *et al.*, 2015, 2021), whose potential is particularly acknowledged for the sustainable development of rural areas (European Commission, 2021). Among the rural socially innovative activities there is social farming (Di Iacovo *et al.*, 2014), which uses agricultural resources to promote services for local communities and the most vulnerable people (Di Iacovo & O'Connor, 2009; Di Iacovo, 2020; Di Iacovo *et al.*, 2014). Recent studies highlighted its potential for the development of a sustainable tourism offer, having positive impacts on both the well-being of end-users and the entire rural territories (Calabrò *et al.*, 2022; Ferrara *et al.*, 2023; Giannetto & Lanfranchi, 2021): indeed, besides fostering rural accessibility (Calabrò *et al.*, 2022), tourism in social farming can foster inclusive economic growth (Ferrara *et al.*, 2023; Giannetto & Lanfranchi, 2021) since it creates the conditions for "a fair distribution of benefits, enhance job creation, protect natural and cultural resources and empower the traditionally marginalized groups" (World Tourism Organization, 2020, p. 5). But "What drives the development of such activity? And what does this generate for and in rural communities?" are questions that research must explore to understand and support such practices.

To this aim, the present study systematizes the scientific literature to frame tourism in social farming as a form of rural social innovation. Therefore, the next section will offer an overview of the features of social innovation and its contribution to sustainable rural tourism development, while social farming will be presented as a specific case of investigation. Afterwards, an overview of the methodology to conduct the literature review will be provided and the results will be reported. Lastly, some conclusions will be drawn by detailing the theoretical and practical implications of this study, while leaving room for reflection on future research.

1. Social innovation: features and contributions to sustainable rural tourism development

Social innovation (SI) is a process of social transformation born to solve socially relevant issues (Howaldt *et al.*, 2015, 2021). Unlike the Shumpeterian concept of innovation which results in new technology, SI is characterised by a strong community-centred nature, which influences the entire process of change (Howaldt *et al.*, 2015, 2021; Murray *et al.*, 2010). The innovative trait of the resulting ideas, products, services, or models is not exclusively novel but can be a re-application of solutions tested in other domains (Murray *et al.*, 2010). Thanks to the marketability of its results, SI is a vehicle for

territorial development, as it becomes a stepping stone for new employment opportunities (European Commission, s.d.; OECD, s.d.). For this reason, socially innovative initiatives are crucial for the liveability of rural areas, as they allow to counteract the lack of services and infrastructures and the consequent outmigration hindering the development of these territories (European Commission, 2021). Although there is no general agreement on the definition of SI, there are three interconnected elements characterizing the phenomenon:

1. a pressing social challenge, which is the object of mobilisation by social actors (European Commission, s.d.; Murray *et al.*, 2010; OECD, s.d.), and the starting point for the development of more inclusive and sustainable societies (Howaldt *et al.*, 2015, 2021);
2. the social agency, is to say the social actors' capacity for (re)action to contextual issues. Several stakeholders can be involved in this process (Terstriep *et al.*, 2020): civil society, governments, research institutions, and companies (Murray *et al.*, 2010; Terstriep *et al.*, 2020), including also the intervention of actors from the social economy, like NGOs and social entrepreneurs (OECD, s.d.);
3. a new asset of relations and collaborations. Indeed, the effectiveness of socially innovative solutions depends on the reorganization of social relations which also determines the overall impact of SI itself (Terstriep *et al.*, 2020).

The role of SI is particularly acknowledged in the current debate on sustainable tourism (Booyens, 2022). Indeed, tourism becomes socially profitable and sustainable in the long run when it helps mitigate local challenges, thus generating a positive impact on the socio-economic development of populations (Booyens, 2022). Therefore, social inclusion and community participation in decision-making are key aspects of making tourism an inclusively prosperous resource (Aquino *et al.*, 2018; Higgins-Desbiolles, 2020; Scheyvens & Biddulph, 2018). In this sense, the contribution of SI is to facilitate the emergence of bottom-up practices that use tourism to achieve a societal mission (Booyens, 2022).

1.1. *Integrating social farming in the discourse of sustainable tourism*

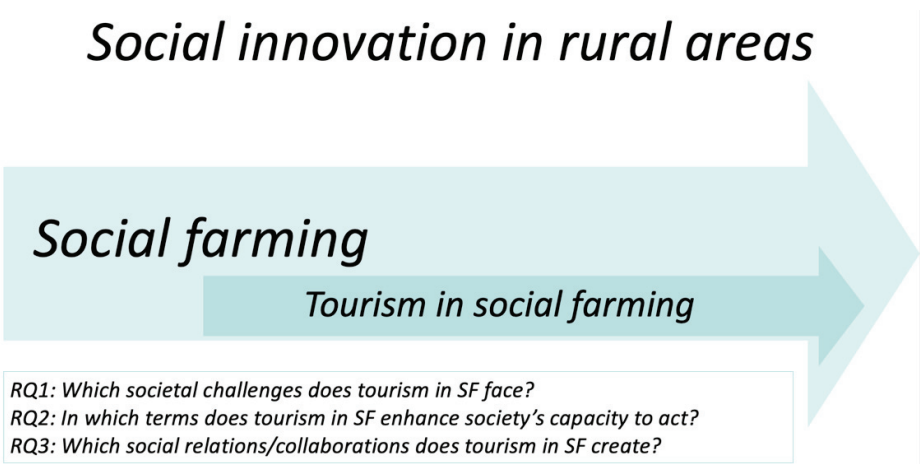
According to Di Iacovo *et al.* (2014), social farming (SF) is a form of SI addressing the lack of services in marginal territories, by creating a multi-stakeholder co-creation arena to define cross-sectoral activities between agricultural and health services for the well-being of rural communities and most fragile people (e.g., children, elderly, prisoners, people undergoing drug or alcohol rehabilitation, or with physical or mental disabilities).

Recreational activities within SF represent a space for social change (Amsden & McEntee, 2011), since they allow visitors to experience meaningful

reflective activities in connection with local food and communities (Farmer, 2012; Wojcieszak, 2018; Mair *et al*., 2008; Amsden & McEntee, 2011; Sumner & Mair, 2020), while enhancing the social value of the agricultural landscape and promote a new role for the farmer in the rural socio-economic system, driven by the principles of ethics and sustainability (Lanfranchi & Giannetto, 2014; Wojcieszak, 2018). More recently scholars emphasised that the provision of a tourism offer in SF can generate positive impacts on rural accessibility and its inclusive economic development (Calabrò *et al*., 2022; Ferrara *et al*., 2023; Giannetto & Lanfranchi, 2021). This allows us to consider SF as a socially innovative space for sustainable rural tourism development (Booyens, 2022). But what are the socially innovative features of tourism in SF? That is to say:
RQ1. What social challenges does tourism in SF respond to?
RQ2. In which terms does it enhance social actors' agency?
RQ3. Which social relations or collaborations does it create?

An overview of the questions addressed by the present study is provided in the following Figure 1:

Figure 1 - An overview of the research questions addressed by this study



2. Materials and methods

To highlight the socially innovative nature of tourism in SF, this study uses a systematic literature review (SLR), for gaining evidence-informed knowledge about the phenomenon (Tranfield *et al*., 2003). Therefore, the research applies the protocol provided by Tranfield *et al.* (2003), by adapting its steps as shown in Table 1:

Table 1 - An overview on the different steps to conduct the SLR (adapted from Tranfield et al., 2003)

SLR steps	Step	Objective(s)	Activities	Tool(s)/ Method	Results
Phase 0 – identification of the need for a review	*Identification of the research question(s)*	Definition of the main research questions leading the study	Review of the meaning of SF as a form of SI (Di Iacovo *et al.*, 2014) and of the potential that tourism in SF (Ferrara *et al.*, 2023; Calabrò *et al.*, 2022) can have as SI (Booyen, 2022)	Bibliographic research	Main research question: in which terms does tourism in SF constitute a form of SI?
		Definition of the specific research questions leading the study	Review on meaning and characteristics of SI	Bibliographic research	RQ1: Which societal challenges does tourism in SF face? RQ2: In which terms does tourism in SF enhance society's capacity to act? QR3: Which social relations/ collaborations does tourism in SF create?
Phase 1 – Preparation of a proposal for a review Phase 2 – Development of a review protocol	*Identification of the protocol for SLR*	Identification of a useful protocol to follow for SLR	Basic review of SLR protocols	Bibliographic research	Evidence-informed knowledge from scientific literature as provided by Tranfield *et al.* (2003)
Phase 3 – Identification of research	*Identifying relevant literature on the topics and relevant search tools*	Defining the field of investigation	Review of the meanings and dimensions of social farming	Bibliographic research	Ferrara *et al.*, 2023; Giannetto & Lanfranchi, 2021; Calabrò *et al.*, 2022; Di Iacovo *et al.*, 2014

Table 1 - continued

SLR steps	Step	Objective(s)	Activities	Tool(s)/ Method	Results
		Developing search strings	Selection of search terms able to encompass the research topics	Use of the boolean terms "and" and "or" to compose the search strings	SF related terminology: "green car*", "social farm*", "farm animal-assisted intervention", "therapeutic garden*", "therapeutic horticultur*", "nature-based rehabilitat*", "care farm*" (García-Llorente *et al*., 2018)
					Tourism-related terminology: touris* OR travel* OR destination* (World Tourism Organization, 2020)
		Identifying search databases	Electronic databases	Scopus; Web of Science	–
	Identification of inclusion/ exclusion criteria	Defining inclusion and exclusion criteria	Establishing a set of exclusion criteria	Bibliographic research	García-Llorente *et al*. (2018)
	Carrying out the research	Initial search and screening	Search on databases according to Scopus and Web of Sciences search criterion "titles, abstracts or keywords"	Scopus; Web of Sciences	28 documents found
			Preliminary screening and selection (elimination of duplicates)	Manual	9 duplicates eliminated

Table 1 - continued

SLR steps	Step	Objective(s)	Activities	Tool(s)/ Method	Results
Phase 4 – Selection of the studies Phase 5 – Study quality assessment	*Study assessment and selection*	Study screening	Preliminary screening and selection (application of exclusion criteria)	Manual	12 studies eliminated from the initial search
			Selection of studies included in the review	Manual	Chen *et al.* (2020); Chin *et al.* (2021); Gramm *et al.* (2019); Lanfranchi & Giannetto (2014); Moriggi (2020); Moriggi *et al.* (2020); Kmita-Dziasek (2017)
		Second phase of search and screening	Backward and forward snowballing across the selected studies	Manual	Chiara *et al.* (2019); Di Iacovo *et al.* (2014); Fazzi (2011); Forleo & Palmieri (2019); Knapik (2018); Knapik (2020); Lanfranchi *et al.* (2015); Moruzzo *et al.* (2020); Nicolosi *et al.* (2021); Tulla *et al.* (2014)
Phase 6 – Data extraction and monitoring process	*Data extraction*	Extraction of information relevant to answer the research question	Data extracted about: 1. Forms of tourism developed in SF contexts; 2. Data related to RQ1, RQ2, RQ3	Manual	Forms of tourism developed in SF context; Useful text related to RQ1, RQ2, RQ3
Phase 7 – Data synthesis	*Data analysis*	Clustering	Clustering of the information reported in the studies	Manual	Clustered information related to RQ1; RQ2; RQ3

Table 1 - continued

SLR steps	Step	Objective(s)	Activities	Tool(s)/ Method	Results
		Analysis	Meta-analysis (qualitative coding analysis) of the information reported in selected studies	Manual	Qualitative meta-analysis of clustered information related to RQ1; RQ2; RQ3
Phase 8 – Report and recommen-dations	–	Summary	Summary of results and conclusions	Manual	Summary of results and conclusions
Phase 9 – Getting evidence into practice	Not applicable				

After defining the topic and the research questions, relevant literature has been scoped to reveal the keywords to be used in the search: the review by García-Llorente *et al.* (2018) revealed the terminologies associated with SF, which have been addressed to relevant tourism-related terms used in the World Tourism Organization (2020) report on sustainable rural tourism development. Next, Web of Science and Scopus databases were used to get access to the articles according to their titles, abstracts or keywords containing at least one of the search terms for each string. By linking the strings with the Boolean operator "AND", the research returned 28 studies (15 from Web of Science and 13 from Scopus). After removing duplicates (9 studies), the research applied inclusion and exclusion criteria as displayed in Table 2:

Table 2 - Inclusion-exclusion criteria to select studies for this review

Criterion	Inclusion	Exclusion
Research field	All	–
Date	>2000	All previous
Language	English	All others
Study type	Empirical and theoretical. All types of peer reviewed journals. Books chapters.	All others
Geography	All	–
Relevance	(i)Addresses tourism in social farming discourse	(i) Addresses tourism and social farming separately (e.g., studies referring to diversification strategies, etc.)
	(ii)Level of analysis: does it contribute to the understanding of tourism in social farming knowledge and development?	(ii) All studies not allowing to contextualize tourism in social farming

Selected studies have been published since the year 2000 (García-Llorente *et al.*, 2018). Only peer-reviewed papers and book chapters published in English have been considered. At this stage, many studies treating tourism and SF separately emerged. Selection choice shrinks to those treating tourism as a key element in SF, to allow contextualising reasons and dynamics of the phenomenon. Due to the low number of results matching the criteria (7 among articles and 1 book chapter), backwards and forward snowballing among the articles (Greenhalgh & Peacock, 2005) was implemented. To do so, guidelines from Wohlin (2014) were followed and 10 new contributions were added, after being revised.

Data collected were synthesised and clustered into RQ1, RQ2 and RQ3 through the means of qualitative meta-analysis (Levitt, 2018), which allows considering information proceeding from independent studies and applying a thematic analysis to reveal the attributes and reasons of phenomena (Gibbs, 2007; Levitt, 2018; Saldaña, 2013). An overview is provided in Annex B.

3. Results

Research includes nineteen scientific articles and one book chapter (Kmita-Dziasek, 2017), distributed over ten years (2011 to 2021) and reported from both European and non-European countries (Chen *et al*., 2021; Chin & Pehin Dato Musa, 2021), while most of the literature originates from Italy (Chiara *et al*., 2019; Di Iacovo *et al*., 2014; Fazzi, 2011; Ferrara *et al*., 2023; Forleo & Palmieri, 2019; Gramm *et al*., 2019; Lanfranchi & Giannetto, 2014; Moruzzo *et al*., 2020; Nicolosi *et al*., 2021).

3.1. *Tourism in social farming: forms and aims*

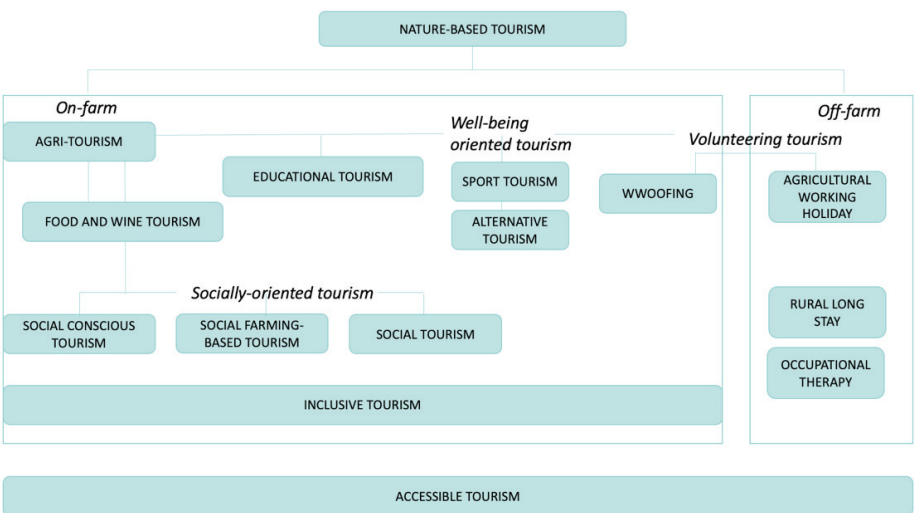
Literature on SF addresses tourism through different terminologies, like nature-based (Moriggi, 2020), inclusive (Ferrara *et al*., 2023) and accessible tourism (Calabrò *et al*., 2022). Often, it highlights *on-farm activities*, as the case of agri-tourism (Chiara *et al*., 2019; Chin & Pehin Dato Musa, 2021; Di Iacovo *et al*., 2014; Giannetto & Lanfranchi, 2021; Knapik, 2020; Moruzzo *et al*., 2020; Nicolosi *et al*., 2021), food and wine-based (Lanfranchi & Giannetto, 2014) and educational tourism (Forleo & Palmieri, 2019; Giannetto & Lanfranchi, 2021) but also *well-being oriented activities* such as sports (Giannetto & Lanfranchi, 2021) and alternative tourism (Chiara *et al*., 2019) or *volunteering* as WWOOFing (Giannetto & Lanfranchi, 2021) and agricultural working holidays (Chen *et al*., 2021). Specific terminologies related to *socially-oriented tourism* are also mentioned, both related to on-farm activities as the case of socially conscious agri-tourism (Tulla *et al*., 2014), social farming-based tourism (Kmita-Dziasek, 2017), or social tourism (Nicolosi *et al*., 2021) and *off-farm services*, as rural long-stay tourism and occupational therapy (Chen *et al*., 2021). Annex A provides an overview of the tourism forms and aims associated with SF.

Overall, "nature-based tourism" (Moriggi, 2020) serves as an umbrella term since it focuses on the core resource of SF projects. However, the term is used in the context of northern European countries, where natural resources are prominent and allow for immersive off-farm activities. Instead, when recreational services are developed on farm, they become an expression of the multi-functional nature of agriculture and the farm itself (Chiara *et al*., 2019; Chin & Pehin Dato Musa, 2021; Di Iacovo *et al*., 2014; Ferrara *et al*., 2023; Forleo & Palmieri, 2019; Giannetto & Lanfranchi, 2021; Gramm *et al*., 2019; Kmita-Dziasek, 2017; Knapik, 2020; Lanfranchi & Giannetto, 2014; Moruzzo *et al*., 2020; Nicolosi *et al*., 2021; Tulla *et al*., 2014). Indeed, "agritourism" refers both to "the act of involving visitors to a (social) farm" (Chiara *et al*., 2019, p.533) and the set of (agritourism) resources "partially unused during the year" (Di Iacovo *et al*., 2014, p.330) which can be employed for social activities (Di Iacovo

et al., 2014; Knapik, 2020). On-farm tourism becomes a source of farm income diversification (Ferrara *et al*., 2023; Forleo & Palmieri, 2019; Gramm *et al*., 2019; Kmita-Dziasek, 2017; Knapik, 2018, 2020). In this case, activities develop through the use of farm products for culinary (as in the case of "food and wine tourism" (Lanfranchi & Giannetto (2014)), or educational offers (Forleo & Palmieri, 2019; Giannetto & Lanfranchi, 2021; Gramm *et al*., 2019). Natural areas constitute a perfect environment for disseminating cultural and societal values (Ferrara *et al*., 2023; Forleo & Palmieri, 2019; Gramm *et al*., 2019; Moriggi *et al*., 2020), thus favouring people's learning and personal growth (Ferrara *et al*., 2023; Kmita-Dziasek, 2017). The educational aspect also drives the activities aimed at improving dietary and healthy lifestyles (Chiara *et al*., 2019; Giannetto & Lanfranchi, 2021), or the discovery of techniques for sustainable agriculture, as in the case of WWOOFing (Giannetto & Lanfranchi, 2021).

Moreover, according to Lanfranchi *et al*. (2015), the "social" activities address mostly marginalized people, not only as beneficiaries of a tourism offer based on specific needs but also as a legitimate tourism workforce (Ferrara *et al*., 2023). The benefits provided by the individual "inclusive farms" can be extended if the recreational offer is organized as a system, based on a network between public and other private actors (Ferrara *et al*., 2023). This is the case of the experience provided by Knapik (2018) who encourages the development of an 'educational social farm' system, or the one provided by Chen *et al*. (2021) related to a long-term care plan encompassing different tourism activities for seniors. A visual overview of forms and categories of tourism in SF is provided in the following Figure 2:

Figure 2 - An overview of tourism forms and categories related to SF



4. Towards a model to understand tourism in social farming as a form of social innovation

This section presents the results of the literature review, according to the three research questions proposed by the study to shed light on the socially innovative features of tourism in SF. In the end, a comprehensive framework is provided as a synthesis.

4.1. *RQ1: Which societal challenges does tourism in social farming face?*

Tourism in SF could respond to several societal needs, from the one for recreation to outmigration and depopulation; population ageing; social and work inclusion of the most fragile people; and a better urban-rural balance, which are strictly related to rural areas. The following sections will provide a detailed overview.

4.1.1. The need for recreation

Tourism in SF ensures an inclusive (Moriggi, 2020; Moriggi *et al.*, 2020) and safe access to nature (Chin & Pehin Dato Musa, 2021), whether this is a wild environment (Moriggi, 2020; Moriggi *et al.*, 2020) or managed by human activities (as in Lanfranchi & Giannetto, 2014). Indeed, farms are key assets for the development of rural tourism, by creating an offer that allows everyone to have a meaningful experience of the local products and rural culture but also creating a space for social integration of the most fragile groups (Lanfranchi *et al.*, 2015; Kmita-Dziasek, 2017). In this sense, the creation of targeted services for different needs allows for stimulating the accessibility of rural places (Calabrò *et al.*, 2022).

4.1.2. Outmigration and depopulation

Rural territories often suffer from depopulation and outmigration (Di Iacovo *et al.*, 2014; Knapik, 2018). Therefore, creating leisure activities can help the development of the local communities' sense of belonging, thus reinforcing the rural identity and stability (Knapik, 2018; Lanfranchi *et al.*, 2015). In particular, tourism activities in SF become relevant in very marginal territories where people's livelihoods are primarily dependent on agriculture and animal breeding since they can help creating new employment opportunities and avoid migration flows (Forleo & Palmieri, 2019; Gramm *et*

al., 2019). This positively influences the familiar cohesion, by allowing women to redeem employment on-farm, as well as favoring the generational turnover (Ferrara *et al*., 2023; Gramm *et al*., 2019).

4.1.3. Population ageing

Population ageing is an issue affecting the global context. Knapik (2020) describes the condition of isolation faced by elders in rural areas as a consequence of the depopulation process. By employing agritourism activities and infrastructure, SF provides them with basic assistance services (Chiara *et al*., 2019; Di Iacovo *et al*., 2014; Ferrara *et al*., 2023; Knapik, 2020) and guarantees support to their family (Knapik, 2020). Similarly, Chen *et al.* (2021) describe the massive Taiwanese retreat migration from urban places to rural territories. In this case, the authors focus on the creation of a destination aimed at rural community-based prevention in primary care, through a semi-residential offer enhancing the social potential of agriculture.

4.1.4. Social work inclusion

Developing a tourism offer in SF can support the creation of job opportunities for the commonly socially excluded groups (Fazzi, 2011; Ferrara *et al*., 2023; Moruzzo *et al*., 2020; Tulla *et al*., 2014). This is relevant in Mediterranean areas where working exclusion is among the most significant societal challenges faced by SF (Di Iacovo, 2020; Di Iacovo *et al*., 2014). Indeed, in these areas tourism can be easily combined with agriculture to provide job opportunities for different in-need people (Tulla *et al*., 2014; Ferrara *et al*., 2023), especially the ones with intellectual, physical disabilities or relational problems (Moruzzo *et al*., 2020). In doing so, social farms not only attract tourism flows to rural areas (Tulla *et al*., 2014) but, when organised in a systemic offer, they can produce positive impacts for inclusive economic growth (Ferrara *et al*., 2023).

4.1.5. Urban-rural balance and environmental sustainability

Natural resources are the foundations of recreational activities in both rural and peri-urban areas (Moriggi, 2020). Here, the provision of nature-based leisure services not only fosters the urban-rural relationships but also promotes the maintenance of natural landscapes (Kmita-Dziasek, 2017; Nicolosi *et al*., 2021), and limits the expansion of metropolitan centres to

the benefit of the surrounding areas. However, a coordinated plan should be designed to develop an array of basic services that enable the liveability of places otherwise vulnerable to uncontrolled displacement (Chen *et al.*, 2021). Table 3 provides an overview of the societal challenges that tourism in SF could help mitigate:

Table 3 - Contributions of tourism in SF to mitigating societal challenges

Societal challenges	**The role of tourism in social farming**
Need for recreation	a) provision of on-farm and off-farm activities b) inclusive and safe access to nature
Outmigration and depopulation	a) new employment opportunities b) familiar cohesion and community sense of belonging
Population ageing	a) targeted offer for senior assistance and support to their families b) Different use of agritourism resources
Social and working inclusion	a) employment opportunities for marginalised people b) inclusive economic rural growth
Rural-urban balance and environmental sustainability	a) improvement of the urban-rural relations, including urban surroundings b) natural landscapes maintenance c) coordinated rural-urban service plan

4.2. *RQ2. In which terms does tourism in social farming enhance society's capacity to act?*

Successful SF activities are developed from the collaboration of different societal actors (Di Iacovo *et al.*, 2014; Knapik, 2020). This review identifies the roles of government, entrepreneurs, civil society, and universities in supporting tourism in SF:

4.2.1. Governmental capacity to act

Having access to nature is a right. In some countries, governments institutionalise the universal right to nature and support the development of tourism activities (Moriggi *et al.*, 2020). At the same time, a legislative framework is also essential for the implementation of SF projects (Knapik,

2020; Lanfranchi *et al.*, 2015). However, legislative attention is essential to combine the two activities and provide safety measures for nature-based tourism, especially when related to the involvement of farm visitors in agricultural works (Ferrara *et al.*, 2023). Without a legal framework, governmental support for local initiatives becomes of the utmost importance to encourage and certify social projects (Kmita-Dziasek, 2017) or to structure a plan for social activities (Chen *et al.*, 2021). Finally, to ensure the sustainability of the social acitities in the long run, the literature suggests a stronger commitment from the public entities to finance recreational activities when addressed to the local communities (Gramm *et al.*, 2019; Knapik, 2020) as well as the training of personnel, together with the universities (Chin & Pehin Dato Musa, 2021).

4.2.2. Entrepreneurial capacity to act

Social entrepreneurs are essential for the social welfare growth (Lanfranchi & Giannetto, 2014; Lanfranchi *et al.*, 2015; Lanfranchi & Giannetto, 2014; Nicolosi *et al.*, 2021): in northern Europe (Moriggi *et al.*, 2020), they are driven by a strong commitment to guaranteeing universal access to nature. Instead, in Mediterranean countries social tourism is used to guarantee a diversified stream of revenues to the farm, to be reinvested in social projects (Di Iacovo *et al.*, 2014; Ferrara *et al.*, 2023; Forleo & Palmieri, 2019), by engaging rural communities and addressing the need for social and working inclusion of disadvantaged people (Fazzi, 2011; Tulla *et al.*, 2014; Ferrara *et al.*, 2023). In both cases, farmers become the bearers of nature-based knowledge and values to be shared with visitors (Forleo & Palmieri, 2019; Moriggi *et al.*, 2020).

4.2.3. Civil society's capacity to act

Tourism in SF can foster agency in civil society, which is intended as the physical association of people. Two experiences are described in the literature: the first one is an educational initiative in Italy, called 'School on the Farm', born from a women's farmer association, to employ skills and knowledge to provide educational and cultural services on farm (Gramm *et al.*, 2019). The second one is about a Catalan social cooperative founded by young people who decided to move to a rural area to oppose a massive urban migration movement. They used rural tourism to allow the social integration of disadvantaged people, thus providing an "economically viable, socially just and environmentally sustainable" experience (Tulla *et al.*, 2014, p. 48).

4.2.4. University's capacity to act

Universities play a key role in social and territorial development (Di Iacovo *et al.*, 2014). In particular, their contribution to the development of tourism in SF could be associated with the action-research or participatory action-research activities (Di Iacovo *et al.*, 2014). Indeed, through field studies, researchers can help to identify the social needs of communities and match them with the available resources (Di Iacovo *et al.*, 2014; Knapik, 2020) to facilitate the design of individual social projects or entire systemic plans (Di Iacovo *et al.*, 2014; Chen *et al.*, 2021; Knapik, 2018). Especially in the absence of regulations, universities can facilitate the multi-stakeholder dialogue, thus fostering inter-sectoral collaboration and becoming an accelerator of the SI (Di Iacovo *et al.*, 2014).

Table 4 provides a comprehensive overview of the societal actors' agency stimulated by tourism in SF:

Table 4 - An overview of the societal actors' agency stimulated by tourism in SF. Author's elaboration from the literature reviewed

Societal actor	Actors' agency
Governments	a) to protect the right to nature, and support nature-based experiences b) to support activities in social farming contexts c) to provide safety laws to access nature d) supporting the design of a systemic offer plan e) to support the training activities for personnel for tourism in SF f) to provide financial support for recreational activities addressed to local communities
Businesses	a) to support economic farm profitability b) to ensure universal access to nature c) to create inclusive employment opportunities c) to share rural and nature-based knowledge and values
Civil society	a) to counteract unsustainable social phenomena b) to enhance community's skills and knowledge for education
Universities	To support the design of a systemic offer plan through: • research (combining needs with available resources) • multi-actor dialogue facilitation • workforce training

4.3. *RQ3. Which social relations or collaborations does tourism in SF create?*

Tourism in SF can create a socially innovative ecosystem, within by the relations among government, universities, businesses, and civil society. In Mediterranean areas, where SF projects experience limited governmental intervention (Di Iacovo, 2020; Di Iacovo *et al*., 2014), the relationships established among farmers, public administrations, citizens, and local producers (Fazzi, 2011; Ferrara *et al*., 2023), are essential for social entrepreneurs to ensure the viability of their social projects (Ferrara *et al*., 2023). In turn, the more relationships they establish with the territory, the more opportunities they will have to diversify their portfolio of activities (Nicolosi *et al*., 2021; Tulla *et al*., 2014).

In general, the organisation of tourism in SF requires collaboration among therapists, instructors, educators, consultants, and farmers (Kmita-Dziasek, 2017; Lanfranchi *et al*., 2015). However, depending on the service offered by the farms, the literature suggests different types of relations: for services dedicated to the elderly, actors from the health and medical sector (Chen *et al*., 2021), local associations, as well as nutritionists and agronomists for a specific culinary offer are needed (Chiara *et al*., 2019). When the tourism service is organised in the context of educational farms, collaboration may integrate schools, and associations of local farmers, to enable the development of farm visits for children (Forleo & Palmieri, 2019; Gramm *et al*., 2019). Forleo and Palmieri (2019) also identify the need to extend collaborations to accommodation businesses and other food industries to develop tourism offers for the general public. Networking with transport agencies is generally suggested (Chen *et al*., 2021; Knapik, 2020; Moriggi *et al*., 2020), together with engaging with tourism, cultural and natural sites (Forleo & Palmieri, 2019; Tulla *et al*., 2014). Table 5 provides an overview of the roles and relations among different societal actors fostered by tourism in SF:

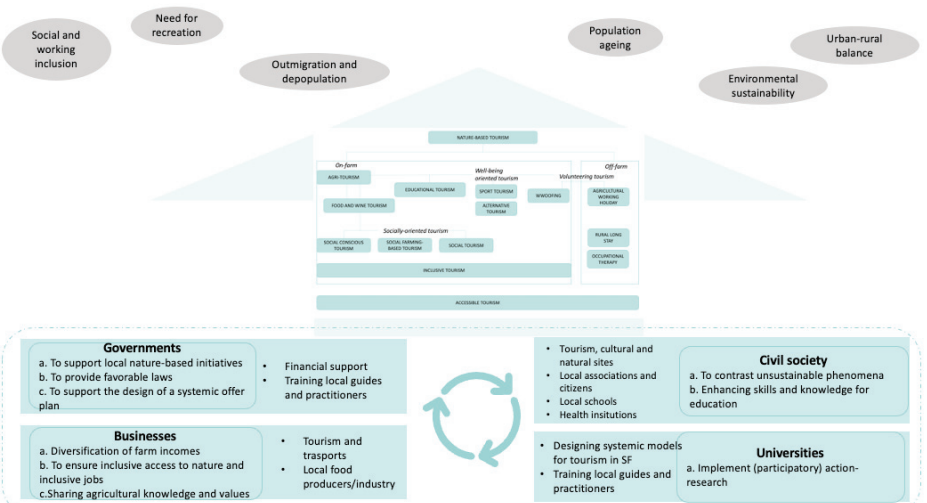
Table 5 - Relations fostered by tourism in social farming. Author's elaboration on the literature reviewed

Businesses	**Civil society and other institutions**	**Government**	**Universities**
• Tourism and transports • Local food producers and industries • Agritourism and accommodation	• Tourism, cultural and natural sites • Local associations and citizens • Local schools • Health institutions/ workers	• Financial support to bottom-up initiatives • Training local guides and practitioners • Designing systemic models for tourism in SF	• Designing systemic models for tourism in SF • Training local guides and practitioners

←→

The following Figure 3 presents a comprehensive framework to understand tourism in SF as a form of SI. Based on the literature reviewed, the upper part of the figure shows the societal challenges mitigated by tourism in SF. In the lower part of the figure, the actors involved in this process are presented in relation to the motivations for intervention, the roles assumed, and their capacity to generate relations within the territory.

Figure 3 - A comprehensive framework to understand tourism in social farming as a form of social innovation. Authors' elaboration based on the literature reviewed



Conclusions

There is an increasing need to ensure inclusive rural development (European Commission, 2021). In this context, where tourism is known to have a key role in promoting economic growth, the current debate about making it a sustainable activity advocates the need for socially innovative practices which could contribute to enhancing community participation and social inclusion (Booyens, 2022). The foundations of this study lie in the well-established field of SF as a form of SI in rural areas (Di Iacovo *et al.*, 2014). Indeed, the most recent studies on the topic emphasise the potential of tourism activities developed in this context to foster accessible services in rural areas (Calabrò *et al.*, 2022) and, more generally, their inclusive economic development (Giannetto & Lanfranchi, 2021; Ferrara *et al.*, 2023). Therefore, the present study was aimed at systematising the scientific literature on the topic and

analysing the socially innovative nature of the phenomenon, by answering three specific questions: What social challenges does tourism in SF respond to? In which terms does it enhance social actors' agency? Which social relations or collaborations does it create? The result, which combines perspectives on the recreational aspects of the activities with those related to the organisation of a tourism offer in non-urbanised areas, highlights the role of agriculture as a place of socially relevant value for our societies.

The present study has, first and foremost, a theoretical contribution as it frames tourism in SF as a form of SI, by highlighting the reasons, interventions, and collaborations that this can generate for the specific purpose, thus extending the aims previously explored in the field (see Di Iacovo *et al.*, 2014). At the same time, the study also has some practical contributions since it provides key elements for the construction of a recreational offer in the context of SF for those territories where tourism is considered an asset for socio-economic development.

However, the literature considered in this study is a contribution from different regions of the world. Although this helped to provide a broad overview of the variables characterising the phenomenon, it does not allow for generalisation of the results. Therefore, further research directions are suggested for the future: the first lies in the application of the evidence-informed knowledge generated by this review (Tranfield *et al.*, 2003), in territories where tourism can be an asset. The author is aware of the fruitful grey literature emerging on the topic, also due to the proliferation of related funded projects. Although this was not considered among the criteria of this review, grey literature could be a source of additional information for further cases to be analysed in the future. Furthermore, since leisure studies have extensively analysed the topic, a further line of investigation concerns the organisation of tourism activities as part of a rural destination, by highlighting their managerial aspects, as well as the impacts generated on both the supply and the demand side.

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Conflicts of interest

The author declares no conflict of interest.

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Annex A - Forms and aims of tourism associated to SF. Data collected from the literature reviewed

Forms tourism in SF	Definition	Source
Nature-based tourism	Recreational activities aiming to promote well-being for all.	(Moriggi, 2020)
Accessible tourism	Tourism and hospitality services aimed to overcome social, cultural, gender and disability barriers	(Calabrò *et al.*, 2022)
Inclusive tourism	Activities for the inclusion of the most marginalized groups, both as target of the tourism offer, and tourism workforce	(Ferrara *et al.*, 2023)
Agri-tourism	Multifunctionality of farm and agriculture for the creation of social and working services	(Chiara *et al.*, 2019; Di Iacovo *et al.*, 2014; Moruzzo *et al.* 2020; Knapik, 2020; Chin *et al.*, 2021; Nicolosi *et al.*, 2021; Giannetto & Lanfranchi, 2021)
Food and wine-based tourism	Activities enhancing farm products and addressed to the general visitors, while providing farm economic diversification	(Lanfranchi & Giannetto, 2014)
Educational tourism	Activities based on disseminatig the rural values and mainly addressed to children, young people, and families	(Forleo & Palmieri, 2019; Giannetto & Lanfranchi, 2021)
Sport tourism	Activities aiming at encouraging a healthy lifestyle in a rural scenario	(Giannetto & Lanfranchi, 2021)
Alternative rural tourism	Activities based on the needs of visitors, with the aim of encouraging a healthy diet and lifestyle	(Filomena *et al.*, 2019)
WWOOFing	Volunteering tourism directed to visitors seeking knowledge about the organic farming and the rural world	(Giannetto & Lanfranchi, 2021)
Agricultural working holidays	Volunteering tourism for seniors, aiming at seeking spiritual growth and fulfilment	(Chen *et al.*, 2021)
Socially conscious agritourism	Recreational activities aimed at improving the quality of life of vulnerable people	(Tulla *et al.*, 2014)

Annex A - continued

Forms tourism in SF	Definition	Source
Social farming-based tourism	Activities intersecting health and education sectors, and the labour market, aiming at maximizing nature's benefits to human being	(Kmita-Dziasek, 2017)
Social tourism	Activities for the social inclusion of the most marginalized people, created from the wellness services and rural well-being vocation of farms	(Nicolosi *et al.*, 2021)
Rural long-stay tourism	Attracting senior city residents to rural areas, by offering nature-based services	(Chen *et al.*, 2021)
Occupational therapy	Nature-based tourism for resident senior, including gardening, eco-therapy, and green exercise	(Chen *et al.*, 2021)

Annex B - Thematic data analysis (adapted from Levitt, 2018; Gibbs, 2007; Saldaña, 2013)

RQ	Theme		Sub-theme		Code	Source of the information
RQ1	Need for recreation	←	Space for recreation	←	On-farm activities	(Lanfranchi *et al*., 2015; Lanfranchi & Giannetto, 2014)
					Off-farm activities	(Moriggi, 2020; Moriggi *et al*., 2020)
			Inclusive right to nature		Safe access to nature	(Chin & Pehin Dato Musa, 2021)
					Inclusive access to nature	(Moriggi, 2020; Moriggi *et al*., 2020)
				←	Rural accessibility	(Calabrò *et al*., 2022)
					Inclusive tourism offers	(Ferrara *et al*., 2023; Lanfranchi *et al*., 2015; Kmita-Dziasek, 2017)
	Outmigration and depopulation	←	Need for basic services in rural areas			(Di Iacovo *et al*., 2014; Knapik, 2020)
			Rural identity and stability	←	Community sense of belonging	(Knapik, 2018; Lanfranchi *et al*., 2015)
			New employment opportunities		New on-farm work opportunities	(Forleo & Palmieri, 2019)
				←	Opportunities for women	(Gramm *et al*., 2019)
					Generational turnover	(Ferrara *et al*., 2023; Gramm *et al*., 2019)
	Population ageing	←	Seniors' needs	←	Need for rural activities in retirement	(Chen *et al*., 2021)
				←	Condition of isolation in rural areas	(Di Iacovo *et al*., 2014; Knapik, 2020)
			Senior assistance	ß	Employment of agritourism resources	(Chiara *et al*., 2019; Di Iacovo *et al*., 2014; Ferrara *et al*., 2023; Knapik, 2020)
				←	Family support	(Knapik, 2020)
	Social-working inclusion	←	Need for work inclusion			(Fazzi, 2011; Tulla *et al*., 2014)
		←	Job creation for socially-work excluded people	←	Categories involved in social-working inclusion	(Fazzi, 2011; Moruzzo *et al*., 2020; Tulla *et al*., 2014)
				ß	Networking as a means for inclusive economic rural growth	Ferrara *et al*., 2023; Tulla *et al*., 2014

Annex B - continued

RQ	Theme		Sub-theme		Code	Source of the information
	Urban-rural balance and environmental sustainability	←	Design of a coordinated service plan			(Chen *et al*., 2021)
		←	Urban-rural relations	←	Maintenance of natural landscapes	(Kmita-Dziasek, 2017; Nicolosi *et al.*, 2021)
				←	Recreation in urban surroundings	Moriggi, 2020)
				ß	Fostering urban movements towards rural areas	(Kmita-Dziasek, 2017)
RQ2	Governmental capacity to act		Support the design of systemic offer plan			(Chen *et al*., 2021)
		←	Recognition and support to initiatives in rural territories	←	Recognition and support of social projects	(Kmita-Dziasek, 2017)
				←	Institutionalisation of the universal right to the nature	(Moriggi, 2020)
		←	Provision of legislative frameworks	←	Legislative framework for SF projects	(Knapik, 2020; Lanfranchi *et al*., 2015)
				←	Legislative framework to allow tourism activities in SF	(Ferrara *et al.*, 2023)
		←	Additional interventions needed	←	Financial support of activities for local communities	(Gramm *et al*., 2019; Knapik, 2020)
				←	Personnel training	(Chin & Pehin Dato Musa, 2021)
						(Gramm *et al*., 2019)
	University capacity to act	←	(Participatory) action-research	←	Preliminary research (needs and resources)	(Chen *et al.*, 2021; Di Iacovo *et al.*, 2014; Knapik, 2020)
				←	Multi-actor facilitation	(Di Iacovo *et al*., 2014)
				←	Support the design of a systemic offer plan	(Chen *et al.*, 2021(Di Iacovo *et al.*, 2014; Knapik, 2018)

Annex B - continued

RQ	Theme		Sub-theme		Code	Source of the information
	Entrepreneurial capacity to act	←	Support the social welfare growth			(Lanfranchi *et al.*, 2015; Lanfranchi & Giannetto, 2014; Nicolosi *et al.*, 2021)
		←	Ensuring inclusive tourism (access and workforce)	←	Ensure universal access to nature	(Moriggi *et al.*, 2020)
				←	Inclusive work opportunity provision	(Ferrara *et al.*, 2023; Fazzi, 2011; Tulla *et al.*, 2014)
				←	Economic profitability of farms	(Di Iacovo *et al.*, 2014; Ferrara *et al.*, 2023; Forleo & Palmieri, 2019)
				←	Sharing knowledge	(Forleo & Palmieri, 2019; Moriggi, 2020)
	Civil society capacity to act	←	Enhance community's skills and knowledge for educational purposes			(Gramm *et al.*, 2019)
		←	Counteract unsustainable movements			(Tulla *et al.*, 2014)
RQ3		ß	Social innovative ecosystem (government, universities, business, and civil society)			(Di Iacovo *et al.*, 2014; Fazzi, 2011; Kmita-Dziasek, 2017; Lanfranchi *et al.*, 2015)
		←	Greater networks, increased activity portfolio			(Nicolosi *et al.*, 2021; Tulla *et al.*, 2014)
	Services targeting seniors	←	Actors/sectors to involve in meaningful collaboration	←	Health and medical sector	(Chen *et al.*, 2021)
				←	Nutritionists and similar	(Chen *et al.*, 2021; (Chiara *et al.*, 2019; Knapik, 2020)
				←	Transport agencies	(Chen *et al.*, 2021; (Knapik, 2020; Moriggi, 2020)
				←	Local associations	(Chiara *et al.*, 2019)
	Service targeting children	←		←	Schools and farmers' associations	(Forleo & Palmieri, 2019)
				←		(Gramm *et al.*, 2019)
	General	←		←	Accommodation businesses and food industries	(Forleo & Palmieri, 2019 (Tulla *et al.*, 2014))
				←	Cultural and environmental bodies	

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Access to Technology to Increase Food Resilience in Rural Households in Indonesia

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Abstract

Food resilience is intricately linked to household standard of living, human development, and economic growth. Higher food expenditure not only signifies improved living standards but also provides households with the necessary energy and nutrition for daily activities. The integration of technology holds promise for bolstering food resilience among households. However, there exists a gap in understanding how technology can enhance household food resilience across different socio-economic classes, considering the diverse food expenditure patterns observed. This paper employs quantile regressions to examine the impact of technology on food resilience, accounting for heterogeneity across socio-economic classes. Utilizing data from the Indonesia Family Life Survey (IFLS) wave 5 dataset, our findings reveal varying effects of certain variables across different classes. Key contributors to food expenditure identified include income, household size, education, and engagement in agriculture as the primary source of employment. Consequently, policy interventions should prioritize expanding internet access for low-decile households residing in rural areas to effectively enhance food resilience.

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Introduction

Household food expenditure is associated with the living standard, allowing household members to have sufficient energy and nutrition to work, learn, and positively contribute to society (Kousar *et al*., 2017; Soseco *et al*., 2022). It is also assumed that a higher food budget can be associated with better access and more options for nutritious food at home (Beydoun *et al*., 2009).

Households can achieve food security through their ability to fulfil the nutritional needs of family members. Food security contributes to increasing labour productivity by allowing individuals to work for longer hours and in productive ways (Alderman *et al*., 2005; Huffman & Orazem, 2007; Wang & Taniguchi, 2003). Rising nutrition improves a population's skill level and reflects increased living standards, improving health standards, and altering time allocation decisions (Fogel, 2004; Huffman & Orazem, 2007). Further, food security is also an important aspect of poverty measurement because of its significant proportion, particularly in the poorest households, where expenditures on food contribute 73.6% to the poverty line value and the increase in food prices contributes 57.8% to the inflation rate (McCulloch & Timmer, 2008).

The issue of food security in Indonesia is important considering the stark difference between population groups, e.g., urban and rural, or by household quantiles (Badan Pusat Statistik, 2021). In March 2021, Indonesia's average monthly food expenditure per capita was about Rp.622,845 (US$43.65). Comparison between urban and rural shows household expenditure in urban areas that reached Rp.681,278 (US$47.74) per month, higher than in rural areas (Rp.545,942 or US$38.26 per month) (Badan Pusat Statistik, 2021). A comparison of food expenditure across classes shows that the poorest households, i.e., those in quantile 1, have the highest shares of food expenditure in March 2021, reaching 64.15%. Lower percentages were found in the next quantiles, where households in quantile 2 had 60.88%, households in quantile 3 had 57.85%, and those in quantile 4 had 54.05%. Lastly, the smallest proportion of food expenditure was in quantile 5, reaching 39.33% (Badan Pusat Statistik, 2021). Another finding shows the importance of rice as the main food commodity for most of the Indonesian population. In contrast, food expenditure is about 67%-72% for low-income households, 16%-26% of which is spent on rice (McCulloch & Timmer, 2008).

Using technology to improve food security gives many benefits, such as reducing associated costs related to nutrition education and knowledge sharing (Anerua & Azonuche, 2010; Brug *et al*., 2005; Neuenschwander *et al*., 2012). Another study shows that internet affects saving behaviour and households' expenditure patterns (Thaariq *et al*., 2012). Technology adoption can also improve the welfare of households in rural areas through increased

agricultural income and diversity of household diets (Muhaimin *et al.*, 2020). Further, the transformation of technological innovations will continue to be an essential driver of future agricultural growth, including greater use of crop varieties, machinery, and land/institutional reforms (Sutardi *et al.*, 2022).

Considering the need to integrate technology into the households' agriculture-related activities, further examination is needed to observe the impact of technology on different household classes. As found by some researchers, the heterogeneity across classes potentially gives variation in food expenditure, hence bringing different levels in diet quality, food diversity, nutrition access, and food security across classes (Bernstein *et al.*, 2002; Darmon & Drewnowski, 2008; Kant *et al.*, 1993; Pampel *et al.*, 2010; Wahlqvist & Specht, 1998).

This paper contributes to the literature investigating the role of technology in increasing nutrition levels, measured from food expenditure across household classes focusing on households in rural areas in Indonesia. We focus on some aspects contributing to households' food resilience in Indonesia, including technology, income, household size, education, and agriculture as main employment. To achieve the above purpose, we used quantile regression to determine the contributors to food expenditure across classes, shown by the relationship pattern between food expenditure as the dependent variable and its covariates. This approach can overcome the standard regression estimation limitations involving average values as it will not capture the possibility of controlling variables varying across classes and misinterpret the results.

The rest of this paper is structured as follows: section 2 presents a literature review of the potential determinants of differences in food resilience, and section 3 describes the methodology and data. Section 4 presents the result of the estimation and policy implications. Then, section 5 presents the conclusion and recommendations for future studies.

1. Literature review

A) Households' Food Expenditure

Neoclassical demand theory suggests that households attempt to maximise their consumption choices subject to preferences and resource constraints, where prices, income, and time constraints affect a household's decision on food expenditure (Fan *et al.*, 2007). Engel's Law, a 19th-century observation, states that as household incomes rise, the percentage of income spent on food decreases, and more money goes to other goods or services. This Law has been widely used to understand the global relationship between household income and food expenditure(Mulamba, 2022).

Additionally, studies have shown that household income, household size, and the age of the household head significantly affect food expenditure. These theories and findings provide valuable insights into the dynamics of household food expenditure patterns and their determinants (Ab *et al*., 2022; Yovo & Gnedeka, 2023).

Another study shows that food resilience refers to the ability of individuals, households, and communities to withstand and recover from shocks and stresses to their food security. It involves measuring and understanding the capacity to consistently access and utilise sufficient, safe, and nutritious food over time. Determinants of food resilience include factors such as socioeconomic status, access to resources, availability of infrastructure, and exposure to shocks (Upton *et al*., 2016).

As a composite index, the resilience index of households includes stability, social safety nets, access to public services, assets, income and food access, and an adaptive capacity. This conceptual framework treats resilience as latent and multidimensional, showing the ability of households to maintain their wellbeing in the face of shocks (Alinovi *et al*., 2010; Ronalia *et al*., 2023).

B) The Determinants of Food Resilience

Previous studies have identified some determinants of food resilience. Technology plays an important role in enhancing the resilience of food supply chains, where digital twin technology, in particular, has been identified as a key factor in improving the resilience and sustainability of food supply chains (Singh *et al*., 2023). In the context of short food supply chains (SFSCs), low-cost digital technologies have been found to support flexibility, collaboration, visibility, and agility, which are important resilience capabilities (Sun *et al*., 2022).

Adopting modern technology in agriculture can lead to high production rates and long-range food resilience in Indonesia(Widodo, 2007). Mobile phone use in the agricultural sector in Indonesia varies depending on farmers' location in their professional network, with conversion factors playing a significant role in achieving food resilience (Wahid & Furuholt, 2012). Mobile phone data-derived indicators also show high correlations (> .8) with food security variables like food or vegetable consumption expenditure in Indonesia (Decuyper *et al*., 2014). Mobile phone use and higher frequency of use are significantly and positively correlated with food access in Indonesia (Wantchekon & Riaz, 2019). Lastly, internet use has a negative effect on agricultural household food insecurity in Indonesia (Ardianti & Hartono, 2022).

Other determinants of household food expenditure in Indonesia are related to income, where higher-income households will have higher food consumption, which leads to higher food expenditure than households with lower incomes (Hafizah *et al*., 2021; Soseco, 2021; Syamola & Nurwahyuni,

2019). Moreover, in the agricultural sector, different land typologies will cause different farmland productivity, impacting household income and consumption(Ariani & Saliem, 2015). On the other hand, Faharuddin *et al*. (2019) observed that agricultural households in Indonesia spent more on buying rice than vegetables and fish, meaning that the consumption of carbohydrates and calories is dominated by less fat and protein, which is inverse to non-agricultural households. Another study by Irawan *et al*. (2006) found that the share of food expenditure to total household expenditure ranges from 61%-65%; the lowest expenditure came from the cocoa-based commodity agro-ecosystem, and the highest was in the rubber agro-ecosystem.

Some studies found the importance of women's role in managing the family's budget. Belotti *et al*. (2017) found that expenditure, age, and education will influence food budget management by women. A similar finding is found in Bertham *et al*. (2011), where women's participation in decision-making is important for the household. Moreover, Mulugeta (2009) found that women with higher education and better financial knowledge will participate in food budget management. Thus, women's involvement leads to higher nutrition consumption for family members to reduce the possibility of stunting (Belotti *et al*., 2017; Islam & Sim, 2021).

2. Method and data

2.1. *Method*

The method used in this paper is quantile regressions that can capture the interaction between variables across household classes that cannot be attained by using the standard regression model. The quantile regression model, first introduced in the seminal contribution by Koenker and Bassett Jr (1978) can be written as:

$$y_{it} = x'_{it}\beta_\theta + u_{\theta it} \text{ with} Quant_\theta(y_{it}|x_{it}) = x'_{it}\beta_\theta$$

where y_{it} is the dependent variable, x is a vector of regressors, β is the vector of parameters to be estimated, and u is a vector of residuals. $Q_\theta(y_{it}|x_{it})$ identifies the θ^{th} conditional quantile of y_{it} given x_{it}.

Using quantile regression offers resilience against outliers, comprehensively depicts the inherent connection, and delineates the entire conditional distribution (Koenker & Bassett Jr, 1978; Abrevaya & Dahl, 2008; Coad & Rao, 2011). Quantile regression serves as a remedy for the shortcomings of ordinary regression models. Unlike the average term provided by conventional

regression, quantile regression avoids offering an incomplete overview of distributions and concealing the fundamental relationship between independent and dependent variables (Abrevaya & Dahl, 2008).

Our analysis contrasted the outcomes with a linear regression model that neglects class heterogeneity. Additionally, we tested intra-cluster correlation to explore whether household food expenditure might be affected by existing correlations, with clusters defined as regions or islands.

2.2. *Data*

Data is obtained from the latest Indonesian Family Life Survey (IFLS) of wave 5 in 2014. The IFLS is the largest and longest ongoing longitudinal dataset that contains rich information regarding households' socioeconomic and health data that covers 21 years of observation (1993 to 2013) and interviewed 15,921 households living in 13 provinces in Indonesia. The IFLS 5 distinguishes respondents' location status, either urban or rural, which is beneficial for our study. In this research, the author(s) define rural and urban areas based on population density, economic activities (particularly agriculture), and geographical characteristics.

The dependent variable is household food expenditure, categorised as an expenditure from food bought by the family, equivalent expenditure from own food production, and total food expenditure. Food expenditure in this research is aimed at measuring food availability in the family, instead of commodities' quantity, to anticipate food prices in Indonesia that are relatively fluctuating and high or unaffordable for some household groups (McCulloch & Timmer, 2008).

The independent variables relate to household characteristics that potentially influence food expenditure. The first aspect is related to the household economy, which is measured by income and employability. The second aspect is demography, which covers information on household size. A household head's education is defined as the accumulation of length of study from school grades, where a household head who has elementary schools (SD) as their highest education is appointed has six years education, junior high school (SMP) is equivalent to 9 years of education, senior high school (SMA) is 12 years of education, college/bachelor is 16 years of education, master degree is 18 years of education, and a doctoral degree is 22 years of education), and household's decision-maker. The third aspect is location, observed whether the household lives in urban or rural, the household has safe drinking water sources (obtained from pipe water, well/pump, well water, and spring water, and the household has electricity). The fourth aspect is related to technology, measured by internet penetration. Table 1 shows the descriptive statistics of variables.

Table 1 - Descriptive Statistics

Variable	Mean	Std. Dev.
Households' food expenditure (Rp)(per week)	356,320.50	311,399.00
Households' production food expenditure (Rp) (per week)	65,917.45	94,732.63
Households' total food expenditure (Rp) (per week)	422,238.00	337,317.60
Households' income (Rp.×1,000,000)(per year)	26,30	48,80
Households size	3.68	1.80
	Freq.	**Per cent**
Households live in rural	6,339	39.82
Household heads sex is male	11,227	70.52
Household heads have no education	5,590	35.11
Household heads' education is elementary (SD)	3,645	22.89
Household heads' education is in junior high school (SMP)	1,912	12.01
Household heads' education is senior high school (SMA)	3,136	19.7
Household heads' education is college/undergraduate	1,543	9.69
Household heads' education is post-graduate	95	0.6
Household heads' primary activity is working	9,992	62.76
Households have safe drinking water sources	14,772	92.78
Households have electricity	15,058	94.58
Households head employment in agriculture	2,676	16.81
Decision-maker is husband	1,325	8.32
Decision-maker is wife	4,440	27.89
Internet availability	3,187	29.31

Source: Analysed by authors.

The average total food expenditure for households in Indonesia in 2014 was Rp.422,238.00, or about US$ 29.59 per week. There was a large gap between food expenditure bought and own produced, where the food expenditure bought (Rp.356,320.50 or US$ 24.97 per week) was far above the food expenditure own produced by the households (Rp.65,917.45 or US$4.61 per week) (see Table 1). The slight variation in food causes this large gap in production, where households commonly plant staple foods, e.g., rice, vegetables, and fruits, which have low prices, and consume processed food with higher prices.

Based on demographic characteristics, the average household size in Indonesia in 2014 was 3.68. Less than half of the population lives in rural areas (39.82%), while the rest live in urban areas. Approximately 16.81% of households have agriculture as their primary source of income, and only 29.41% of households can access the internet (Table 1).

3. Results

3.1. *Food Expenditure Across Classes*

The distribution of food expenditure across classes shows household food expenditure has a positive association with their classes, where the higher the classes (the more income or wealthier the household is), the more their food expenditure. Comparison across classes shows households in the lowest percentiles (percentiles 1-10) in rural areas have Rp.43,180.71per week of food expenditure (about US$2.87), and the wealthiest households (who are in percentiles 90-100) spent Rp.1,032,212.00(US$68.81) per week for food expenditure.

Table 2 - Food Expenditure Across Classes, 2014

Percentiles	Food Expenditure		Own Production Food Expenditure		Total Food Expenditure	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Urban						
1-10	17,945.47	1,781.72	0.00	(omitted)	37,277.45	2,796.73
10-20	112,466.70	2,553.07	0.00	(omitted)	159,191.90	2,645.75
20-30	176,076.50	2,469.77	1,341.68	223.37	226,534.20	2,557.12
30-40	231,460.60	2,508.28	9,062.41	423.64	280,795.20	2,457.68
40-50	285,195.30	2,627.35	19,357.65	541.72	336,767.50	2,897.01
50-60	344,226.40	3,308.92	33,712.38	858.10	401,435.70	3,459.02
60-70	416,882.80	3,698.26	53,049.40	1,051.55	480,825.60	4,308.82
70-80	512,439.80	4,719.38	79,931.43	1,402.98	583,833.60	4,897.86
80-90	657,265.30	6,592.11	123,127.90	1,973.17	739,823.30	7,079.99
90-100	1,121,623.00	17,836.38	282,186.90	5,974.25	1,230,867.00	18,839.13
Rural						
1-10	18,554.90	1,721.21	0.00	(omitted)	43,180.71	2,864.92
10-20	88,161.30	2,345.77	2,786.17	308.25	142,452.30	2,744.36
20-30	139,984.60	2,539.60	12,200.58	572.20	198,124.40	2,616.20
30-40	183,907.50	2,294.55	24,496.49	780.99	247,084.20	2,737.44
40-50	227,257.10	2,848.83	39,378.17	995.82	293,638.30	2,932.18
50-60	275,408.30	3,017.49	56,345.51	1,026.47	346,519.60	3,369.91
60-70	333,129.20	3,830.70	75,853.72	1,267.11	408,905.70	4,256.92
70-80	408,273.30	4,613.75	101,509.00	1,557.76	495,488.70	5,242.38
80-90	527,110.00	6,659.02	144,237.20	2,584.40	629,361.10	7,257.79
90-100	889,233.20	17,068.78	289,140.50	6,614.96	1,032,212.00	19,304.54

Food expenditure has a larger proportion than own production food expenditure in urban and rural areas. In urban areas, households in percentiles 1-10 and 10-20 have zero value in their food production while

still maintaining the consumption of food bought by the household. This condition reflects limited resources for the poorest households to produce food, e.g., limited land area, limited capital, or knowledge, resulting in the inability to grow staple foods like fruits and vegetables. Hence, buying food products is the only way to solve the family's food demand. In contrast, only percentiles 1-10 in rural areas cannot grow their food production, resulting in zero value in their food expenditure. This condition indicates the benefits of living in rural areas, as relatively abundant land allows most households to produce food than their counterparts in a similar class in urban areas.

Table 3 shows the differences in food expenditure between urban and rural Indonesia. In 2014, households in rural areas had lower total food expenditure than urban households except for percentiles 1-10. This condition is shown by the ratio of total food expenditure in rural households in Table 3 Column 6, which is approximately 15% lower than in urban households. Low-income rural households might influence this condition, which limits their ability to buy food as much as urban households.

A comparison of bought and own-produced food in Table 3 shows contrary findings where rural households in all classes except the poorest class have lower food expenditure than urban households. At the same time, rural households in all classes except the highest class consume own-produced food more than urban households. This condition might be relevant to sources abundant in rural areas that allow most households to produce food.

Table 3 - The Difference in Total Food Expenditure between Urban and Rural

Percentiles	Food Expenditure		Own Production Food Expenditure		Total Food Expenditure	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
0-10	1.034	0.140	1.213	0.062	1.158	0.116
10-20	0.784	0.027	1.265	0.053	0.895	0.023
20-30	0.795	0.018	1.335	0.046	0.875	0.015
30-40	0.795	0.013	1.317	0.042	0.880	0.012
40-50	0.797	0.012	1.260	0.035	0.872	0.011
50-60	0.800	0.012	1.200	0.028	0.863	0.011
60-70	0.799	0.012	1.137	0.027	0.850	0.012
70-80	0.797	0.012	1.080	0.022	0.849	0.011
80-90	0.802	0.013	1.048	0.026	0.851	0.013
90-100	0.793	0.020	0.953	0.031	0.839	0.020

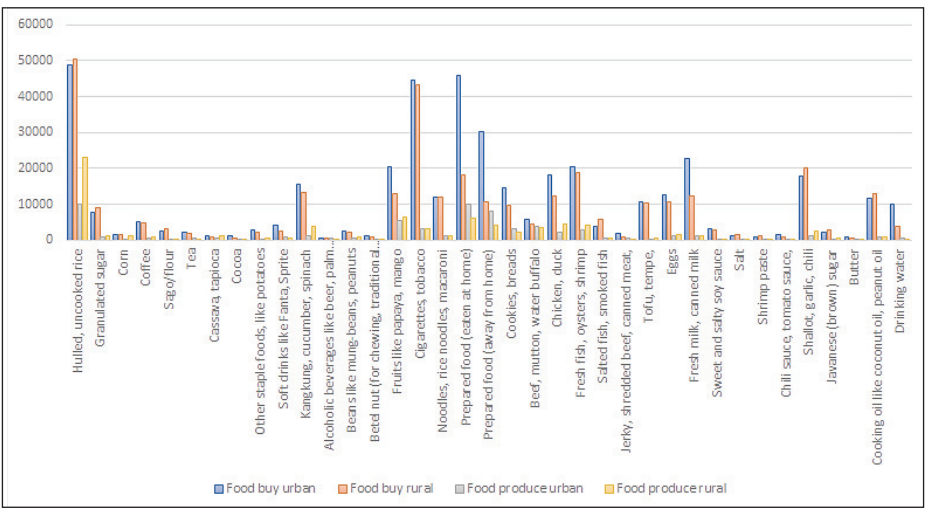
Note: This contrasts with respect to households in urban areas.

Source: analysed by authors

However, attention should be focused on the poorest households (percentiles 1-10) as even though they have higher food expenditure than urban households, this does not necessarily mean high quality of food as they tend to consume more staple foods mainly consisting of carbohydrates and less diverse food as well as increased consumption on tobacco. While the wealthiest households tend to consume more meat, snacks, and dried food (Pangaribowo & Tsegai, 2011).

Looking at the differences in the expenditure on food bought and own food production between rural and urban households, the higher the classes, the lower the differences (See Table 3). This condition might be caused by different food consumption patterns where low-class households prioritise food purchases over non-food expenses like education, health, or entertainment (Crotty *et al.*, 1992; Hymans & Shapiro, 1976). Besides, it is also associated with a high proportion of food expenditure relative to their low income, where food costs account for 60-80% of low-income households' entire income (Maxwell *et al.*, 2000; Ruel *et al.*, 1998). This condition is also supported by government subsidies mainly for low-income families, e.g., a cash transfer program/ BLT or rice for poor households/ Raskin, which can increase households' income but is mainly allocated to buy food (Rinukti, 2018; Satriawan & Shrestha, 2018).

Figure 1 - Food Commodities Urban and Rural, 2014



Source: Analysed by authors.

Our findings also show the variety of own-produced food products consumed by rural households are stapled food (rice, sugar, corn, coffee, cassava, potato), vegetables (kangkong, cucumber, mung-beans, betel nut), fruits (papaya, mango, banana), poultry (chicken, duck), eggs, spices (shallot, garlic, chili, candle nuts). Since those products require a large land area to grow, FAO (2018) explained that land area is one beneficial factor that allows rural households to improve access to a greater food supply, bringing increased quantity and variety of food for family members.

On the other hand, households in urban areas consume bought food more than rural households, mainly processed food commodities, e.g., tea, cocoa, cigarettes, tobacco, noodles, cookies, bread, meat from cattle (beef, mutton, water buffalo, jerk, shredded beef, canned beef), milk (fresh milk, canned milk), and butter (see Figure 1).

3.2. *The Determinants of Food Expenditure in Households in Rural Areas*

Table 4 shows the linear regression to find the determinants of food expenditure, own production food expenditure, and total food expenditure that ignores the heterogeneity across classes. From the base model (columns 2-4), some significant contributors to food expenditures are income, household size, rural living, and education. When we add variables of agriculture as the main employment sector and internet access, those variables significantly affect food expenditure components (see Table 4).

The role of agriculture and internet access on households' food expenditure is relevant to previous studies that show agricultural households who have internet access have better living conditions, e.g., in income terms than other households who lack internet access (Khanal & Mishra, 2013).

Since the results from Columns 2-10 in Table 4 show the effect of the determinants on households' food expenditure, lacking information on the impact of variables on different classes, either in low, middle, or high classes, the findings potentially hide the influence variables in each class.

We then test for the existence of intra-cluster correlation as it might influence the variations in the variables by using a procedure by Parente and Santos Silva (2016) and using provinces as clusters. The null hypothesis is that there is no intra-cluster correlation. Table 5 shows that each decile has a probability of 0.000. Hence, we cannot reject the null hypothesis of no intra-cluster correlation. Therefore, there is no intra-cluster correlation.

Table 4 - The Influence of Variables on Households'Food Expenditure in Rural Areas

	Food Exp.	**Own Production Food Exp.**	**Total Food Exp.**	**Food Exp.**	**Own Production Food Exp.**	**Total Food Exp.**	**Food Exp.**	**Own Production Food Exp.**	**Total Food Exp.**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln income	0.059***	0.042**	0.05***	0.056***	0.045**	0.048***	0.055***	0.044**	0.047***
	(0.011)	(0.019)	(0.009)	(0.011)	(0.019)	(0.009)	(0.011)	(0.019)	(0.009)
Households size	0.177***	0.056***	0.151***	0.176***	0.055***	0.151***	0.178***	0.057***	0.153***
	(0.008)	(0.013)	(0.006)	(0.008)	(0.013)	(0.006)	(0.008)	(0.013)	(0.006)
Household heads' s ex is male	–0.014	–0.041	–0.027	–0.003	–0.054	–0.021	0	–0.052	–0.018
	(0.044)	(0.074)	(0.035)	(0.044)	(0.074)	(0.035)	(0.044)	(0.074)	(0.035)
Household head's years of schooling	0.028***	0.013***	0.026***	0.03***	0.011**	0.027***	0.026***	0.008	0.023***
	(0.003)	(0.005)	(0.002)	(0.003)	(0.005)	(0.002)	(0.003)	(0.005)	(0.003)
Household heads' primary activity is working	0.023	0.012	0.004	0.029	0.004	0.007	0.029	0.004	0.008
	(0.044)	(0.073)	(0.036)	(0.044)	(0.073)	(0.036)	(0.044)	(0.073)	(0.036)
Households have safe drinking water sources	0.143**	–0.068	0.062	0.13**	–0.054	0.054	0.128**	–0.055	0.052
	(0.058)	(0.094)	(0.047)	(0.057)	(0.094)	(0.047)	(0.057)	(0.094)	(0.046)
Households have electricity	–0.173*	–0.094	–0.095	–0.191*	–0.077	–0.104	–0.19*	–0.076	–0.103
	(0.101)	(0.167)	(0.08)	(0.101)	(0.167)	(0.08)	(0.101)	(0.167)	(0.08)
Decision-maker is wife	0.037	–0.056	0.009	0.07**	–0.096*	0.028	0.073**	–0.095*	0.031
	(0.029)	(0.049)	(0.023)	(0.03)	(0.05)	(0.024)	(0.03)	(0.05)	(0.024)
Household heads' employment in agriculture				–0.145***	0.163***	–0.082***	–0.13***	0.176***	–0.065***
				(0.028)	(0.046)	(0.022)	(0.028)	(0.047)	(0.023)
Households can access internet							0.114**	0.093	0.131***
							(0.045)	(0.077)	(0.037)
Constant	10.653***	10.041***	11.233***	10.736***	9.951***	11.279***	10.745***	9.957***	11.29***
	(0.206)	(0.34)	(0.165)	(0.206)	(0.341)	(0.166)	(0.206)	(0.341)	(0.165)
R-squared	0.166	0.010	0.183	0.173	0.014	0.186	0.174	0.015	0.189
Number of observations	3,507	3,192	3,523	3,507	3,192	3,523	3,507	3,192	3,523
F-statistics	87.19	4.22	98.35	81.11	5.17	89.21	73.74	4.80	81.84

Note: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Parentheses refer to robust standard error. Estimated using standard regression model.

Source: Analysed by authors.

Table 5 - Parente-Santos Silva test for intra-cluster correlation

Deciles	**T**	**P > T**
1	16.461	0.000
2	30.191	0.000
3	40.956	0.000
4	45.853	0.000
5	43.568	0.000
6	34.431	0.000
7	34.059	0.000
8	27.997	0.000
9	13.229	0.000

Source: Analysed by authors.

Tables 6-8 show estimations from quantile regressions for households' food expenditure in rural areas to show the effect of variables on different percentiles or classes. Results in Tables 6-8 show that some variables have a different effect for low, middle, or higher classes that cannot be obtained from regression, which ignores heterogeneity across classes in Table 4.

Table 6 - Quantile Regression for Household Food Expenditure in Rural Areas

	Deciles								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Ln income	0.058**	0.075***	0.072***	0.074***	0.064***	0.061***	0.044***	0.042***	0.029**
	(0.023)	(0.016)	(0.013)	(0.013)	(0.012)	(0.012)	(0.013)	(0.013)	(0.012)
Households size	0.227***	0.194***	0.18***	0.172***	0.158***	0.154***	0.146***	0.137***	0.119***
	(0.015)	(0.009)	(0.008)	(0.007)	(0.008)	(0.007)	(0.009)	(0.007)	(0.006)
Household heads' sex is male	0.219	–0.031	–0.005	–0.027	–0.06	–0.035	–0.043	–0.117**	–0.071**
	(0.143)	(0.072)	(0.052)	(0.058)	(0.05)	(0.037)	(0.058)	(0.06)	(0.031)
Household head's years of schooling	0.033***	0.036***	0.031***	0.024***	0.024***	0.019***	0.019***	0.023***	0.018***
	(0.006)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)
Household heads' primary activity is working	0.123	0.019	0.014	0.012	–0.014	0	0.054	0.092**	0.095*
	(0.084)	(0.076)	(0.061)	(0.052)	(0.043)	(0.04)	(0.048)	(0.043)	(0.054)
Households have safe drinking water sources	0.318	0.186**	0.154	0.067	0.039	0.077	0.064	0.029	–0.007
	(0.2)	(0.088)	(0.116)	(0.077)	(0.065)	(0.055)	(0.072)	(0.097)	(0.08)
Households have electricity	–0.138	–0.159	–0.187	–0.161*	–0.078	–0.222	–0.159	–0.148	–0.09
	(0.206)	(0.191)	(0.148)	(0.097)	(0.093)	(0.158)	(0.141)	(0.133)	(0.065)
Decision-maker is wife	–0.194***	–0.156***	–0.099***	–0.094***	–0.101***	–0.105***	–0.136***	–0.152***	–0.152***
	(0.059)	(0.038)	(0.033)	(0.03)	(0.028)	(0.029)	(0.031)	(0.031)	(0.032)
Household heads'' employment in agriculture	0.157**	0.083**	0.058*	0.072**	0.028	0.013	0.015	0.035	0.004
	(0.062)	(0.039)	(0.034)	(0.03)	(0.029)	(0.03)	(0.034)	(0.032)	(0.033)
Household can access internet	0.086	0.023	0.089	0.11***	0.114**	0.132***	0.166**	0.155***	0.195***
	(0.086)	(0.063)	(0.054)	(0.042)	(0.048)	(0.044)	(0.067)	(0.05)	(0.06)
Constant	9.071***	9.745***	10.117***	10.426***	10.832***	11.146***	11.551***	11.868***	12.384***
	(0.455)	(0.324)	(0.27)	(0.231)	(0.219)	(0.246)	(0.255)	(0.253)	(0.212)
R-squared	0.118	0.113	0.101	0.093	0.086	0.083	0.079	0.076	0.075
Number of observations	3,507	3,507	3,507	3,507	3,507	3,507	3,507	3,507	3,507

Note: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Parentheses refer to robust standard error.

Source: Analysed by authors.

Table 7 - Quantile Regression for Household Food Production in Rural Areas

	Deciles								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Ln income	0.047	0.047	0.05*	0.033	0.02	0.013	0.035**	0.045**	0.058***
	(0.036)	(0.037)	(0.03)	(0.025)	(0.021)	(0.016)	(0.017)	(0.019)	(0.021)
Households size	0.007	–0.01	0.014	0.075***	0.075***	0.095***	0.094***	0.098***	0.075***
	(0.018)	(0.022)	(0.024)	(0.018)	(0.015)	(0.012)	(0.011)	(0.014)	(0.012)
Household heads' sex is male	–0.051	–0.026	–0.037	–0.046	0.022	–0.031	–0.087	–0.047	–0.03
	(0.159)	(0.109)	(0.119)	(0.094)	(0.075)	(0.078)	(0.073)	(0.08)	(0.069)
Household head's years of schooling	0.021**	0.007	0.014	0.008	0.002	0.005	0.009*	0.009*	0.006
	(0.01)	(0.01)	(0.009)	(0.007)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
Household heads' primary activity is working	0.06	0.234*	0.069	0.035	–0.026	–0.034	–0.029	–0.119	–0.055
	(0.108)	(0.139)	(0.142)	(0.104)	(0.084)	(0.079)	(0.07)	(0.079)	(0.105)
Households have safe drinking water sources	–0.039	–0.069	0.16	–0.053	–0.034	–0.013	0.014	–0.143	–0.119
	(0.251)	(0.108)	(0.12)	(0.161)	(0.117)	(0.073)	(0.094)	(0.136)	(0.103)
Households have electricity	0.059	–0.192	–0.104	0.124	0.156	0.062	0.035	–0.124	0.07
	(0.289)	(0.231)	(0.159)	(0.143)	(0.24)	(0.262)	(0.124)	(0.277)	(0.412)
Decision-maker is wife	0.312***	0.356***	0.309***	0.228***	0.136***	0.106***	0.083*	0.033	0.015
	(0.092)	(0.089)	(0.075)	(0.06)	(0.051)	(0.041)	(0.043)	(0.044)	(0.053)
Household heads' employment in agriculture	–0.143	–0.166*	–0.191**	–0.119*	–0.078	–0.064	–0.047	–0.048	–0.067
	(0.089)	(0.094)	(0.085)	(0.065)	(0.055)	(0.043)	(0.047)	(0.045)	(0.054)
Household can access internet	–0.328**	0.056	0.045	0.147	0.154*	0.128*	0.102	0.135	0.296***
	(0.141)	(0.176)	(0.128)	(0.108)	(0.082)	(0.069)	(0.069)	(0.11)	(0.082)
Constant	8.165***	9.04***	9.271***	9.754***	10.24***	10.646***	10.546***	11.014***	11.004***
	(0.62)	(0.627)	(0.499)	(0.445)	(0.419)	(0.366)	(0.294)	(0.418)	(0.533)
R-squared	0.012	0.01	0.008	0.008	0.01	0.015	0.017	0.018	0.015
Number of observations	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192	3,192

Note: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Parentheses refer to robust standard error.

Source: Analysed by authors.

Table 8 - Quantile Regression for Household Total Food Expenditure in Rural Areas

	Deciles								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Ln income	0.05***	0.053***	0.064***	0.05***	0.049***	0.048***	0.041***	0.044***	0.037***
	(0.016)	(0.012)	(0.011)	(0.011)	(0.01)	(0.011)	(0.012)	(0.012)	(0.014)
Households size	0.172***	0.164***	0.157***	0.15***	0.148***	0.142***	0.142***	0.138***	0.115***
	(0.012)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.009)
Household heads' sex is male	0.043	–0.029	–0.015	0.003	–0.018	–0.012	–0.026	–0.106*	–0.073
	(0.071)	(0.044)	(0.044)	(0.047)	(0.04)	(0.039)	(0.065)	(0.055)	(0.078)
Household head's years of schooling	0.028***	0.028***	0.025***	0.022***	0.021***	0.021***	0.017***	0.015***	0.015***
	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Household heads' primary activity is working	–0.007	0.024	–0.013	–0.017	0.006	0.026	0.042	0.035	0.081
	(0.071)	(0.043)	(0.048)	(0.039)	(0.036)	(0.042)	(0.05)	(0.038)	(0.064)
Households have safe drinking water sources	0.212*	0.084	0.04	0.046	0.071	–0.007	–0.014	–0.027	–0.056
	(0.109)	(0.087)	(0.067)	(0.048)	(0.058)	(0.071)	(0.062)	(0.055)	(0.08)
Households have electricity	0.031	–0.034	–0.012	–0.099	–0.07	–0.102	–0.091	–0.169***	–0.006
	(0.222)	(0.149)	(0.099)	(0.137)	(0.098)	(0.074)	(0.157)	(0.054)	(0.192)
Decision-maker is wife	–0.066	–0.055*	–0.028	–0.06**	–0.053**	–0.061**	–0.06**	–0.053*	–0.118***
	(0.042)	(0.029)	(0.027)	(0.026)	(0.026)	(0.026)	(0.03)	(0.03)	(0.036)
Household heads' employment in agriculture	0.049	0.016	0.035	0.025	0.01	0.004	0.008	0.011	–0.004
	(0.042)	(0.032)	(0.027)	(0.027)	(0.027)	(0.027)	(0.032)	(0.031)	(0.039)
Household can access internet	0.097*	0.069	0.087**	0.099**	0.113***	0.104**	0.17***	0.22***	0.207***
	(0.057)	(0.054)	(0.039)	(0.046)	(0.042)	(0.044)	(0.053)	(0.054)	(0.064)
Constant	10.09***	10.56***	10.617***	11.127***	11.249***	11.505***	11.806***	12.127***	12.419***
	(0.342)	(0.245)	(0.207)	(0.227)	(0.187)	(0.194)	(0.257)	(0.201)	(0.301)
R-squared	0.135	0.124	0.11	0.101	0.096	0.091	0.085	0.08	0.073
Number of observations	3,523	3,523	3,523	3,523	3,523	3,523	3,523	3,523	3,523

Note: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Parentheses refer to robust standard error.

Source: Analysed by authors.

Table 6 shows that variables of income, household size, education, household head's employment in agriculture, and internet access are the significant contributors to food-bought expenditure in all classes, with a decreasing effect for higher classes. A possible explanation for this decreasing effect is the higher the household classes and the demand shift from quantity-oriented to quality-oriented food. Since the food budget consumes the most significant proportion of Indonesian households' budgets, poorer families tend to consume low-quality food to maintain food sufficiency. In contrast, upper classes households tend to maximise their utility by buying less food with higher quality and variety.

Table 7 shows that variables of households living in rural areas are the only significant contributors to own production expenditure for all classes. On the other hand, variables of income and agriculture employment are significant for the low and middle classes. At the same time, household size and internet access variables are significant for the middle and upper classes.

These findings indicate that living in rural areas allows households to produce their food largely due to sufficient resources available in rural areas that are not always easily found in urban, e.g., land areas, access to water, and direct sunlight exposure, which are important for crop growth. Further, the benefits of having agriculture as the main employment sector, which is only owned by 16.81% of Indonesian households, allow them to have flexible working hours and higher knowledge to produce their food. Smallholder farmers and their families produce food to fulfill their necessities and cope during drought and adverse times (FAO, 2018). According to FAO (2018), 93% of Indonesian farmers are classified as small farmers who live in subsistence farming. The farmer's family consumes nearly all the crops or livestock raised, leaving little, if any, surplus for sale or trade. Hence, the combination of irregular income received from trade and the inability to buy food forced them to produce their food (Faharuddin *et al*., 2017; Priyanti *et al*., 2007).

Findings in Tables 6-8 show that only households in the middle and upper classes can benefit from internet access, which positively impacts their food self-reliance. In Tables 6-8, households in the low deciles have a positive but insignificant impact on internet access, which indicates the disproportionate benefit of the internet for household classes, as the World Bank (2021) found. Further, the World Bank (2021) shows that highly educated populations, commonly occupying the middle and upper classes, are five times more likely to be connected to the internet than those with lower educational levels. At the same time, individuals from lower-income families are three times less likely to connect to the internet than those from top-income families. This digital divide can result in a food consumption gap, leading to decreased human resources and a loss of economic potential. Hence, increasing access to the internet for the poorest households is important to ensure households

have the knowledge to improve their food self-reliance and can raise their standard of living,

The above findings also imply that producing one's food is not significantly influenced by household income. Instead, households that rely on high-value assets like land area and water access can fulfill their food production, as found in the agriculture employment sector. The significance of agriculture in Indonesia's economy is shown by its contribution to more than 14% of GDP in 2017, which is generated from 32% of the nation's total land area used for agricultural production. Further, the agricultural sector serves as the second-biggest job absorption, especially for those living in rural areas where 33% of Indonesia's labour force is employed in the agricultural sector (FAO, 2018). Another study found that farmers act as producers and consumers; therefore, households allocate resources to produce goods and services and use goods and services to fulfill their needs (Priyanti *et al.*, 2007).

Table 8 shows that income, household size, education, and internet access significantly contribute to total food expenditure in all deciles. At the same time, variables of households living in rural areas and agriculture employment are significant for middle and upper deciles. Findings in Table 8 show that internet access can benefit households as it allows households to have higher knowledge of food nutrition, an active lifestyle, and great deals to save on food expenses, which then leads to wiser decisions on food expenditure (Ezeoha *et al.*, 2020; Liang *et al.*, 2020; Mwalupaso *et al.*, 2020). In addition, having a mobile phone and access to the internet increases household income, which indirectly increases food security (Liang *et al.*, 2020; Xue *et al.*, 2021).

To check the robustness of quantile regression, we reviewed the results with the robust-to-outliers method, as Verardi and Croux (2009) proposed in Table 9. This estimator provides similar median results of quantile regression in Tables 6-8; hence, we can accept that estimations from quantile regression are robust to explain the relationship between technology and food expenditure in Indonesia.

Considering findings from quantile estimations in Tables 6-8, the focus of development should be aimed at households living in rural areas as it consistently contributes significantly to supporting households' food resilience. Further, intervention in households in the lowest classes should be done as any financial support from external resources like the government will significantly help them increase their food resilience, as Maipita *et al.* (2011).

We also should increase internet access for rural households as it lacks significance on own food production for low deciles but is significant for food-bought expenditure for the same deciles. Internet use among low-decile rural households increases knowledge and productivity, especially when agriculture is their primary employment, contributing significantly to food

Table 9 - Estimation of Robust Regression

	Robust Regression			Ordinary Least Square		
	Food Exp.	**Own Production Food Exp.**	**Total Food Exp.**	**Food Exp.**	**Own Production Food Exp.**	**Total Food Exp.**
Ln income	0.067***	0.016	0.054***	0.055***	0.044**	0.047***
	(0.014)	(0.019)	(0.012)	(0.011)	(0.019)	(0.009)
Households size	0.152***	0.09***	0.146***	0.178***	0.057***	0.153***
	(0.008)	(0.014)	(0.007)	(0.008)	(0.013)	(0.006)
Household heads' sex is male	–0.067	–0.037	–0.02	0	–0.052	–0.018
	(0.05)	(0.079)	(0.043)	(0.044)	(0.074)	(0.035)
Household head's years of schooling	0.023***	0.006	0.02***	0.026***	0.008	0.023***
	(0.003)	(0.006)	(0.003)	(0.003)	(0.005)	(0.003)
Household heads' primary activity is working	0.005	–0.042	0.006	0.029	0.004	0.008
	(0.046)	(0.085)	(0.04)	(0.044)	(0.073)	(0.036)
Households have safe drinking water sources	0.006	0.006	0	0.128**	–0.055	0.052
	(0.073)	(0.107)	(0.062)	(0.057)	(0.094)	(0.046)
Households have electricity	–0.079	0.093	–0.085	–0.19*	–0.076	–0.103
	(0.133)	(0.17)	(0.114)	(0.101)	(0.167)	(0.08)
Decision-maker is wife	–0.106***	0.122**	–0.045*	–0.13***	0.176***	–0.065***
	(0.028)	(0.051)	(0.025)	(0.028)	(0.047)	(0.023)
Household heads' employment in agriculture	0.015	–0.082	0.006	0.073**	–0.095*	0.031
	(0.028)	(0.051)	(0.025)	(0.03)	(0.05)	(0.024)
Household can access internet	0.118***	0.166*	0.112***	0.114**	0.093	0.131***
	(0.047)	(0.089)	(0.042)	(0.045)	(0.077)	(0.037)
Constant	10.856***	10.38***	11.269***	10.745***	9.957***	11.29***
	(0.252)	(0.36)	(0.222)	(0.206)	(0.341)	(0.165)

Note: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Parentheses refer to standard error. Robust regression is estimated using Verardi and Croux (2009) estimator.

Source: Analysed by authors.

production. Hence, breaking down barriers to mobile internet connectivity in Indonesia will be critical to delivering better economic benefits, for example, by providing affordable internet-capable phones for low-income households living in rural and remote areas households, as they need to spend at least one-fifth of their monthly expenses to buy a phone (Setiawan *et al*., 2022). Expanding internet coverage should also be encouraged. Hence, infrastructure development is needed to increase internet adoption in the population (Ariansyah, 2018). Moreover, the government should upgrade households' internet-related skills to allow them to use the internet effectively (Makun & Jayaraman, 2012; Rath & Hermawan, 2020).

The positive but decreasing impact of household size on food expenditure in classes shows that the larger household size variable positively impacts food expenditure but with a decreasing effect for higher deciles. Since higher food expenditure for the poorest households does not necessarily mean better

food variety or quality, the government needs to increase households' income to ensure their ability to support themselves when they face additional household members.

3.3. *Policy Implication*

Several strategies can be implemented to enhance food security by targeting key determinants such as household size, income, education, and agricultural practices, as identified in the preceding sections. Policy implications stemming from this research are delineated below.

Firstly, bridging the technology gap across communities is imperative, particularly for low-income households. This can be achieved by expanding internet accessibility in remote regions, reducing internet expenses for educational purposes, and enhancing digital literacy among individuals. Improved internet access can empower households with valuable knowledge and skills, thereby enhancing productivity and contributing to overall food security.

Secondly, promoting the adoption of advanced agricultural technologies and eco-friendly farming practices through dissemination efforts, pilot projects, and financial incentives is crucial. These initiatives can enable households to reduce farming costs, lessen reliance on chemical inputs, and bolster food security levels.

Thirdly, advocating for family planning programs can enhance dietary outcomes for household members. With similar expenditure levels, smaller households can prioritize the quality of food consumption over larger households. This underscores the importance of addressing household size dynamics in fostering better nutritional outcomes.

In summary, interventions aimed at reducing disparities, fostering agricultural development, and promoting smaller household sizes are essential for creating a more inclusive and sustainable environment. These measures will not only improve dietary diversity but also enhance food security among households, ultimately contributing to broader socio-economic development.

Conclusions

This paper investigates technology's contribution to the increase of households' standard of living measured by food expenditure among households in rural areas in Indonesia. Observation of different households' classes shows the importance of technology in supporting nutrition

sufficiency. Other important contributors to food expenditure for different household classes are income, household size, education, and agriculture as main employment. The focus should be on widening internet access for low-decile households as it can help them increase knowledge in selecting food commodities and increase productivity in food production.

While this research can achieve the determinants of household food expenditure across classes, some limitations exist. First, using food expenditure as a monetary proxy for household food sufficiency potentially hides the variety and quality of household food consumed, providing a more accurate measurement of household food sufficiency. Second, this study focuses only on internet availability and does not cover the differences in intensity and scope of internet use, which may lead to different results on food security levels. Future research can use panel data to examine the trend of the relationship between the internet and nutrition sufficiency over time. The differences in the pattern of internet use in households and the contribution of spatial aspects are also interesting to find.

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Advisors and inspectors for the development of organic agriculture in Italy

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Abstract

The advisory services play a pivotal role in addressing the challenges of the European green transition and enhancing the quality of services along the organic agricultural supply chain. However, there is limited evidence regarding the role and current working conditions of professionals supporting organic farming. The present study aims to fill this gap by investigating the working characteristics and job satisfaction levels among Italian organic advisors and inspectors. The analysis of selected variables encompassing interviewee characteristics, work activities, and satisfaction metrics provides insights into the perspectives of advisors and inspectors on their roles and working conditions. The findings reveal that while technicians generally express satisfaction with their remuneration and opportunities for personal and professional growth, they also report significant stress levels and workload. Identifying variables influencing satisfaction levels was pursued to measure the association between variables. This research establishes a foundation for developing strategies to enhance the well-being and effectiveness of organic farming advisors and inspectors, thereby promoting agricultural knowledge and innovation. One potential avenue for further investigation is monitoring agricultural technicians' operational activities at both the national and regional levels.

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Introduction

The European Green Deal has attributed great importance to the development of organic agriculture due to its ability to support farmers' incomes while protecting biodiversity, soil fertility, and water resources (EC, 2022; Polidori, 2003; Reganold & Wachter, 2016; Seufert & Ramankutty, 2017). The European Union's target for 2030 is to dedicate 25% of its utilised agricultural area (UAA) to organic farming. Italy has made substantial progress towards this objective, with organic agriculture increasing from just over 1 million hectares of UAA in 2008 to almost 2.3 million in 2022, representing 18.7% of the overall national UAA. The number of operators nearly doubled during the same period, going from 47.7 thousand to 92.8 thousand (Ismea, 2022; Sinab, 2023a,b; Willer *et al.*, 2022).

It is worth noting that the development of organic agriculture is closely linked to environmental and social factors (Zanoli *et al.*, 2018). To meet future challenges, organic agriculture must invest in its human capital by constantly acquiring new knowledge and skills (Rahmann *et al.*, 2017). The European strategy has been working in this direction for some time, promoting knowledge and innovation in agriculture (EC, 2022; Eyhorn *et al.*, 2019; Klerkx, 2020; Raina, 2020; Sanders *et al.*, 2011) through the Agricultural Knowledge and Innovation System (AKIS[1]), defined as the partnership between all stakeholders engaged in the sector's development through technology, innovation, and the promotion of human capital (Christoplos, 2010; Davis & Sulaiman, 2014; Masaf, 2021).

The support role of professionals in the organic supply chain is to assist in decision-making processes (EC, 2019), promote a better understanding of production techniques, and facilitate communication with those responsible for controls (Canavari *et al.*, 2010). Indeed, some Italian wine producers highlight the value of a well-established organic network, acting as an essential innovation cluster that assists sustainable farming transformation (da Rocha Oliveira Teixeir *et al.*, 2023).

The literature underscores the need for farmers to access consultancy and extension services providing viable solutions to their agronomic issues (Arbenz *et al.*, 2017) and covering technical, economic, social, and environmental aspects (Baloch & Thapa, 2019; Faure *et al.*, 2012; Ingram, 2008; Kassem *et al.*, 2021; Landini *et al.*, 2022; Swanson & Rajalahti, 2010).

1. The Agricultural Knowledge and Innovation System (AKIS) is a collection of agricultural organizations and/or people, and the links and interactions between them, engaged in the generation, transformation, transmission, storage, recovery, integration, dissemination and use of knowledge and information, with the aim of working synergistically to support decision making, problem solving and innovation in agriculture (Röling, 1990).

Pascucci & De Magistris (2011) conducted research with Italian farmers, revealing a preference for specialised, targeted, and continuous extension services that offer a holistic view of farm strategies, adapting to different agri-food chains (EC, 2019; Van Oost, 2019).

The farmers' needs and the heterogeneity of the Italian agricultural system confirm the importance of having an efficient assistance network at the national level. In this regard, the European Commission (EU, 2024) highlights the pivotal role of advisors in tackling the challenges of organic farming. They are involved in a wide range of activities (Cristiano *et al.*, 2020), including providing practical training to organic farmers and encouraging the growth of new entrants into the sector (Birke *et al.*, 2022; Cristiano *et al.*, 2020).

The satisfaction of advisors with their job activities can be a driving force for increasing the effectiveness of services. The topic of worker satisfaction has extensive references in the literature, starting from the work of Locke (1969), in which satisfaction is defined as a positive emotional state resulting from an evaluation of the job. Hulin and Judge (2003) describe satisfaction as a set of psychological responses related to work, including cognitive, affective, and behavioural components. Other authors have explored subjective and organisational aspects (Bakker & Demerouti, 2017; Rhodes, 1983; Yadav *et al.*, 2022). In the agricultural field, one strand of this literature is interested in the degree of satisfaction of farmers (e.g., Kolstrup, 2012; Meyerding, 2017), often concerning their mental and work health (Jones-Bitton *et al.*, 2019; Logstein, 2016; Lopez- Garcia *et al.*, 2019).

A considerable number of studies focus on individuals occupying different roles within the AKIS, exploring their attitudes, skills, and experiences (Kaur *et al.*, 2021; Musshoff, *et al.*, 2013; Sastoque, 2015). Proietti and Cristiano (2023) emphasise the importance of consultants possessing cross-cutting, management, and methodological skills and positive personal attitudes to provide adequate support. Angsukanjanakul *et al.*, 2019 show how high experience and knowledge and minimal work overload, as well as sufficient levels of work autonomy (Deci & Ryan, 2008; Gagnè & Deci, 2005; Hofmans *et al.*, 2013; Moran *et al.*, 2012) can positively influence advisors' job satisfaction and, in turn, their work performance. The job satisfaction of these professionals allows them to transfer their wealth of experience efficiently and improve farmers' performance (Alotaibi *et al.*, 2021; Angsukanjanakul *et al.*, 2019; Faure *et al.*, 2012).

The literature on advisory and assistance services in Europe is rich in studies. However, there is limited evidence regarding the role of organic farming advisors and inspectors and their current working conditions.

To our knowledge, this topic still needs to be addressed in the scientific field, specifically for advisors operating in the Italian organic farming industry. The present study aims to address this gap through a quantitative investigation. Therefore, the relationships between the objective and subjective characteristics of work activities and the level of job satisfaction experienced by advisors and inspectors were examined.

The study is organised as follows: The following section illustrates the data collection and data analysis methodologies. The result section illustrates respondents' observed characteristics and job satisfaction, while the last two sections discuss the results, and provide conclusions, and implications for policymakers.

1. Materials and methods

The research was conducted in two phases. In the first phase, qualitative interviews were held with leaders of the ATBio National Association (Association of Organic Technical Inspectors and Technical Consultants) National Association. The Association aims to represent and protect the common interests of Italian technical advisors and inspectors, the latter carrying out control activities to certify production processes. These investigations revealed that job satisfaction among organic technicians is sporadically adequate.

Therefore, a second phase of the research focused on a quantitative investigation of the job satisfaction levels of advisors and inspectors. Additionally, the study delved into their subjective characteristics, the organic farms they served, and their relationships.

In this paper, the focus is on five different ways of understanding job satisfaction:

a) economic satisfaction (or dissatisfaction);
b) satisfaction (or dissatisfaction) with job autonomy;
c) personal and professional satisfaction (or dissatisfaction) related to the valorisation of personal and professional skills (e.g., the tasks performed, the relationships with customers, the work environment, the feedback received, the emotions that everyone draws from their work, and personal growth);
d) satisfaction (or dissatisfaction) with perceived stress levels;
e) satisfaction (or dissatisfaction) with the responsibilities assumed.

Data was collected through an online questionnaire between 19 April and 19 May 2022. The web-based Google form tool was used to create and send the survey. The questionnaire comprised 42 questions and was organised into sections covering personal data, geographical area of operation, level

of activity specialisation, and workload sustainability and evolution. Job satisfaction was measured using a Likert-type scale.

The research group prepared and tested the questionnaire by administering it to the association's leaders. This collaboration facilitated the questionnaire's distribution and encouraged technicians' participation, reducing the risk of a low response rate.

During the fieldwork, we solicited the respondents two times to reach a significant number of responses. Additionally, we requested participating technicians to forward the questionnaire link to other technicians, not association members, promoting a snowball effect.

At the end of the field investigation, 116 advisors and inspectors participated in the electronic survey. Unfortunately, the total number of technicians involved in organic farming in Italy (either as advisors or as inspectors) is unavailable. The Association counts about 150 advisors and inspectors, while estimates provided by the Association count 1300 technicians nationally, so we can estimate to have collected the opinions of about 9% of the technicians.

Subsequently, the responses provided by respondents were collected in an Excel file and subjected to data cleaning to guarantee the accuracy and reliability of the data.

The literature examined (Angsukanjanakul *et al.*, 2019, in particular) informed the focus on three types of variables for data processing. According to the previously listed meanings, there were variables relating to the characteristics of the interviewees, variables relating to workloads, and variables relating to the degree of satisfaction or dissatisfaction with the job. In Table 1, we report the variables selected and analysed.

Table 1 - Analysed variables (variable name, question, nature) of the survey

Variable name	Question	Variable nature
Respondents' characteristics and work activities		
Educational Qualification	Define your educational qualification	Ordinal
Specialisation area	Define the area of specialisation of your major	Nominal
Professional activities	What professional activities do you usually do? (possible multiple choice)	Ordinal
Working localisation	Is your work activity performed in one region?	Dichotomous
Specialisation of activities	Is your professional activity about a specific value chain?	Nominal

Variable name	Question	Variable nature
Workload evolution	How much have the workloads changed over the years?	Ordinal
Workload hours per week	On average, how many working hours per week do you devote to your job?	Ordinal
Workload sustainability	Are current workloads sustainable over time?	Dichotomous
Satisfaction levels		
Job remuneration	The job satisfies me economically	Likert Ordinal
Job autonomy	I am satisfied with the level of job autonomy	Likert Ordinal
Personal/professional satisfaction	The job entails a valorisation of personal and professional skills	Likert Ordinal
Job stress	The job entails a high level of stress	Likert Ordinal
Responsibility	The job entails a high level of responsibility	Likert Ordinal

Source: Our online survey.

During the data processing phase, the frequencies of each level for each attribute were calculated. Attention should be paid to the variable relating to professional activities because all interviewees work as freelancers, and many carry out multiple activities simultaneously. Therefore, the absolute frequencies of professional activities are higher than the number of respondents, resulting in a total percentage higher than one hundred. A derived variable was also calculated about this aspect, which quantifies the number of activities carried out by each interviewee and their degree of work specialisation.

Referring to the literature (e.g., Angsukanjanakul *et al*., 2019), we found it challenging to consider the five questions related to job satisfaction as items of a single construct. However, we carried out some checks on a routine basis about it, computing the value of Cronbach's alpha.

Finally, we examined the degree of association between 40 pairs of variables. We combined the 8 variables related to the interviewees' characteristics and workloads with the 5 variables related to their degree of job satisfaction/dissatisfaction. The verification was mainly based on calculating traditional statistical indicators, Pearson's chi-square and the chi-square likelihood ratio, to verify a generic association for all pairs of variables. Furthermore, we calculated statistical indices by considering the variables' nominal, dichotomous, or ordinal nature. The contingency

coefficient, Phi (coefficient), Cramér's V, Lambda, Goodman and Kruskal's tau, and the uncertainty coefficient were calculated for nominal or dichotomous variables. We calculated Gamma, Kendall's tau-b, Kendall's tau-c, and Somers'd for ordinal variables.

The indicators above were calculated using the IBM® SPSS® software.

2. Results

2.1. *The characteristics of the respondents*

Regarding educational background, we can first observe how over three-quarters of the respondents have a university degree (Table 2). Furthermore, most respondents held a license or a degree in agricultural sciences.

As already mentioned, more than one professional activity can be carried out. 78.4% of the respondents work as technical inspectors, while 50% carry out consultancy activities exclusively or with other activities. The plurality of activities carried out by the freelancers who responded to the questionnaire is confirmed by the fact that 18.9% carry out training activities as instructors on organic farming topics. In comparison, 25.8% of respondents carry out "other activities". Among the latter, the most frequently cited are those of instructors and farmers. Considering the numerous professional activities, 42.2% of those interviewed carry out a single activity (either as advisors or inspectors). Some equally numerous technicians carry out two activities, and the number of those who carry out three or four activities is significant, too (15.6%). Approximately 60% of respondents operate in vast areas, while the remaining share carries out their activity only in a single region, mainly Emilia-Romagna, Tuscany, and Sicily.

The activities carried out only rarely refer to a single production chain. Specifically, 15.5% of those interviewed performed their activity on specific production processes, mainly supporting farms. The farms that most frequently resort to the services of technicians are specialised in arable land, fruit growing, viticulture, and olive growing. These production processes have seen the most growth in invested surfaces in recent years (Sinab, 2023a,b). 49.1% of the technicians carry out cross-cutting activities. 35.3% of them have developed multiple skills and provide consultancy to farms and companies across different agricultural productions.

Table 2 - Technicians' characteristics and professional activities: relative frequencies

Sample characteristics	% of 116 respondents
A. Educational Qualification	
PhD	6.0%
Master's degree	70.7%
Bachelor's degree	5.2%
High school degree	16.4%
Other	1.7%
B. Specialisation area	
Agricultural science	74.1%
Animal production	7.8%
Forestry and environmental sciences	6.0%
Food technology	5.2%
Other	6.9%
C. Professional activities (*)	
Technical inspector	78.4%
Technical Advisor	50.0%
Other activities (instructors or farmers)	25.8%
Organic agriculture trainer	18.9%
D. Working localisation	
Activity performed in a single region	40.5%
Activity performed in several regions	59.5%
E. Specialisation of activities	
Yes, the activities are production chain-specific	10.3%
Yes, even if the activities are not production chain-specific	5.2%
No, the activities are cross-functional	49.1%
No, the activities are production chain-specific, but I acquired different skills/professional expertise	35.3%

Note: Some interviewees carry out multiple activities simultaneously. As a result, the absolute frequencies of the "professional activities" (*) variable are higher than the number of respondents, and the total percentage exceeds one hundred.

Source: Our elaboration on online survey data.

The respondents were asked to indicate how much their workload had changed over their working years. Around 75% of the technicians reported an increase over the years. Half of the respondents' workload has risen substantially, while 25.9% report a moderate increase in the load itself (Table 3). On the contrary, only 13.8% of technicians report a reduced workload (9.5% moderate reduction and 4.3% considerable reduction of 4.3%).

Table 3 - Technicians' view about workload: relative frequencies

Sample characteristics	**% of 116 respondents**
A. Workload evolution	
Large increase	50.0%
Moderate increase	25.9%
Unchanged	10.3%
Moderate reduction	9.5%
Large reduction	4.3%
B. Workload hours per week	
> 50 h	31.9%
30-50 h	62.1%
< 30 h	6.0%
C. Workload sustainability	
Current workloads are sustainable over time	69.8%
Current workloads are unsustainable over time	30.2%

Source: Our elaboration on online survey data.

Regarding the weekly working hours, the determination of the specified ranges (< 30h / 30h-50h / > 50h) was contingent upon various factors resulting from interviews with the association leaders. The respondents primarily comprise freelance professionals who frequently contend with seasonal employment opportunities. Consequently, we aimed to ascertain the extent to which the actual working hours of the respondents deviated from the conventional 40-hour weekly standard.

In particular, the results show that 62.1% of technicians declare that they work between 30 and 50 hours on average and are within a normal range. 6.0% of technicians say they work less than 30 hours per week, while 31.9% work more than 50 hours per week, constituting a potential critical element.

Regarding the long-term sustainability of the current workload, 30.2% of technicians define it as unsustainable. Even if it involves a minority of

the technicians interviewed, this symptom of dissatisfaction should not be underestimated, as it reveals an inefficiency of the AKIS, as pointed out in the discussion session.

Technicians highlighted the leading causes of unsustainable workloads, and the most frequent factor was increased bureaucracy. Additionally, their proposed solutions included administrative simplification, business reorganisation, and staff recruitment.

2.2. *The job satisfaction*

The reliability analysis did not support the possibility of considering the five variables relating to job satisfaction as items of the same construct. When calculated on the raw data, Cronbach's alpha was unacceptable (.258). By transforming the values relating to the job stress and job responsibility variables (reverting hi-lo values), Cronbach's alpha took on a higher but still questionable value (.656).

After that, considering the five variables related to job satisfaction one by one, we had mixed results. The phrase "work satisfies me economically" has mainly gathered support. In particular, 54.3% of technicians somewhat agree with this sentence, while 12.1% fully agree with the same statement (Table 4). Those who declared themselves dissatisfied in terms of salary represent 20.7% of those interviewed (18.1% moderately dissatisfied and 2.6% completely dissatisfied), while those who declared themselves neither agree nor disagree represent 12.9%.

Table 4 - Technicians' views on job satisfaction: relative frequencies

Satisfaction levels and survey questions	Completely agree	Moderately agree	Neither agree nor disagree	Moderately disagree	Completely disagree
Job remuneration	12.1%	54.3%	12.9%	18.1%	2.6%
Job autonomy	26.7%	53.4%	12.1%	5.2%	2.6%
Personal/ professional satisfaction	26.7%	52.6%	15.5%	5.2%	0.0%
Job stress	14.7%	35.3%	27.6%	14.7%	7.7%
Responsibility	20.7%	36.2%	24.1%	12.1%	6.9%

Note: Refer to Table 1 for the complete questions.

Source: Our elaboration on online survey data.

The frequency analysis highlights how economic satisfaction is significantly associated with two variables relating to the characteristics of the respondents and the activities carried out (Table 5, and Tables A1 and A2 in the appendix for detailed information). Pearson's chi-square highlights a non-random distribution of frequencies when considering, on the one hand, the opinion expressed on remuneration and, on the other, the number of professional activities carried out, as well as views relating to sustainability during the current workloads. The data examination highlights how salary satisfaction is mainly associated with the performance of a single professional activity and with a judgment of the sustainability of the current workloads.

Table 5 - Association between variables related to job satisfaction and respondents' characteristics and work activities: Pearson Chi-Square

Satisfactions	**Respondents' characteristics or work activities**	**Pearson Chi-Square**	**Likelihood Ratio**
Job remuneration	Professional activities	18.98	
Job remuneration	Workload sustainability	9.64*	10.23*
Job autonomy	Specialisation of activities	21.06	21.49*
Personal/professional satisfaction	Workload sustainability	14.19**	14.07**
Job stress	Workload evolution	33.15**	35.63**
Job stress	Workload sustainability	25.97**	27.28**
Responsibility	Workload evolution	27.88*	27.57*
Responsibility	Workload h/w	17.68*	18.63*

Note: Only values with a significance higher than .90 are shown. * Significance higher than .95. ** Significance higher than .99.

Source: Our elaboration on online survey data.

Regarding job autonomy, 80.1% of technicians agree (moderately or definitely) that their job "allows them autonomy over decisions about activities, how and when to carry them out". In contrast, negative ratings were only 7.8%. Satisfaction with work autonomy is associated only with the specialisation of the consultancy activity. In this case, Pearson's chi-square has a significance greater than 0.9, and the Goodman & Kruskal tau index (reported in the appendix) is highly significant. In this regard, data analysis highlights how those focusing on specific production chains are more frequently satisfied with their working autonomy.

The satisfaction that technicians feel for the possibility of enhancing their personal and professional qualities is widely shared. Approximately 80% of technicians agree with this assessment, while only 5.2% express their moderately negative assessment. The judgment is strongly associated with the evaluation regarding the sustainability of the current workload, and Pearson's chi-square is significant above .99. Examining the database, we observe how technicians who are satisfied from a personal and professional perspective evaluate the current workloads as sustainable. This judgment is further strengthened as the level of satisfaction increases.

The assessments relating to stress levels somewhat overshadow the favourable assessments observed so far. Indeed, 50.0% of those interviewed complained that their work involves excessive stress (35.3% moderately and 14.7% definitely). Furthermore, perceived stress is associated with several variables relating to the characteristics of the interviewees and their work activities. The values reported in Table 5 highlight significant associations with the increase in workload and its sustainability over time, as well as the training background and the average hours worked per week (indices in the appendix). Surprisingly, among those who complain of work stress, relatively more technicians declare that they work between 30 and 50 hours a week, i.e., a regular or almost regular number of hours.

57.0% of technicians feel the burden of excessive responsibility (36.2% only moderately and 20.7% definitely), and only 19.0% believe their job involves low commitment. Also, in this case, the level of satisfaction is associated with assessments relating to the evolution of workloads and indications regarding the average number of hours worked per week. The database confirms that technicians who complained of excessive responsibility recorded an increase in their workload in most cases.

3. Discussion

Technical advisors and inspectors are committed to supporting organic farming and disseminating knowledge and information to meet farmers' needs. This commitment is confronted with an operational reality that needs to be discovered and analysed. The study combines a review of existing scientific literature (e.g., Alotaibi *et al.*, 2021; Angsukanjanakul *et al.*, 2019; Birke *et al.*, 2022; Faure *et al.*, 2012; Landini *et al.*, 2022; Pascucci & De Magistris, 2011) with field research to shed light on the daily challenges faced by technicians and their job satisfaction. This is particularly important in light of the European Union's objectives for developing the organic production system. The survey provides an original contribution to understanding the working conditions of professionals who support farms and companies operating in organic agriculture.

The first aspect to underline is that technicians often carry out multiple activities in parallel, but this does not appear to be associated with higher salary satisfaction. A complex issue regarding remuneration arises, which is difficult to define because technicians work as freelancers. Moreover, such a question of remuneration does not seem to constitute an exception in the (national) labour market, where training and human capital enrichment activities often find it hard to receive higher remuneration (Mußhoff *et al.*, 2013). However, it should be underlined that the diversity of roles assumed in this case may lead to a conflict of interest. This should be avoided to guarantee the credibility of the production system that revolves around organic agriculture.

A second issue that emerged concerns the types of activities carried out. Specifically, it has been observed that individuals who engage in cross-functional activities complain of dissatisfaction with work autonomy. This topic warrants further exploration, although the current observations appear to confirm the findings of Moran *et al.* (2012). They suggest that having high expectations concerning job autonomy is associated with more stimulating work activity characteristics. It may be appropriate to hypothesise that cross-cutting activities are burdened by bureaucratic and routine work, which should be lightened or automated. This would allow technicians to dedicate their energy and skills to supporting organic production.

The third issue concerns the low consistency of some answers. Most of those interviewed reported an increase in their workload in recent years. However, this did not result in an excessively high working hours per week. In fact, around two-thirds of those interviewed declared that they worked between 30 and 50 hours per week, which is partially in line with the standard working hours (40 hours per week), especially given the seasonal nature of agricultural production.

Evaluations of the sustainability of current workloads also provided a positive picture of the working situation of technicians. Overall, there are two possible explanations for the apparent contradiction between these values: a) the growth in workloads has allowed the full employment of technicians who were previously underemployed, and b) the productivity of the technicians themselves has grown over time. However, upon detailed analysis of the responses, it becomes clear that around a fifth of the interviewees express positions that differ from the ‘average’ ones. They complain about solid growth in the workload, working hours exceeding 50 hours per week and the unsustainability of the current workload over time. These technicians represent a critical area for the production system, and finding ways to enhance their skills and reduce their stress levels is imperative. The bivariate analysis confirmed a connection between declared work stress and workload.

The survey results confirm the importance of verifying technicians' job satisfaction levels, which can influence the quality and effectiveness of their work performance, as highlighted in the literature (Angsukanjanakul *et al.*, 2019).

4. Conclusions

The quantitative investigation allowed for a first 'subjective' vision of the agricultural technicians' work. The results can serve as a basis for analysing the strengths and limitations that must be addressed to improve the technicians' relationship with their work and, consequently, with the agricultural enterprise.

The results allow us to hypothesise some strategic areas of action that can add value to the technician's role. Possible reorganisations could concern: 1) the planning of educational activities (training and life learning) to provide more specialised knowledge and skills for organic farming, 2) the development of methods to optimise one's activities, and 3) the identification of more effective and relevant tools to improve the relationship between technicians and farmers.

The study allowed some characteristics of the technicians, activities carried out, and levels of job satisfaction to emerge. However, the study's limitations must be acknowledged. The lack of qualitative analysis has made it impossible to evaluate causal links between the variables considered with certainty.

Another limitation is the representativeness of the sample. As previously stated, no national list of technicians providing organic farm services is available. A registry is necessary to implement a sample selection procedure and estimate the representativeness of those interviewed. The estimated 1,300 technicians provided by the association involved in the investigation is plausible if we consider that, based on social security data, there would be around 12,300 freelance consultants supporting agriculture in Italy. However, consolidating the list of organic farming technicians would strengthen the analysis results.

A third limitation arises from the separate consideration of job satisfaction according to five different meanings. The lack of an "overall" evaluation regarding the technicians' level of satisfaction results from a choice made in defining the survey methodology. In particular, we tried as much as possible to elicit immediate responses, avoiding respondents adopting strategies to ensure the answers' internal consistency. This was useful in highlighting some disparities in the perception of satisfaction, but it did not allow us to assess overall satisfaction levels.

The study revealed that a more comprehensive investigation is feasible. However, fundamental information is required to obtain more reliable results. The findings provide a basis for further quantitative and qualitative research to enhance the efficiency of consultancy services and promote agricultural knowledge and innovation. This may require the regular monitoring and evaluation of the operational activities of agricultural technicians, accompanied by the implementation of adjustments to existing policies to address emerging challenges and opportunities at the national and regional levels. Furthermore, this could result in formulating policies designed to support the freelance profession and enhance their working conditions and stability.

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Table A1 - Statistical indicator of the association between variables (nominal x ordinal)

Satisfaction levels	Respondents' characteristics or work activities	Lambda	Goodman & Kruskal tau	Uncertainty Coefficient	Phi	Cramer's V	Contingency Coefficient
Job remuneration	Workload sustainability		.21*	.35*	.288*	.288*	.288*
Job autonomy	Specialisation of activities		.68**	.78*	.426*	0.246*	0.392*
Personal/professional satisfaction	Specialisation area	.55					
Personal/professional satisfaction	Workload sustainability	0.44	.03**	.05**	.35**	.35**	.33**
Job stress	Specialisation area	.55.80					
Job stress	Workload sustainability		.05**	.08**	.47**	.47**	.43**

Note: Only values with a significance higher than .90 are shown. * Significance higher than .95. ** Significance higher than .99.
Source: Our elaboration on online survey data.

Table A2 - Statistical indicators of the association between variables (ordinal x ordinal)

Satisfaction levels	Respondents' characteristics or work activities	Somers'd	Kendall's tau-b	Kendall's tau-c	Gamma	Spearman Correlation	Pearson's R
Job remuneration	Professional activities	-.18*	-.18*	-.16*	-.28*	-.21*	-.22*
Job stress	Workload evolution	.25**	.24**	.21**	.33**	.27**	.26**
Job stress	Workload h/w	.19	.16	.15	.25	.18	.19*
Responsibility	Workload evolution	.20*	.19*	.16*	.26*	.21*	.18

Note: Only values with a significance higher than .90 are shown. * Significance higher than .95. ** Significance higher than .99.
Source: Our elaboration on online survey data.

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