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Mapping young farmers' choice to pursue Geographical Indication in a rural context: application of fuzzy cognitive map

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Abstract

The shortage of young people in agriculture and the decline of rural areas are increasingly pressing issues that capture the attention of European policymakers and researchers. Despite the low rate of youth involved in agricultural production, recent data reveal a significant proportion of young farmers in Italy that are engaged in geographical indication (GI) production. Statistics provide trend analysis, but they alone are not sufficient in clarifying the motivations behind young people's decision-making. We conducted a qualitative study of Sicilian youth involved in GI to understand their motivations to pursue GI certification and the implications for youth embeddedness in rural areas. Using a fuzzy cognitive map (FCM), qualitative data have been translated in quantitative, giving evidence on key variables and their inter-relationships that influence young people's decision-making in a GI complex system. A total of twenty-two categorized variables have been identified. Results show how the young entrepreneurs' thinking in GI is structured, based on the cause-effect relationships between the variables. This study finds evidence that the GI system facilitates young generations of farmers in developing a personal approach to modern agribusiness starting from traditions and origins. At the same time, it gives evidence of a new perspective for involving young people in agricultural careers. In this sense, the present research contributes to the literature on factors that add attractiveness to the agricultural sector, to lead researchers and policymakers in dealing with alternative strategies for incentivizing youth involvement in farming.

Keywords: Young farmers, Rural development, Geographical indication, GI, Fuzzy cognitive map, FCM

Introduction

According to the 2022 Italian report *Giovani e Agricoltura* (Youth and Agriculture) released by the National Rural Network (RRN)¹ the existence of Geographical Indication (GI) is a catalyzing factor for young people's involvement in agriculture and the dynamism of rural areas (RRN, 2022). The 2021 Census of Agriculture, conducted in Italy,

¹ National Rural Network or Rete Nazionale Rurale (RRN) supports rural development policies through the exchange of experiences and knowledge between rural areas and improved implementation and management of rural development programs in Italy.

indicates a low percentage (9.3%) of farms are led by young people under 40 years old. Of this small percentage, a significant portion (23%) is involved in agri-production with GI certification (ISTAT 2022).

GI is a policy instrument employed by the European Union (EU) to safeguard local biodiversity and traditions. These indications act as a form of intellectual property rights that protect products originating from a specific geographical area and ensure that their unique characteristics, tied to their origin, are preserved and respected. Regulation (EU) No. 1151/2012, commonly referred to as the "quality package", outlines the framework for GI distinguishing between Protected Designations of Origin (PDO) and Protected Geographical Indication (PGI). In this study, the term GI will be used to encompass both EU PDO and PGI GI. Many authors have identified GI as an alternative food system in response to globalization (Goodman 2004; Mancini 2013). In the current context, the competitiveness of local territories within markets mainly leverages cultural, territorial, and economic features (OECD, 2016). Various implications of GI have been examined: economic (Belletti et al. 2017; Vandecandelaere et al. 2018), socio-cultural (Brunori and Rossi 2000; Carrà and Peri 2006; Tregear et al 2007; Giovannucci et al 2009; Valverde et al. 2023), environmental (Flinzberger et al. 2022) and for rural development (Belletti and Marescotti, 2021; Cei et al. 2018; Crescenzi et al. 2022; Arfini et al. 2019). There is thus a clear interest in assessing GI in terms of multiple dimensions. In this regard, Belletti and Marescotti (2021) recently suggested that researchers focus on a 'chain of causality'² between the dimensions involved to generate a comprehensive evaluation model. In doing so, they underlined the need to consider the specific heterogeneity of the context in which GI operate (Crescenzi 2022) and the different actors involved (Dentoni 2012). A lot of GI originates in rural areas. While it is recognized that they generate benefits (Tregear et al. 2007; Bowen and De Master 2011; Cardoso et al. 2022), their performance can be negatively affected by widespread rural vulnerability (Carbone et al. 2014). The declining condition of Europe's rural areas has long been documented and is a cause for concern and attention by governance. Rural depopulation, mainly by younger generations, is considered a primary challenge for most European rural spaces (Eurostat 2023). Cersosimo and Nisticò (2021) discussed it as an "internal migration trend" that stems from the economic conditions of a place and the resulting natural propensity of workers to move from an area with few stable jobs to one that offers a higher number of opportunities. Within this framework, agriculture influences and is influenced by migration. On one hand, the limited jobs offered in rural areas and in the agricultural sector push younger people to leave farming communities. On the other, the loss of human capital makes the agricultural sector more at risk (Consentino et al. 2023).

The involvement of young people in agriculture is thus a priority and addressing this means dealing with a complex phenomenon, as it involves several socio-cultural and economic factors. Although significant, income is not the only variable that young people take into consideration whether to become farmers (Sponte 2014; Zagata and Sutherland 2015; Coopmans et al. 2021). Elements such as personal attributes and values as well as aspirations for the future and rural lifestyle come into play in the choice of

² "An ordered sequence of interlinked events in which every event in the chain causes the next one(s)". Source: Belletti and Marescotti (2021).

being a farmer (Burton and Wilson 2006; Consentino et al. 2023). In this sense, understanding what the pull factors are for the participation of young people in agriculture and how these factors influence each other, is relevant to support policymakers in developing appropriate strategies to guarantee an adequate rate of generational renewal.

Study background and context

Italy boasts 317 GI products, which contribute to a total production value representing 19% of Italy's total agri-food turnover (ISMEA, 2022). Sicily is the second region in Italy in terms of the number of GIs. It counts 36 certified products (16 PGIs and 20 PDOs) with EUR 94 million, equal to 17.2% of the national GIs turnover (ISMEA, 2022). Despite the overall importance of Sicilian GI production, there is a dichotomy between well-established products and products that have yet to emerge. The consolidation of a GI product derives from a well-organized system built up over the years, in which actors such as producers, processors, institutions, and associations cooperate for the promotion of the product and local development (D'Amico et al., 2011). Some examples of consolidated GI products are the Blood Orange (Villari et al. 2020), the Bronte pistachio (Petino et al. 2024), and the Pachino tomato (Sgroi 2021), which, especially in recent years, have seen a significant increase in exports as well as in the number of workers employed in the business. Other cases concern products that, although highly relevant in terms of quality and traditionality, are still experiencing limited growth, as evidenced by weak local involvement, low-volume production, moderate market position, and minimal employment opportunities. The absence of significant growth for these products goes along with the more general socio-economic decline of the areas where production takes place. These are areas where the population decreases significantly every year, losing a substantial portion of young people and the active population.

Objectives and research questions

For the first time and according to recent literature, this study explores the relationship between youth entrepreneurship and GIs. It examines the factors influencing young farmers' decisions to adopt GI in rural areas. Personal, motivational, and social factors are surveyed along with economic factors. The research questions can be outlined as follows:

Q1) Based on young people's values and professional experience, what are the factors that influence their engagement with GI?

Q2) Do these factors affect each other and, if so, how and to what extent do they relate?

Two focus groups were conducted with young farmers from Sicilian rural areas who are involved in producing GI. To address the research questions, a Fuzzy Cognitive Map (FCM) was applied as an extension of mental models already recognized as relevant tools for understanding farmers' behavioral intentions and decision-making (Halbrendt et al. 2014).

Theoretical aspects of FCMs

Most of today's systems are classified as complex systems, given the variety of variables involved whose dynamics are often unknown. Within complex systems, human learning and decision-making may be poor (Paich and Sterman 1993). Many times, complexity

refers to the presence of economic, social, and environmental elements that generate a system in which the individual's evaluation may result in uncertainty and vagueness (Porritt 2013). Following Checkland and Scholes (1999), in approaching a theme, all its aspects should be considered as well as the interactions between the different parts. A theme approached in a multidisciplinary perspective reduces the possibility of certain relevant aspects being sidelined (Bammer and Smithson, 2012). Several methods have been developed to deal with perceived aspects in complex systems of the real world. Conventional methods have contributed a lot in the research, but their contribution in dealing with increasing complexity has been proven to be limited (Groumpos 2010; Ozesmi and Ozesmi, 2004). New methodologies have been designed, making direct use of human knowledge, beliefs and experience on topics. The term "cognitive map" was first used by Axelrod (1976), who focused on the way in which individuals' thinking is structured. Traditional cognitive maps can only be used in systems where it is necessary to assess the impact of particular concepts on the stability of the whole system (Tatarakanov et al. 2022). Axelrod (1976) applied diagrams to show causal relationships among variables defined and described by people themselves. His studies later found support in constructivist psychology, according to which individuals dynamically construct knowledge and awareness by creating mental models in which they categorize, explain, and give meaning to external context and experiences (Raskin 2002). In their work, Jones and colleagues (2011) argued that the mental model provided a useful mechanism for understanding the motivations for human behaviour. Despite this, issues had already been noted with mental models, which were sometimes considered confusing, incomplete, and inaccurate (Forrester 1971). In this framework, Kosko (1986) introduced Fuzzy Cognitive Maps (FCM). Until Kosko's study, the measurement of mental models had not been conceived. Kosko combined an insight of cognitive psychology with fuzzy logic (Kosko 1986), introduced to develop a mathematical model of vagueness and ambiguity (Novak, 2012). In this way, even from a common language, it was possible to identify quantitative estimates of perceived relationships between variables within a complex system (Lynam et al. 2007; Jose 2010).

The FCM admits both variables as measurable physical quantities and variables as complex aggregates and abstract ideas. The development of FCM makes it possible to observe situations in their complexity and wholeness. According to Serman (1994), who suggests a holistic view of research topics, the application of FCM makes it clear to individuals that 'you cannot look at just one thing,' but that 'everything is connected to everything else'.

Materials and method

The study was conducted in September 2023 with young farmers who manage farms in rural areas of Sicily and endorse GI certifications. Recruitment was carried out through a non-probabilistic purposive sampling technique that does not seek statistical representativeness but rather selects cases of particular interest for the research (Creswell and Creswell 2017; Schutt 2018). A sample of 30 young people aged between 26 and 30 years old who chose to stay in rural areas was selected. The sample consists of 10 women and 20 men, who manage farms of a minimum size of 5 ha and a maximum of 40 ha. The purpose of the study was not to look at a specific product but at young farmers' views of GI

production. The participants therefore deal with different productions (Leonforte Peach, Bivona Peach, Pantelleria Caper, Ispica Novellara Carrot, Mazzarrone Table Grape, San Cono Prickly Pear, Nocellara del Belice, Siracusa Lemon, Etna Cherries, EVOO oils from the Iblei mountains, Valle del Belice and Val di Mazara). However, they share the characteristics of coming from rural and depopulated areas and dealing with emerging GI products in Sicily. The methodology was structured into four phases: design of the focus group interview; collection of data; systematization of data; and analysis of data using Fuzzy Cognitive Map. FCMs have been previously applied to rural themes and issues (Papageorgiou et al. 2019; Liang 2022; Gan et al. 2023; Faisal and Rahman 2023) but they have never been applied to GI-related topics or to young farmer's decision making. Here, FCM is useful to capture individual perceptions of the topic, identify key concepts, and establish their interconnections in a cause-effect relationship.

Designing the focus group interview

The focus group is a technique for collecting data starting from an informal discussion among participants to develop FCM analyses (Christen et al. 2015; Lalani et al. 2021; Targetti et al. 2021). Group debate was facilitated by the presence of moderators who guided the discussion according to the aims outlined in the research and sought to create a comfortable environment, where participants could feel free to express their opinions (Acocella 2012). Group interaction helped participants become more inclined to think about and reflect on aspects of their daily lives that are typically overlooked (Morrison 1998). During the discussion, values, intentions, and ideals emerged. Although the moderators had the task of not directing the answers given by the participants, the main aim was to keep the focus on the topic. It became necessary to carry out a pilot test before conducting focus groups. According to Krueger and Casey (2014), a pilot test is useful for (i) obtaining comments on the way the questions are formulated and check their meaning, (ii) deciding whether other aspects need to be included, and (iii) finding out how effective the moderators are. In this study, internal testing was conducted with 6 young researchers who had expertise on the topic. It was conducted in person and lasted one and a half hours. Apart from some minor adjustments, the structure proved to be adequate for addressing the research questions.

Data collection

Two focus groups were carried out with the selected sample. The purpose of the first focus group was to collect data while stimulating an initial dialogue among participants. It was conducted online via Zoom and lasted approximately 2 h and half. The decision to conduct it online was linked to logistical reason. Indeed, as mentioned, the participants come from distant areas of Sicily. Considering the number of young farmers involved (30), random groups were created, and participants were split into different virtual rooms. Each virtual room consisted of 10 participants, making a total of 3 virtual rooms where a moderator was present for each one. It is recommended to organize focus groups with a maximum of 10 participants, as a smaller group facilitates active participation and discussion, allows for a good variety of experiences without making the discussion too scattered, and increases the time available for each participant (Krueger and Casey 2014). Approximately every 50 min, the virtual rooms were randomly

reassembled. The interchange between the groups was designed to allow participants to interact with all others and to facilitate dialogue. Although the group was fairly homogeneous in terms of knowledge, age, and cultural background, each individual brought a unique form of inspiration to the others. The moderators used the Miro virtual whiteboard to take notes on the answers. Miro is commonly applied in the case of online interviews to stimulate brainstorming, ideation, and mapping while ensuring creative engagement through visual support elements (Slingerland et al. 2022; Wong-Villacres et al. 2020). The whiteboard was visible to all participants to actively involve participants in the discussion. During the discussion, initial relationships between the concepts emerged and were noted on the Miro whiteboard.

Data systematization

The primary source of data consisted of participants' quotes that were extracted from group discussions (Carley 1997). After the first focus group and according to the notes taken, qualitative data obtained were then coded into categorized variables. A total of 22 variables emerged. Table 1 shows the extracted and translated quotes and the aggregation into resulted variables. At the same time, variables were associated with an alphanumeric abbreviation to simplify graphs in the results section.

At the beginning of the second focus group, participants were asked to validate the variables that had emerged. They confirmed the results, with the exception of some minor adjustments that were implemented to build Table 1.

Data analysis using fuzzy cognitive map

Once the variables were identified and validated by the participants, the second focus group engaged the participants in the construction of cause-and-effect relationships, to collaboratively build the map. It was conducted online and lasted one and a half hours. At first, the connections that had already emerged during the first focus group were applied. Subsequently, the connections were implemented through dialogue between the participants on the variables that emerged. As stated by Salmeron et al. (2019), "FCM not only shows relationships using links. Indeed, each node is associated with a weight". The weight is often in the range $[-1, 1]$ (Ozesmi and Ozesmi, 2004), but to simplify the process and facilitate the participants in assigning values, it was decided to give them linguistic values such as *very negative*, *negative*, *positive* and *very positive*, converted into fuzzy numbers as follows in Table 2. Indeed, fuzzy numbers are linked to linguistic values to account for the vagueness of human judgment (Ocampo et al. 2018). The process of building maps fosters discussions among the participants involved, reduces the number of important criteria omitted, and contributes to a deeper understanding of cause-and-effect relationships between variables (Ferreira et al. 2016).

Three types of causal relationships between variables can be applied: positive, negative, or zero causal relationships (Carlucci et al. 2018).

Considering the following form:

$$G = \langle E, W \rangle,$$

In which 'E' is a variable, and 'W' is a binary relation on 'E' that determines the connections and weights between its elements. W indicates how strongly the variable E_x influences E_y . Depending on the value of W_{xy} , we can understand the type of relation:

Table 1 Quote extraction and categorized variables

Quotes extraction	Categorized variables	Abbreviation
The fact that there is a consortium has allowed us to have more strength on the market	Consortia and associations	E1
Being part of a producers' association means sharing inspiring ideas to safeguard our products and territory		
I am aware that the presence of a consortium prompts us farmers to join forces for common advantages		
I joined GI certification because our product is unique and deserves to be preserved	Sense of belonging and local pride	E2
I want to make a personal effort to safeguard the distinctiveness of our place		
I am afraid that my hometown will go into oblivion, along with all its traditions		
Our historical landscape would not be the same without the typical scenery given by the local cultivations	Preservation of local landscapes	E3
Traditional practices are essential to safeguard the product and the environment in accordance with local history	Traditional farming practices	E4
I consider that without GI certification our biodiversity would be lost	Conservation of local biodiversity	E5
Our culture should be carefully nurtured; it is what differentiates us	Cultural heritage	E6
I decide to stay and preserve the traditions of my family and my hometown		
Work required to cultivate GI cannot be mechanized; one of the greatest strengths of these products lies in the practical skills of those who farm them	Skilled labour	E7
We are not limited by ideas (we have many), it is the financial resources that are lacking	Lack of access to credit	E8
Previous generations are an inexhaustible source of knowledge; we have a responsibility to make sure [the knowledge is] not lost	Intergenerational knowledge transfer	E9
The reputation of the product is the result of the right combination of natural elements	Conditions of natural resources	E10
We share an overwhelming concern about the limited and deteriorating natural resources		
There should be a synergy between institutions and farm enterprises to preserve natural conditions		
I am interested in both product processing and hospitality and restoration; I think it could be an opportunity for me and the community	Activities diversification	E11
My work is appreciated by fellow citizens	Membership in local community	E12
I perceive my work as relevant for the community		
Being an active part of the community makes me feel connected with it		
GI products give reputation to the territory	Territory promotion	E13
It is pleasant to show the outside world the beauty of our town, with its traditions and uniqueness		
I cannot afford year-round labourers, but it is harder to find someone if they are asked to work only for short periods	Seasonal work	E14
I am aware that it is crucial to be constantly updated to have both managerial and hands-on expertise and thus stay on top of things	Training	E15
Most of my peers and friends have gone elsewhere to work	Rural exodus	E16
It is difficult to find people willing to work at my farm, there is hardly anyone here		

Table 1 (continued)

Quotes extraction	Categorized variables	Abbreviation
I am convinced networking can be our lever of strength but unfortunately, there is still a strong lack of trust that hinders it	Networking	E17
I think that the municipality should support us more and dialogue between entrepreneurs and local politics should be constant	Rural governance	E18
Institutions must intervene promptly, especially given the drastic environmental conditions		
I would like to hire local people; it would be a pleasure to give opportunities to my fellow citizens	Local jobs	E19
GI certification allows me to sell at a higher price	Profitable business	E20
GI certification enables easier market access		
I can export the GI product successfully		
The time spent on promoting the product is just as important as the time spent on cultivation itself	Product promotion	E21
I can count on previous product promotion		
Consumers appreciate products for their organoleptic qualities as well as the traditions behind them	Consumer appreciation	E22
We strive to ensure that our product continues to be appreciated by consumers, it is our strength		

Table 2 Linguistic values and related fuzzy numbers

Linguistic values	Fuzzy numbers
Very negative	- 1
Negative	- 0.5
Positive	+ 0.5
Very positive	+ 1

If $W_{xy} > 0$.

it means that there is a *positive causal relationship* between the variables E_x and E_y , i.e., an increase/decrease in the value of the variable E_x leads to an increase/decrease in the value of the variable E_y .

If $W_{xy} < 0$.

a *negative causal relationship* exists between the variables E_x and E_y , which means that an increase in the value of the variable E_x leads to a decrease in the value of the variable E_y , while a decrease in the value of the variable E_x increases the variable E_y .

If $W_{xy} = 0$.

there is a *zero causality*, which means that there is no relationship between the variables E_x and E_y .

Along with weight, direction also helps in recognizing key concepts of the system. Three dimensions can be observed: i) outdegree, associated with the connectors that leave the variable. High outdegree values influence the other variables and are considered driving forces; ii) indegree, associated with the connections that enter the variable, considered response variables; and iii) centrality, the sum of the outdegree and indegree indices (Gray et al., 2014). Centrality is a relevant measure of the complexity

of the map. By analysing these three dimensions, it is possible to understand which variables are of greatest interest among participants.

Results

By employing the FCM, it became possible to effectively quantify and interconnect qualitative data. The presence of a mathematical model facilitates comparison of results across various contexts or among different participant groups. For instance, when multiple groups construct FCM on the same topic, the weights assigned to the variables can be compared to observe how perceptions shift among groups and across contexts. This approach enhances the replicability and reliability of the study (Sun et al. 2004; Olazabal et al. 2018). Moreover, a comprehensive understanding of the complex system's dynamics enables the identification of actions that can lead to meaningful changes within the system. This insight assists decision-makers in drawing the potential consequences of their choices, allowing them to make more informed and deliberate decisions. Indeed, it becomes easier to assess whether implementing a particular variable will positively or negatively impact the entire system (Christen et al. 2015; Lalani et al. 2021; Targetti et al. 2021). Finally, the application of an FCM model allows the graphical representation of the results as presented in Fig. 1. In this, variables are distinguished by black/red and thicker/thinner arrows. The colour black indicates a positive relationship between the variables, while red indicates a negative one. The thickness of the arrows indicates the greater or lesser weight, according to Table 2. The thicker indicates the value of 1, while the thinner indicates the value of 0.5. In addition, arrows depict the direction of causality. The direction of the arrow must be taken into account, indicating which variable influences the other, thereby providing insights into the direction of causality.

Three dimensions have been observed: outdegree, indegree, and centrality. Indegree refers to the number of incoming connections to a particular node. In FCM,

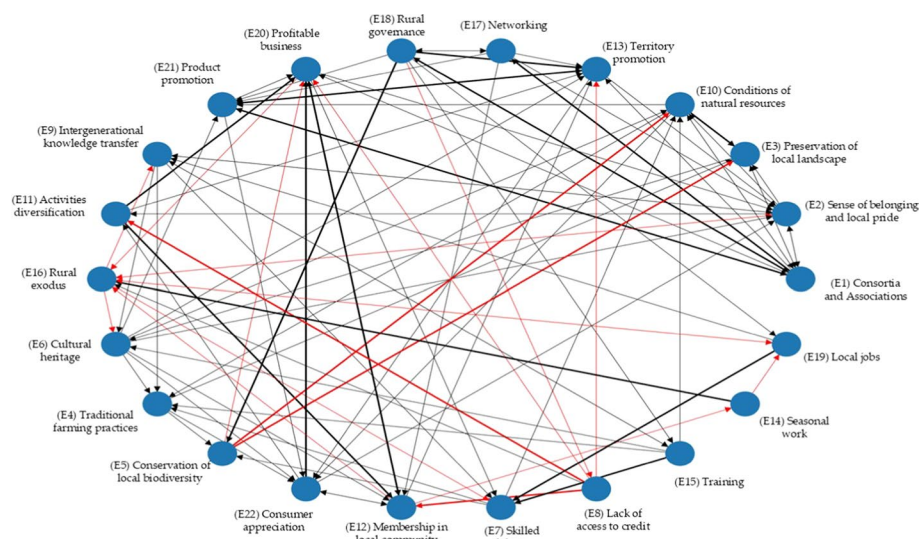


Fig. 1 Our elaboration of FCM Map. Red arrow: negative relation; Black arrow: positive relation. The thickness of the arrows indicates the weight of the relations. This visualization has been generated using the programming language Python (Van Rossum and Drake 1995) and the Python package NetworkX (Hagberg, A. A.; Schult, D. A.; Swart, P. J. 2008)

indegree represents how many other concepts influence a given concept. Understanding the indegree helps identify which variables are heavily reliant on others within the system. For instance, "Profitable Business" has a high indegree. This suggests that it is shaped by various factors, including "Consumer appreciation", "Activities diversification", "Product promotion", "Skilled labour", "Consortia and associations". Such insights can inform decision-makers about which factors should be considered when analyzing changes or interventions in that variable.

Outdegree refers to the number of outgoing connections from a particular variable. A variable with a high outdegree value has a significant impact on multiple other concepts. By examining the outdegree, it can be possible to identify key drivers within the system. For example, if a variable like "Rural governance" has a high outdegree, it suggests that it affects various outcomes such as "Networking", "Training", "Local jobs", "Consortia and associations". Recognizing these influential variables can aid in predicting the broader effects of changes in policy or strategy.

For better clarity, a bar graph is provided in Fig. 2. The visualization of the bar graph allows the comparison of indegree and outdegree. Moreover, it provides insight into the centrality degree for each variable simultaneously, providing a straight-line view. Centrality is observed as the sum of the absolute values of the weight of each variable. More simply, it is the sum of outdegree and indegree, represented by the entire bar for each variable. Identifying the centrality of variables is crucial for understanding the overall dynamics of the system. High centrality indicates that a variable not only influences others but is also significantly influenced by various factors. Thus, the higher the centrality value of a variable, the more essential that variable is for the functioning of the entire system. In this study, "Consortia and associations" results in being variable with the highest centrality, followed by "Sense of belonging and local pride", "Membership in local community" and "Profitable business" which share the same degree of centrality.

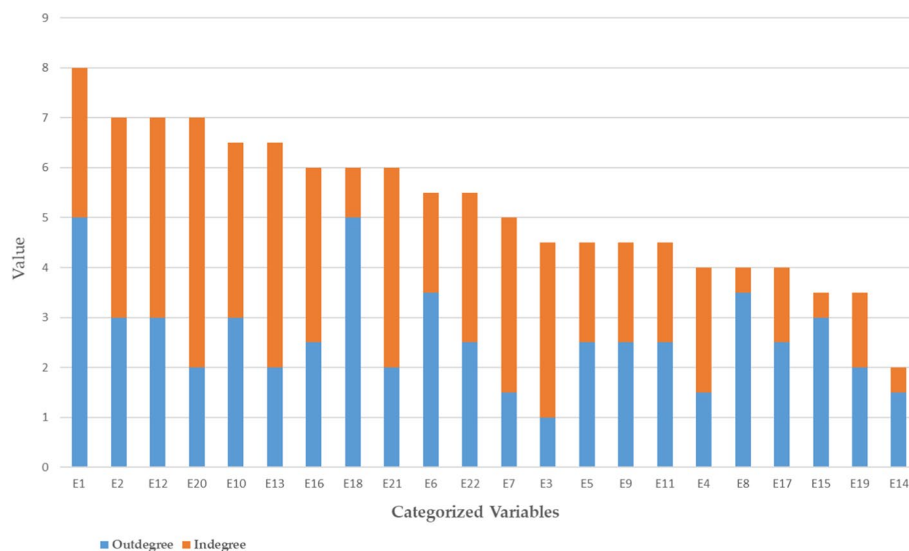


Fig. 2 Our elaboration of Outdegree and indegree of categorized variables. Centrality is depicted by the total height of the bars (outdegree plus indegree)

Discussion

The relevant factors for youth engagement in the GI system seem to be related to several dimensions-economic, environmental, and social. Using FCM, the thinking structures and the young generation's decision-making emerged. The original language has been retained as much as possible so that the meaning is not misconstrued (Ozesmi and Ozesmi, 2004). Although some of the variables may seem similar or mergeable, they have been defined in such a way that they do not deviate from the actual vision of the young farmers. So, the variables indicate different nuances that can be useful in the process of understanding the youth's way of thinking. The FCM has revealed how the system is structured according to the participants' perspectives and has allowed for the identification and understanding of the concepts that support the entire system as well as how they are interconnected with others. Based on the centrality, output, and input degrees of the variables (Fig. 2) and the revealed connection (Fig. 1), this section provides a lens through the discovered results.

Cooperation and willingness to take steps together

The existence and reputation of GI products are intrinsically linked to territorial cooperation, establishing economic and human interconnections that aim to safeguard both natural and cultural biodiversity (Mariani et al. 2021, 2022). The GI system impacts the aggregation of producers from the same area, who cooperate to obtain advantages in terms of profit, product, and territory promotion. Young farmers emphasised the economic and market positioning advantages of belonging to a protection consortium. Alongside the economic potential, however, they pointed out the importance of the social benefits of aggregation. The idea of sharing ideas and visions with other farmers, both young and old, who experience similar conditions but may operate differently, is an attractive prospect for those joining the GI. According to them, staying together for a common goal allows for the merging of the different skills, abilities, and inventiveness of each, mitigating the sense of isolation and dispelling the perception of farming as work confined to the borders of one's land. It has previously been hypothesized that collaborative work strengthens the sense of belonging in the community and people's willingness to provide each other support (Prager 2015; Velten et al. 2021; Spina et al. 2023). In support of the literature, this study provides evidence of how the existence of cooperation generates and stimulates the desire to participate. However, some of the interviewees reported elements that hinder the expansion of a wider network. In particular, the widespread lack of trust among farmers as well as the conflict of personal interests that outweigh the desire to generate benefit for the community do not allow to benefit from a broad and beneficial collaboration. Against the scenario of an agricultural community strongly characterized by a sense of mutual mistrust and self-interest (Mariani et al. 2019), the aspiration and awareness of young people to promote a culture of cooperation can become a resource for togetherness. GIs offer young people the opportunity to experience acting collectively, enabling them to understand the advantages and areas for improvement. This stimulates their desire to address shortcomings as a new generation while recognizing the advantages of being in a group.

Contributing to place and farmer identity

In rural areas, individuals and communities may experience marginality due to vulnerabilities that result from several aspects. Most of the discussions on marginality concern economic and context-based factors, but it has long been proven that the discussion also needs to consider cultural and social elements (Mehretu et al. 2000; Burton et al. 2020). As Von Braun and Gatzweiler (2014) affirmed ‘where people are’ refers not only to physical locations but also to societal positions. Rural populations often suffer feelings of abandonment or marginalization compared to those living in larger centres (Leyshon 2008). In addition, is the social and widely identified marginality of being a farmer. Farmers suffer not only the secondary status of being a rural citizen but also may feel a sense of social exclusion from their community that can make them feel undervalued and misunderstood (Baselice et al. 2021). From this perspective, being a farmer increasingly does not meet the ambitions and desires of the younger generations (Consentino et al. 2023). In this context, respondents highlighted GI as boosting the reputation of the area and the value of the farmer as well. More specifically, GI is observed as a tool to transform marginality into local uniqueness, and being a farmer is a means to participate in that transformation. By preserving and enhancing the richness of local culture and nature, young farmers find the willingness and opportunity to actively work in establishing a distinctive identity for their native place while they demonstrate their key role in society. Cersosimo (2000), using the example of Italy, argued that areas with a strong construction of identity were those that experienced the most pronounced development results. This has been recently pointed out by Basile and Cavallo (2020), who highlight how a rural identity is established from the concept of local authenticity resulting in positive and interdependent implications for sustainable development. In this sense, GI is a policy for safeguarding rural identity. Young farmers point out their interest in safeguarding local identity. This is accomplished by preserving the landscape and biodiversity, carrying on traditional farming practices, and acting as an indispensable resource in preserving cultural heritage. By performing these actions, farmers feel they are contributing to the survival of niche products and to local growth (Brunori et al. 2016; McAravey 2022). This allows them to resist the perceived ‘superiority’ of the urban centers with their attributes of attractiveness and innovativeness. By choosing to stay in rural areas and perpetuating rural traditions, young farmers receive great appreciation from their fellow citizens and the whole community. The positive opinions and appreciation of others result in additional reasons for youth to continue their activities and participate in the growth of the community.

Maintaining and diversifying agricultural skills

Interviews revealed concern about labor shortages and interest in technical and theoretical training. GI products have specifications that require specific agricultural skills. According to respondents, the worrying exodus and estrangement from farm life increasingly threaten the possibility of recruiting local labor. They cannot afford to hire a full-time worker, but at the same time, they need highly skilled seasonal workers in processing agricultural techniques. The main concern regards finding workers capable of performing the traditional practices that characterize GI (pruners, processors, animal management experts). Hiring unskilled workers exacerbates the challenges associated

with the erosion of traditional farming practices and the continuity of a generations-old culture (FitzSimmons 2017; Mariani et al. 2022; Di Vita et al. 2023). From this perspective, young farmers have emphasized their willingness to organize training courses for operators, aiming to maintain high standards of production quality while also creating and providing opportunities for others, promoting highly specialized and therefore well-paid employment. In doing so, intergenerational training becomes a pivotal element. According to the interviewees, the exchange between different generations is the only way to ensure that family traditions endure over time. Indeed, the renown of products is closely linked to the preservation of the history of places and farming families, and without this aspect, GI products tend to lose their *raison d'être* as well as their attractiveness in the market. In this vein, equal importance is placed on developing new skills (marketing, risk, and business management, knowledge of sustainable practices and new technologies, e-commerce) which are considered crucial for managing a business (Charatsari and Lioutas 2019; Pogorelskaia and Várallyai 2020). Young farmers perceive themselves as entrepreneurs and are keen to acquire various types of knowledge that can help them run a successful business. They place significant value on complementary activities alongside the typically productive ones, as they are attentive to consumer trends and interests. In most cases, respondents have expressed a desire to develop their skills and broaden their knowledge base. Skill diversification is indeed considered a valid strategy to increase the income of a farm, with spillover benefits for the entire territory and the creation of new job opportunities.

Building an effective dialogue with local government

The performance of a GI product is linked to an interaction between public and private interests. Considering the GI as a public good, the local government keeps a vigilant eye on the operations of producers to guarantee long-term interests for the community. At the same time, they need to work in such a way as to make full use of producers' experience and innovative potential (Penker et al. 2022; Carbone 2017). As highlighted before, young farmers involved in GI are aware of their key role in protecting local products as well as in bringing dynamism to rural places. With this awareness comes a desire to be heard by the competent authorities from whom they demand prompt answers and collaboration. Among the participants, there is a variety of responses regarding the positive or not yet satisfactory interaction with local policymakers. While some have stated they are satisfied with the actions of local institutions, others have indicated a lack of significant support. This lack of support occurs because young entrepreneurs feel they are left alone in the task of promoting a product and, with it, the territory. In the other mentioned case, positive experiences are instead related to the sharing of efforts between those involved in production and local government. It has been demonstrated that small firms struggle to build their reputation and collaborating with institutions can help them overcome this issue (Carbone 2017; Vindigni et al. 2022). In addition to improving local visibility and reputation, young farmers have emphasized the need to cooperate with institutions to safeguard natural resources, local biodiversity, and the natural landscape. The young individuals involved are aware of the importance of these aspects and admit to dedicating much time and energy to caring for the local environment. However, they are severely affected by water scarcity, soil fertility erosion, and damaging weather

events. For these reasons, they consider constant dialogue on the allocation of financial resources and proper planning of maintenance infrastructure necessary. Timeliness is the keyword and the sore point to work on. In this regard, young farmers show a remarkable willingness to actively participate, contributing their experience and insights. Their request concerns an interaction among various stakeholders (such as authorities, experts, producers, and civil society) to stimulate social learning in the development of effective actions.

Conclusion

At a time when attracting young people to agriculture and fostering their connection to rural areas is a challenge, Geographical Indication (GI) occupies a leading position in ensuring that young farmers learn models where innovation and tradition are interconnected. The study revealed how young farmers structure their thinking and make decisions about pursuing GI products, as well as the variables influencing their choices and interconnections. The application of Fuzzy Cognitive Mapping (FCM) has provided the opportunity to combine qualitative and quantitative results. By analyzing the experiences of the younger generation within the GI system, a map was created to synthesize opinions into variables and data, allowing for a graphical representation of their thought processes. This map highlights how the choice to be a farmer in a quality and territoriality production system is influenced by multiple variables linked to economic, social, and environmental aspects. Although some variables are more central than others, these are intertwined in an indispensable cause-effect network. FCM increases the possibility of replicating the study in other contexts to observe how variables interconnect and position themselves in terms of centrality in the system according to local peculiarities.

This study focused on the Sicilian rural context, where factors such as production profitability, reputation, and consumer appreciation were found to exert significant influence. However, it was revealed that the added value of GIs lies in the experience of aggregation, the perception of local and personal identity, and the desire to establish a synergic relationship with the environment and local institutions. Overall, the combination of these variables seems to increase the desire to contribute to the pursuit and development of a career in agriculture. Being actively involved in the conservation and growth of the land brings young people closer to greater personal satisfaction, fostering an awareness of the positive value of being a farmer for the benefits that extend from personal to collective. Although GI as a policy tool was not originally implemented with the specific purpose of supporting generational renewal, this study shows how it has had an indirect and cross-cutting effect on it. Enhanced policies and strategies that take into account local specificities could replicate the favorable conditions observed by young people with GI. Future directions could guide researchers and policymakers to explore this perspective more deeply across various contexts, to determine whether similar results and conclusions emerge on a broader scale.

Limitation

Despite FCMs allowing for interpretative flexibility, the presence of subjectivity introduces the possibility of cognitive biases or personal prejudices that could distort the representation of the system, emphasizing or overlooking concepts or relationships based

on individual preferences or preconceived beliefs. FCMs have the potential to offer valuable insights into complex and qualitative phenomena that are difficult to quantify, which need to be managed carefully in search of a balance between flexibility and the risk of bias, to ensure credible and actionable results.

Availability of supporting data

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Author contributions

FC and IP conceptualized the study, FC, IP, GV conducted the interviews, GV, ML, and FC were responsible for applying the methodology, FC and IP edited the manuscript, and GV and DS revised the text. All authors read and approved the final manuscript.

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Declarations

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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