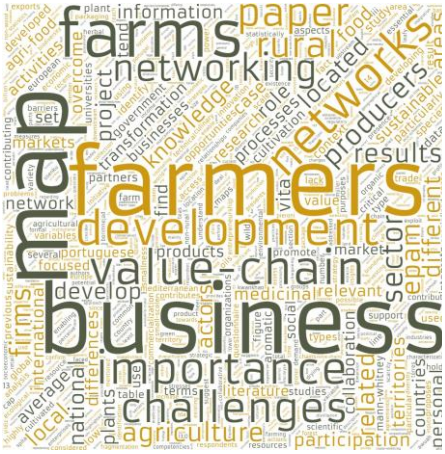
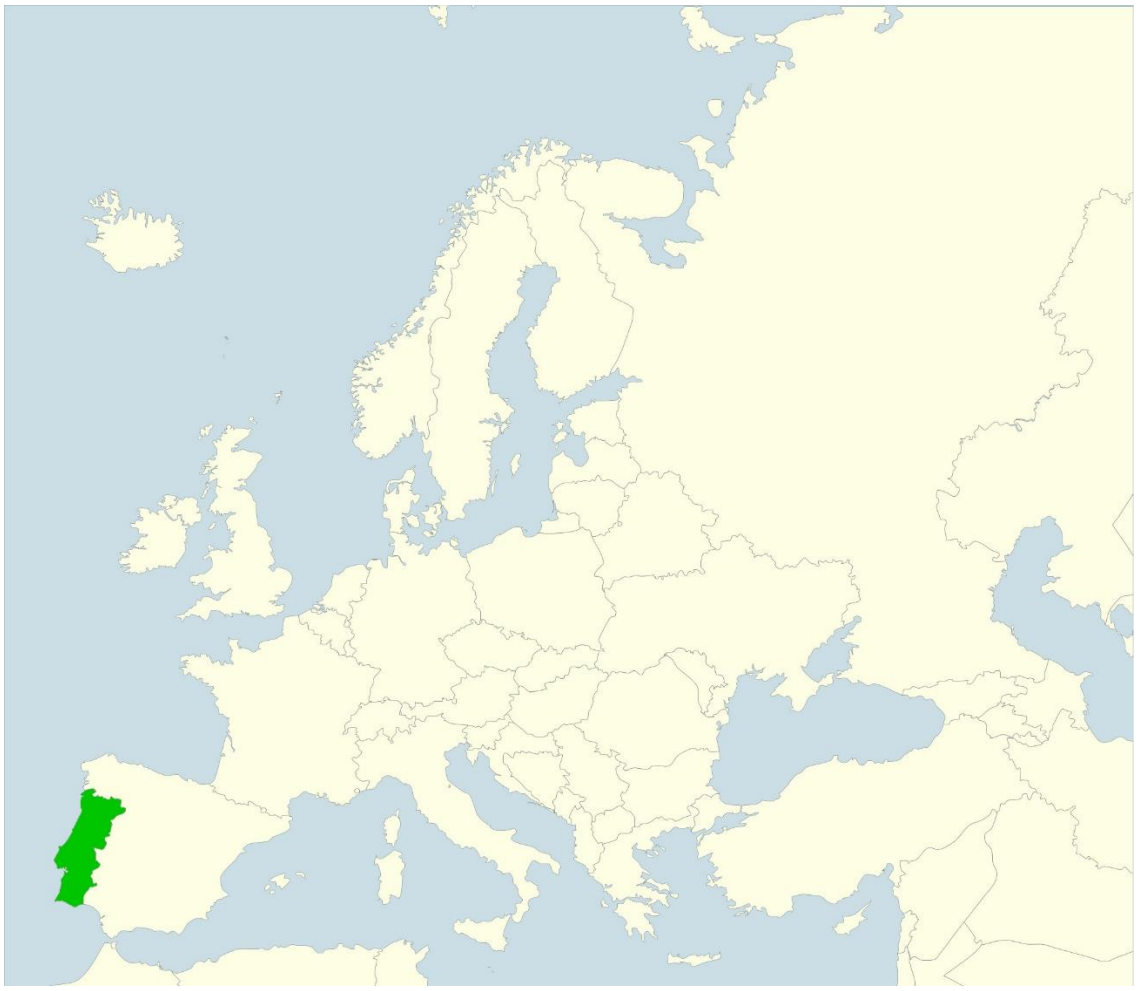
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SMALL, SMART AND SUSTAINABLE: NETWORKING TO DEVELOP THE MEDICINAL AND AROMATIC PLANTS VALUE-CHAIN IN PORTUGAL

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Abstract: The paper aims to study the use of medicinal and aromatic plants (MAP) farmers' networking activities to overcome challenges in the development of their business. MAPs are mostly cultivated in small farms located in rural territories. This presents many challenges in different dimensions of business development through the value-chain, namely in commercialization. That is why networking and collaboration with other actors may have an important role, by providing the scale and critical resources towards business success and value-chain sustainable development. The paper draws on a purposefully collected set of data on a network of Portuguese producers of MAP, organized under the EPAM project. The data was collected through a questionnaire and quantitatively analyzed in order to understand: i) how MAP farmers perceive the importance of networks for the development of their businesses? ii) How are networks enabling farmers with different profiles to develop their businesses? The results confirm the importance of networks for the development of these businesses, namely with other firms. However, it is possible to identify some diversity in the assessment of the role of those networks, both by taking into consideration the location of the farms and their positioning in the value-chain. The study contributes to a better understanding of how networking contributes to overcome barriers in the sustainable development of an agri-food value-chain, by stressing a variety of networking proposes and partners and the existence of differences across types of firms.

Keywords: agri-food value-chain, medicinal and aromatic plants, network, collaboration, smallness, sustainability, business development, Portugal

Highlights

- Medicinal and aromatic plants offer important opportunities for farmers, namely in Mediterranean countries.
- The development of the MAP value-chain is hindered by sustainability, and fragmentation of the producers.
- Networking and collaboration processes contribute to overcome those challenges.
- Different types of MAP farmers have diverse perceptions of networks.

1. Introduction

This paper aims to study the role of networks in the development of small agricultural businesses. More specifically, it addresses the use of farmers' networking activities for overcoming a set of challenges in the development of their business. It focusses on a particular value-chain, related to the production of medicinal and aromatic plants (MAP). MAP are leafy species used for culinary, cosmetic, and medicinal purposes. They are the base of phyto-medicines, essential oils, herbal teas, and have an important culinary use. MAP have a time immemorial presence in human societies and are cultivated all over the globe.

Like other agricultural and forest related products, the ongoing dynamics in this sector need to be contextualized in the main global challenges and concerns, namely climatic changes, and food insecurity. After the Covid-19 pandemic, Ukraine-Russian war increases the risks of food crises and stresses the importance of "basic" sectors, including agri-food systems. This is visible in the increase of literature on food system and food security. According to Li and Song (2022), the period from 2013 to 2020, when the consequences of the 2008 financial crisis were still being felt and the pandemic was just getting started, corresponds to a "fruitful and active period" in the literature on food security (Li and Song, 2022: 1).

The existing EU institutional framework considers the systemic crises we are facing. Within this framework, the European political agenda is particularly relevant, namely the Green Deal, the Strategy of

Biodiversity, the Farm to Fork Strategy and the Common Agricultural Policy (CAP). This agenda sets the priorities and guides farmer's decisions and investments, affecting all agricultural value-chains.

The Farm to Fork Strategy is at the heart of the European Green Deal aiming "to make food systems fair, healthy and environmentally-friendly"[2]. CAP 2023–2030 is built around ten key objectives, focused on social, environmental, and economic goals. These objectives are in line with the European Green Deal and, thus, with both strategies at its heart – Biodiversity and Farm to Fork. In more practical terms, this means, for instance, that cross-compliance measures, that is the minimum requirements that CAP beneficiaries must meet to receive support, are now more ambitious. For example, on each farm, at least 3% of arable land will be dedicated to biodiversity and non-productive elements, with the possibility to receive support through eco-schemes to reach 7%. All wetlands and peatlands will be protected. Eco-schemes will be mandatory for all Member States. This new voluntary instrument will reward farmers for implementing climate and environmentally friendly practices (organic farming, agro-ecology, integrated pest management, etc.), as well as improvements in animal welfare. Moreover, member States must allocate at least 25% of their income support budget to eco-schemes (total of €48 billion direct payments budget). Likewise, at least 35% of rural development funds will be allocated to agri-environmental commitments, which promote environmental, climate and animal welfare practices[3].

Current research on agri-food systems and its transition towards more sustainable models is mainly focused on the environmental dimension of sustainability. Social, economic, and political aspects have not been so central and although we are dealing with a multidisciplinary area, the predominance of environmental and ecological sciences is clear, while social sciences have been overlooked (Bilali *et al*., 2021). The main research topics found in the literature are food security, the comparison between organic and conventional agriculture, and the embeddedness and local agri-food systems (Bilali, 2019).

MAP value-chain has important economic, social, cultural, and ecological impacts. However, its study has been overlooked. The existing studies stress their importance and potential for the business diversification of small-scale farmers generating new sources of income to rural communities, and the growth of demand and business opportunities, both at local and international markets (Marshall, 2011; Mattew and Jack, 2011; Kwankhao *et al*., 2020; Agize and Zouwen, 2016; Imani *et al*., 2015; Yamoah *et al*, 2014; Borimnejad, 2008). More recently, it is possible to find some research on the sector's value-chain that provides some important insights regarding its sustainability (Di Vita *et al*, 2023; Spina *et al*, 2023; Taghouti *et al*, 2022). In this regard, it is also important to refer the recent *White Paper on non-wood forest products for people, nature and the green economy, lessons learned from around Mediterranean*, published by the European Forest Institute and FAO on non-wood raw materials, namely MAP (Arano et al., 2022).

Previous research identifies some challenges faced by MAP value-chain. Those challenges are mainly related to climate change, over-exploitation of wild plants and herbal/traditional medicine extinction, which raise the issue of their sustainable use and production (Groner *et al*., 2022; Ssenku *et al*., 2022; Marshall, 2011; Mattew and Jack, 2011; Rana *et al*., 2020; Barata *et al.*, 2016; Imani *et al*., 2015).

Although most of the existing studies have addressed the potentialities and challenges in developing countries, MAP value-chain is also relevant in developed countries, namely in the EU (Pieroni *et al.*, 2014; Marshall, 2011; Mattew and Jack, 2011), where the current political strategies previously mentioned offer an institutional framework potentially favorable for the smart and sustainable development of the value-chain.

This paper stresses the fact that MAP producers tend to be small-scale farmers located in rural, low-density territories (Xhoxhi *et al.*, 2020; Ssenku *et al.*, 2022; Imani *et al.*, 2015), therefore facing both the liability of smallness and remoteness. Entrepreneurship and innovation literatures already discuss the role of networks and collaboration processes to overcome barriers related to smallness and remoteness. The results of recent studies confirm the need to better understand MAP producers' networking and

[2] https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en

[3] https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/new-cap-2023-27/key-policy-objectives-new-cap_en

collaboration processes considering some critical aspects of the sector, namely the absence of market power due to the dominant fragmentation and small scale (Di Vita *et al*, 2023). In fact, the study of how networking contributes to overcome those barriers in the development of an agri-food value-chain is still scarce. The paper contributes to fill the gap on the subject by exploiting two research questions:

1. How MAP farmers perceive the importance of networks for the development of their businesses?
2. How are networks contributing to development of MAP value-chain, enabling farmers with different profiles develop their businesses?

To answer these questions, the paper resorts to an original data set, purposefully collected through a survey questionnaire sent to all MAP producers involved in an initiative to promote the MAP sector in Portugal: the EPAM project[4]. The survey was focused on the role of networking and collaborations to promote the farmers' business and therefore to strengthen the value-chain.

The paper is structured as follows: section 2 presents the literature review, stressing the characteristics of the MAP value-chain, and the role of networks and collaboration processes for the development of small, rural businesses in the sector; section 3 presents the method. Section 4 presents the results; and section 5 discusses the findings and concludes.

2. Literature review

2.1 Characterization of the MAP value-chain

MAP are leafy species used for culinary, cosmetic, and medicinal purposes. Phyto-medicines (namely essential oils, herbal teas, food supplements and plant-based drugs), and culinary are among the everyday uses of these plants. They have a time immemorial presence in human societies, are cultivated all over the globe, and have an important role in economic, social, spiritual, cultural, and ecological terms (Barata *et al.*, 2016; Imani *et al.*, 2015; Pieroni *et al.*, 2014).

Around 60,000 species are considered MAP (Barata *et al.*, 2016), among which sage, rosemary, oregano, lemon balm, chamomile, peppermint, lavender, basil, are some of the most known and worldwide commercialized. In Europe, at least 2000 MAP species are commercialized, from which 1300 are native to Europe (Marshall, 2011; Mattew and Jack, 2011).

MAP value-chain includes "collection, cultivation, manufacture and sale of botanical entities primarily for therapeutic and aromatic purposes as components of natural, cosmetic, medicinal and pharmaceutical products and services." (Mckenna, 2018, p. 10). In the context of this paper, the 'MAP value-chain" refers primarily to upstream stages of production, preceding its transformation into complex goods (e.g., plant-based drugs). In this context, "value-added processing can be undertaken to create derivative dry and liquid substances" that can be subsequently used as inputs in other industries (Mckenna, 2018, p. 11). The value-chain, therefore, includes not only cultivation and collection, but also, drying, distillation and extraction activities, as well as packaging for direct selling proposes (Taghouti *et al.,* 2022; Sultan, 2020).

MAPs can arrive to the market in different forms, namely fresh, dried, in herbal teas and in essential oils and extracts (mostly used as high value compounds for downstream industries). Fresh MAPs are perishable and, thus, usually sold in local/domestic markets. This can be done directly by the producer (in short-supply chains) or through wholesalers and retail chains (resorting to one or more intermediaries). Drying is a transformation process that enables MAPs storage for longer periods and, thus, long distance transportation and export. Dried MAPs can be used for seasoning, as herbal teas or further transformed for the obtention of extracts and essential oils. In case of being exported, dried MAPs are usually sold to wholesalers that distribute MAPs to different downstream industries and different countries. Essential oils and extracts that are used for medicinal or cosmetic purposes, usually integrating global value-chains. Farmers often integrate transformation activities in their business (drying, distillation, and/or extraction) (Taghouti *et al.*, 2022). Some farmers produce commercial end products that are directly sold to the final

[4] EPAM: entrepreneurship in aromatic and medicinal plants.

consumer or to intermediaries (specialized retailers or supermarkets), while others transform the raw material (e.g., essential oils). Therefore, the market opportunities have a multiscale geographical reach since "while the trade in some products is largely confined to local, national and regional markets, others are successfully internationally traded commodities" (Marshall, 2011, p. 10).

The socioeconomic characterization of the value-chain is hampered by the scarcity of systematic studies and statistics. Some publications of Food and Agriculture Organization of United Nations (FAO), provide some important insights to the knowledge of the sector. This is the case of Diversification booklet 17 on health and wealth from medicinal aromatic plants. According to this publication, "cultivation of MAP is (…) a feasible diversification enterprise for many small-scale farmers as demand is high, trade opportunities are increasing and the income generating potential is good" (Marshall, 2011, p. 1). The lack of official statistics and reliable secondary data, lead to studies that resort to surveys and interviews and tend to adopt descriptive and qualitative approaches using small samples. This is the case of the approaches to national cases, namely in the Mediterranean region (Di Vita *et al,* 2023; Spina *et al*, 2023; Taghouti *et al*, 2022).

Estimates point that currently the global MAP trade is worth around 70 billion USD (Türkekul and Yildiz, 2021). According to FAO, in 2021, 90.8 million tonnes of MAPs were produced around the world, of which 5.5% in Europe and 9 million tonnes were traded internationally (Spina *et al*, 2023). Trade numbers increase when local markets, where trade occurs informally (Spina *et al*, 2023), are added. In 2021, the global export market of MAP reached USD 21.2 million, being dominated by China and India, which represent around 1/3 of world exports. The larger importers are the United States, Germany, Japan, and Hong Kong (China) (Marshall, 2011; Mattew and Jack, 2011). Existing statistics also show a rise in the global exports of MAPs (Türkekul and Yildiz, 2021) that reflects the expansion of the use of MAP, but also a rise in prices. The world demand is relatively inelastic, since MAPs are critical inputs to several large global industries.

MAPs can be either be sourced from the wild or cultivated. More than half of MAPs are wildly harvested from community or national forests, and other public spaces (Barata *et al*., 2016; Mckenna, 2018). This raises many sustainability-related challenges, namely overharvesting, and, in some cases, extinction, habitat loss, and climate change (Di Vita *et al,* 2023; Spina *et al*, 2023; Taghouti *et al*, 2022; Groner *et al.*, 2022; Ssenku *et al*., 2022; Marshall, 2011; Mattew and Jack, 2011; Rana *et al*., 2020; Barata *et al.*, 2016; Imani *et al.*, 2015). Moreover, trends of demand growing, and plant population reduction are leading to problems of substitution, adulteration, and mistaken identities between species (Barata *et al.*, 2016). In the case of medicinal plants, Groner *et al.* (2022) analyzed one of the "most widely traded plants in informal medicine markets in South Africa" (Natal Lily (Clivia miniata)) and concluded that it has lost over 40% of plant individuals during the last 90 years (Groner *et al.*, 2022, p. 1). Ssenku *et al*. (2022) pointed out a high threat of herbal medicine extinction in Uganda, which is causing the erosion of Traditional Medicinal Knowledge. In Europe, the extinction problem affects approximately one quarter of plant species (Marshall, 2011, p. 3).

The overharvesting of wild plants is driven by the importance of this product as a source of income for local economy, particularly in remote and mountain territories (Di Vita *et al,* 2023; Spina *et al*, 2023; Taghouti *et al*, 2022; Marshall, 2011; Mattew and Jack, 2011; Kwankhao *et al.*, 2020; Agize and Zouwen, 2016; Imani *et al.*, 2015; Yamoah et al, 2014; Borimnejad, 2008). According to CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), the sustainability of the MAP value-chain demands sustainable harvesting and legal, well-regulated trade[5]. Increasing the number of MAP in cultivation presents an opportunity to deal with these threats (Marshall, 2011), particularly if sustainable agriculture practices are adopted. This also provides new business opportunities for rural communities.

MAP farming is already very critical for some rural communities, namely small-scale farmers in developing countries (e.g., Kwankhao *et al.*, 2020; Agize and Zouwen, 2016; Yamoah et al, 2014; Marshall, 2011; Mattew and Jack, 2011; Borimnejad, 2008). The sector has also known some expansion and increased its importance also in developed countries, namely in Europe (Di Vita *et al,* 2023; Spina *et al*, 2023; Taghouti

[5] https://cites.org/eng/prog/medplants

et al, 2022; Nicola *et al.*, 2006), where Mediterranean, Central and Eastern European countries have an important presence (Pieroni *et al*., 2014). In 2018, the European Union, the European Bank for Reconstruction and Development, and FAO, developed a program to promote exports of Georgia's fresh culinary herbs. This initiative was focused on the value-chain and aimed the expansion of the product to the global market (Marshall, 2011; Mattew and Jack, 2011).

Besides the differences in the socioeconomic contexts of developing and developed countries, the sector presents common aspects: small-scale of farms predominates; its economic importance is particularly relevant for disadvantaged areas (Di Vita *et al,* 2023; Spina *et al*, 2023; Taghouti *et al*, 2022; Sultan, 2020; Imani *et al.*, 2015; Pieroni *et al.,* 2014); the variety related with "processing and adding value" depending on the plants and rural territories. It is also important to note the important presence of women in the activities of the value-chain within the sector, namely collection and commercialization in the case of developing countries (Barata *et al.*, 2016).

The conclusions of recent research on MAP value-chain allow the identification of critical aspects aiming future developments of the sector. That is the case of the research on the Italian case (Di Vita *et al*, 2023; Spina *et al*, 2023). The main problems of MAP market are associated with actor's absence of power in the value-chain, because of fragmentation and small scale. This is notorious in the results of the research of Di Spita *et al*. The authors identify the following "critical aspects" of MAP market: foreign products, bargaining power of the distributors, low sales prices, lack of coordination among producers, lack of knowledge among supply-chain actors, lack of supply-chain agreements. As a result, and among other aspects, the authors suggest that "cooperation among producers" can be a route to overcome MAP value-chain problems (Di Spita et al, 2023: 8). These results are in line with other study on MAP supply chains in Italy. In fact, Di Vita *et al*, mentioned the "low bargaining power", the "lack of horizontal integration", and the "lack of agreements in the supply chain", among other factors, as the main challenges of the sector (Di Vita, 2023: 16). The importance of increasing the power of producers in the value-chain, was also highlighted by Taghouti *et al (2022)* who developed their research on four Mediterranean countries.

This paper focus on a Portuguese MAP producer's networks and collaboration processes is in line with the insights of the previously mentioned literature, allowing to gain knowledge on how networking contributes to overcome the challenges of a MAP value-chain in a Mediterranean country and, thus, contribute to understanding the developments of an important sector within the problems of rural development and climatic changes.

2.2 The role of networks and collaboration processes for the development of small rural businesses

Entrepreneurship and innovation studies recognized, for a long time and extensively, the role of networks for the development of businesses, particularly for small and medium-sized firms. In fact, research has shown that networks and collaborative actions:

- reduce market entry costs, time and risks (Coviello and Munro, 1995; Zhou *et al.*, 2007);
- support to get advice and solve problems (Hoang and Antoncic, 2003; Salavisa *et al.*, 2012);
- facilitate the identification of business opportunities (Awuah *et al*., 2011; Harris and Wheeler, 2005);
- able to access tangible and intangible resources, namely information and scientific and technical knowledge (Salavisa *et al.*, 2012);
- enhance competencies and capabilities, namely to expand markets (Awuah *et al*., 2011; Musteen *et al.*, 2013) and develop regional labels (Haugum and Grande, 2017; Heer and Mann, 2010).

Recently, scholars have begun to recognize the role of networks in agriculture sectors within the context of transition towards more sustainable models and regional development, stressing that they:

- Promote innovation (Ferreiro and Sousa, 2019; Borgers *et al.*, 2020), agroecological innovation (Castella *et al.*, 2022), and social innovation (Ferreiro *et al.*, 2022);
- Facilitate the adoption of new technologies (Filippini *et al.*, 2020);

- Improvement of values, motivation, and capacity building among young farmers (Drottberger *et al*., 2021);
- Contribute to the development of food hubs (Hyland and Macken-Walsh, 2022).

Research has also suggested that the development of agri-food businesses requires the participation in networks with a wide set of stakeholders, including universities and public organizations (Thomson et *al.*, 2017; Vercher, 2022) at different geographical scales (Ferreiro *et al.*, 2021).

As mentioned in the previous section, MAP tend to be cultivated in small farms located in remote rural regions. Some studies already recognize the role of networks for overcoming barriers related to the smallness of farms (Kurniawati *et al.*, 2022; Torres, 2006). Musso and Francioni (2015) showed that small Italian wine producers benefited from network relationships in their internationalization. Brinkmann *et al*. (2014) concluded that agri-food sector micro and small enterprises depend heavily on their networks, primarily for reaching and connecting with consumers, for sharing knowledge and for social support. Ramanauskas *et al.* (2021) stressed the importance of small farms networking for the development of sustainable agriculture Hersleth *et al.* (2022) found that farm-based entrepreneurs use several types of networks to mobilize their resources into developing the market, namely, to get access to food retail chains and to approach chefs. Henchion and McIntyre (2005) identify several difficulties of Irish small and medium enterprises of food sector in terms of market and competitiveness. Heer and Mann (2010) addressed spatial restrictions of local food networks in Germany.

In the case of MAP, collaborative actions, namely networks, might have a positive impact in some of the main problems faced by the sector, that is, value-chain, growth and potential in commercial terms (Sultan, 2020; Schunko et al., 2019; Schunko and Vogl, 2018; Grivings and Tisenkopfs, 2018; Belcher and Vantomne, 2003; Imani et al, 2015; Marshall, 2011; Mattew and Jack, 2011), but also in production, post-harvest technology, safety, quality, and traceability (Sultan, 2020; Imani *et al.*, 2015). Sultan (2020), for instance, proposes the use of a triple helix model to upgrade the medical and aromatic plants value-chain in the Palestian case. Considered as one of most promising sectors within agriculture but presenting many fragilities in all the value chain (e.g., yields fragmentation, low levels of trust, predominance of informal markets), Palestinian MAP presents many potentialities regarding the combination of the three institutional spheres of triple helix model (firms, universities and government) and the consequent development of innovation (Sultan, 2020).

Collaboration processes and the participation in networks are also considered a critical factor to overcome the difficulties and the challenges faced by enterprises located in rural areas, regardless of their dimension. Some authors have developed frameworks to analyze the interaction between the context (location) and the business development. Korsgaard *et al.* (2015) developed ideal types of rural entrepreneurship regarding the 'place' and 'space' concepts. This research distinguishes the entrepreneurial activities that have limited embeddedness with the territory and those that are locally embedded and thus "leverage local resources to re-connect place to space" (Korsgaard *et al.,* 2015, p. 7). In a more recent study, Müller and Korsgaard (2018) propose a typology of rural entrepreneurs within an analytical model that highlights the role of space in the development of entrepreneurship, namely rural territories. According to the authors, there are two "distinct modes through which the spatial context influences the rural entrepreneurial process: spatial resource endowments, and spatial bridging" (Müller and Korsgaard, 2018, p. 224). Beside networks, literature mentions other cooperation and communication actions such as 'structural, relational and cognitive social capital' on 'resource acquisition' in the case of small enterprises located in deprived areas, such as rural ones (Lee *et al.*, 2018).

Summing up, it is possible to find some literature on the importance of farm size and context, namely the location in disadvantage territories (such as some rural territories), on the opportunities and challenges for business development. However, scholars also consider that more research is needed to better understand the link between these dimensions (e.g., Müller and Korsgaard, 2018; Trettin and Welter, 2011; Heer and Mann, 2010; Henchion and McIntyre, 2005).

3. Method

3.1 Empirical context

The empirical analysis of this paper addresses a specific case: the farmers involved in a Portuguese initiative that was designed to support the development of a MAP value-chain in the country – The EPAM project. EPAM is the acronym (in Portuguese) of Entrepreneurship in the value-chain of Medicinal and Aromatic Plants. The promoter of the project is a Local Development Association (LDA) located in Baixo Alentejo, a low-density Portuguese region (NUT III). The project started in 2011 and is still running. It has been stimulating networking and collaborative solutions, involving farmers and other relevant actors, researcher organizations, intermediaries, processing companies, technical experts, and public organizations, covering all Portuguese continental territory. The activities related to network animation, research, information sharing and training have been contributing to the development of a strategic and innovative ecosystem.

In Portugal, the MAP value-chain presents positive potential impacts, both in commercial/economic and in environmental terms, namely by contributing to soil recovering from ecological damages caused by forestry fires, and to the sustainability of land management (Guapo, 2020). The cultivation of MAP has been supported by some funding schemes (e.g., the Portuguese Ecosystem Services Compensation Program, the National Plan for the Integrated Management of Rural Fires) as an activity that allows to restore, value, and protect biodiversity in some territories, namely in mountain areas, and that contribute to the multifunctionality of agroforestry spaces (AGIF, 2021).

Like in other countries, the data on the value-chain is scarce. To the best of our knowledge, the most recent study conducted by the Portuguese Ministry of Agriculture dates from 2013. According to this study (MAR-GPP, 2013), most national producers are located around the country, with some agglomeration in coastal North and Centre and in Alentejo. The total area under production, in 2012, was about 180 ha, from which the largest portion (about 97 ha) was cultivated under organic production, in very small farms (MAR-GPP, 2013). Moreover, the report, shows that farmers tend to be young and very educated, differing from the average sociodemographic profile of the Portuguese farmers.

3.2 Data collection and analysis

The MAP farmers were identified, in November 2020, through the EPAM database (https://epam.pt/produtores/). An e-mail was sent to all 157 farmers listed, using the contacts available on-line. During the process of finding the contacts and sending an e-mail asking for participation in this research, it became apparent that several farmers had ceased activity. Consequently, a total of 136 active MAP farmers related to the EPAM project were contacted. A link to an on-line survey was provided.

The questionnaire was available between 16th November 2020 and 30th January 2021. After a gentle reminder e-mail to increase the number of responses, a total of 34 valid questionnaires were obtained, corresponding to a 25% response rate.

The questionnaire had 5 parts. The first part was focused on the general characterization of the farm. The second part was focused on the importance of the participation in the EPAM network for the development of the business using a 5-point Likert scale, ranging from not important to highly important; it included questions related to several aspects of business development mentioned in the literature, namely obtaining information (about markets, regulatory processes, and funding), technical knowledge, and credibility; finding new partners (commercial, research, other producers) and new business opportunities; co-creating and transferring knowledge, collaborating in commercialization; defining the strategy; promoting the organizations and its projects; and developing personal relationships. The remaining parts draw on the literature that stresses the need to involve a wide set of actors at different geographical scales to develop agri-food businesses. Thus, the third part was focused on the importance of networking with a set of different type of actors to identify and exploit new business opportunities. The fourth part was focused on the importance of networking with a set of different type

of actors to access and/or develop scientific and technical knowledge. The fifth part was focused on the importance of networking with a set of different type of actors to get strategic counseling.

The questionnaire was able to create 54 variables (see Annex). The data was then quantitatively analyzed using descriptive univariate and bivariate statistics. In particular, to detect significant differences across groups of farmers, the Mann–Whitney U test was used. This non-parametric test was able to compare the distributions of two independent groups when the dependent variables were either ordinal or continuous but not normally distributed (Field, 2009), as is the case of the variables used in this research.

4. Results

4.1 General characterization of the respondent farmers

The respondent farmers cultivate 68 different species of MAP, among which the more common are presented in Figure 1. Only one of the farmers is specialized in one plant (see Figure 2). Only one farmer combines the cultivation of MAP with its harvesting from the wild.

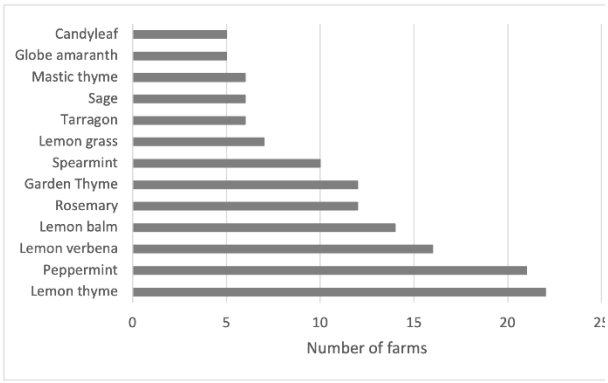


Fig 1. Most common MAP species produced.

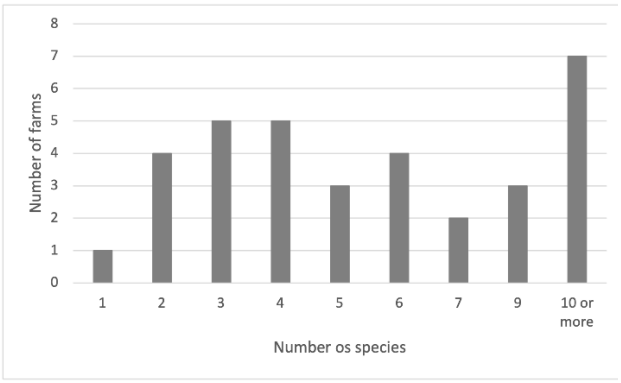


Fig 2. Number of MAP species produced by the respondents.

Source: author's own elaboration

The respondent farms produce in a small or very small scale, in line with what happens in other countries (Xhoxhi *et al*., 2020; Imani *et al.*, 2015). The average size of land area dedicated to MAP is 3.5 ha. This average is strongly influenced by the maximum value of the distribution, which corresponds to an association of organic MAP producers, therefore representing several farms. Moreover, familiar agriculture predominates, and no farm has more than 9 employees.

The farms are dispersed throughout the continental territory of the country, as evidenced in Figure 3. More than half of the respondents (56%) are located in rural territories, that is, they are located in a parish with less than 150 inhabitants per km^2.

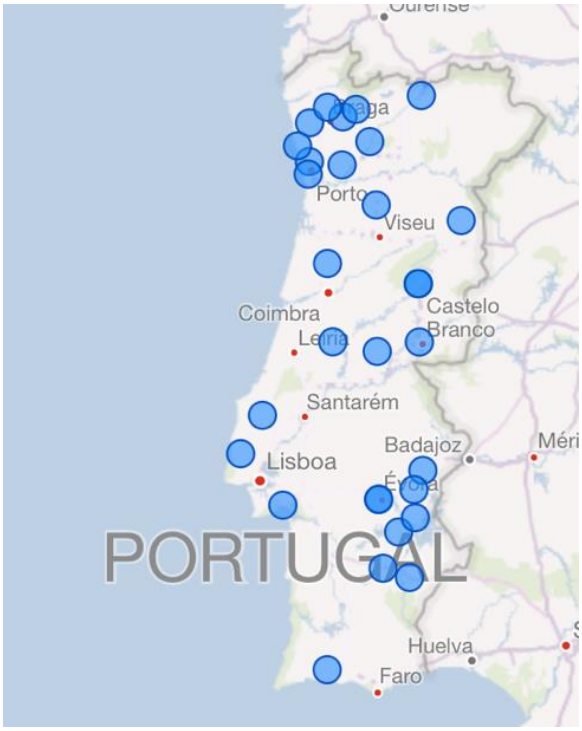


Fig 3. Localization of the respondents. Source: author's own elaboration

All respondents practice organic farming and most (67.8%) have a formal certification, namely by Ecocert, Certis, Kiwa Sativa, Naturalfa and Certiplanet. About half of farms have certificates that cover other products (namely, olives, mushrooms, forest, fallow). This is in line with the idea that sustainable MAP cultivation can be an opportunity to overcome overexploitation threats (Marshall, 2011) while contributing to an increase of demand (Barata *et al.*, 2016).

Finally, only three farmers do not perform any transformation of the MAPs, being specialized in cultivation and harvesting. The remaining farmers integrate downstream activities into the value-chain, and do some type of transformation, such as drying and/or distillation and even packaging and branding (53%). Moreover, 38% of the respondents have on-line selling through their own webstore (this excludes sales through social media like Facebook and Instagram). This suggests that these farmers are exploiting business opportunities that enable them to valorize the traditional knowledge they possess through the integration of activities that add-value to the agriculture products (Taghouti et al., 2022).

4.2 Importance of networks for the MAP farmers business development

The EPAM project network is broadly relevant for the MAP small business. Figure 4 shows that it is, on average, positively assessed by the farmers since the lower value is 3.32 on a scale of 1 to 5. The project is highly relevant to expand markets and product commercialization (find commercial partners, find information about markets and clients, identify new business opportunities), but also to access to technical knowledge and other competencies (namely related to regulatory processes). Therefore, the overall results confirm the idea that these small farmers perceive networks as being important for the development of their business (Kurniawati *et al.*, 2022; Torres, 2006), particularly for market related issues (Musso and Francioni, 2015; Brinkmann *et al.*, 2014).

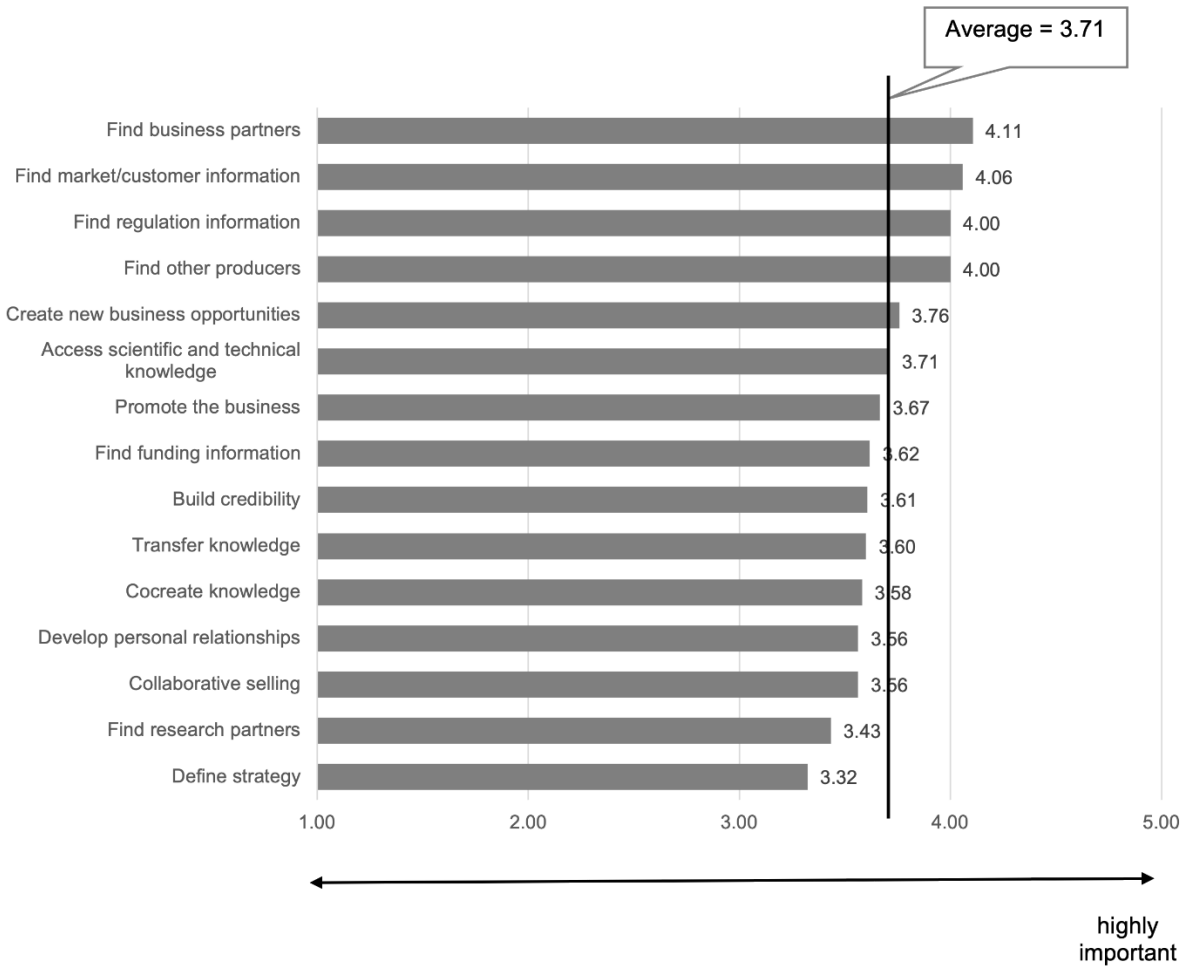


Fig 4. Average importance of the EPAM project for the MAP farmers' businesses. Source: author's own elaboration

On average terms, the types of partners that are particularly relevant to these farmers are other firms. In fact, firms are rated as important partners to identify and exploit new business opportunities (Figure 5), to access and or develop scientific and technical knowledge (Figure 6) and to get strategic counseling (Figure 7), namely other EPAM project members and foreign and national firms, and to a lesser extent local firms. Non-business partners, namely national universities, LDAs and governmental organizations related to agriculture are also relevant.

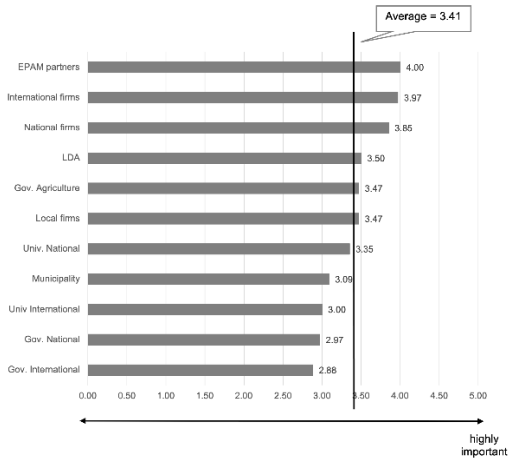


Fig 5. Average importance of each type of partner to find and exploit new business opportunities.

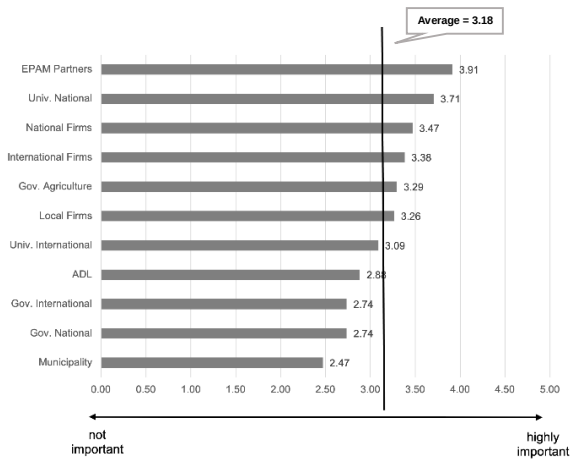


Fig 6. Average importance of each type of partner to access and/or develop scientific and technical knowledge.

Source: author's own elaboration

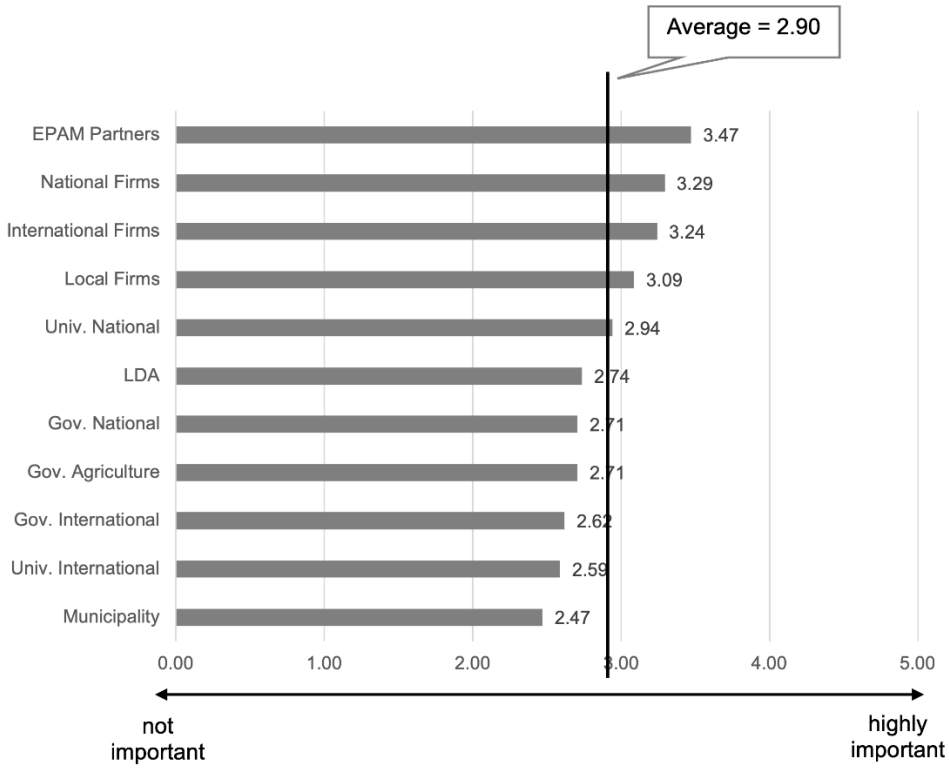


Fig 7. Average importance of each type of partner for strategic counselling. Source: author's own elaboration

4.3 Importance of networks for MAP producers with different profiles

Although networks and collaborative processes are globally relevant to these farmers. it is important to understand whether there are differences between groups of farmers according to their location and position in the value-chain.

4.3.1 Farms located in different types of territories

To know if there is a difference in the importance given by the farmers to networks according to the type of territory where they are located, Mann–Whitney U tests were performed for all the variables related to networking. Table 1 presents the results for the variables where the differences are statistically significant.

Tab 1. Comparing farms according to the type of territory where they are located. Source: author's own elaboration

Variable	Mann-Whitney U	Rural Average (N=19)	Non-Rural Average (N=15)
Find other producers	96.0*	3.5263	**4.2667**
Develop personal relationships	72.5**	2.9474	**4.0667**
Business – national firms	97.5*	3.3316	**4.1333**
Business – international firms	90.0*	3.6842	**4.3333**
Knowledge – EPAM partners	55.5***	3.4211	**4.5333**
Knowledge – local firms	85.5**	2.8421	**3.8000**
Knowledge – national firms	89.5*	3.1579	**3.8667**
Knowledge – international firms	90.0*	3.0000	**3.8667**

*** p < 0.01; ** p < 0.05; * p < 0.1

According to the results, when differences are statistically significant, farmers located in rural territories tend to attribute a lower importance to networking. The result may be counterintuitive. It could be expected that farms located in rural territories, portrayed as “less rich”, would give greater value to their

networks, compared to the ones located in non-rural territories to overcome the local resource scarcity (Heer and Mann, 2010; Reypens *et al.*, 2021). However, as stressed by Lee *et al.* (2018), entrepreneurs located in deprived areas may experience less resource acquisition. Moreover, as highlighted by Müller and Korsgaard (2018), some rural entrepreneurs may be highly embedded in the local context by using local resource endowments. The analysis of variables in which the differences are significant may help to understand the result.

This result holds for the importance of the EPAM project to find other producers and to develop personal relationships. Since rural territories have a lower number of actors, farmers may find it easier to find producers and to develop personal relationships in the vicinity, therefore attributing less importance to the EPAM formal network for those purposes. Conversely, farmers located in non-rural areas tend to rely more on the participation on the cluster-reinforcing initiative to develop personal relationships.

The results also hold for the importance of networking with national and international firms to identify and exploit new business opportunities and for the importance of networking with firms (other MAP producers that are also members of the EPAM network, and national and international firms) to develop and/or access to scientific and technical knowledge. This may be related to the opportunities to develop relationships with geographically distant firms when the context has a lower number of actors and resources. This may suggest that entrepreneurs located in non-rural areas attribute more importance to the participation in flows of knowledge and products across multiple locations.

4.3.2 Farms in different stages of the value-chain

Firstly, we compare farms that only perform cultivation and harvesting with the ones that perform any type of transformation. The results for the statistically significant differences are presented in Table 2.

Tab 2. Comparing farms that do transformation with farms that do not. Source: author's own elaboration

Variable	Mann-Whitney U	Do – Average (N=31)	Do not – Average (N=3)
Find business partners	13.0**	**4.1935**	2.3333
Find regulation information	14.0**	**3.6452**	2.0000
Promote the business	20.5*	**3.7419**	2.3333
Develop personal relationships	17.5*	3.3226	**4.6667**
Business – international universities	13.0**	**3.1613**	1.3333
Business – LDA	14.5**	**3.6452**	2.0000
Business – national government	6.0***	**3.1613**	1.0000
Business – international government	9.0**	**3.0645**	1.0000
Knowledge – international universities	10.5**	**3.2581**	1.3333
Knowledge – municipality	10.5**	**2.6129**	1.0000
Knowledge – national government	10.5**	**2.9032**	1.0000
Knowledge – international government	12.0**	**2.9032**	1.0000
Counseling – international universities	10.5**	**2.7419**	1.0000
Counseling – LDA	10.5**	**2.9032**	1.0000
Counseling – government national	13.5**	**2.8710**	1.0000
Counseling – government international	16.5*	**2.7742**	1.0000

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

The only case in which companies exclusively dedicated to agricultural activities attach greater importance to networking takes place in the use of the EPAM project to develop personal relationships. In the remaining cases, the farms that integrate downstream activities in the value-chain, consider networking more important. This holds for the role of the EPAM project to find business partners and information about regulatory processes and to promote the business. It also holds for networking with a set of actors to identify and exploit new business opportunities, to develop and/or access to scientific and technical knowledge and to get strategic counseling. We find differences that involve non-business actors, namely foreign universities, local development associations (LDA), and governmental organizations (at all scales).

The results suggest that being upstream in the value-chain requires more mobilization of networks, with a more varied set of actors, including non-business and international organizations.

Next, we assess the existence of difference between farmers that package and brand their products and those that sell "bulk" products (either transformed or not). The results are presented in Table 3. The only two variables where differences between the two groups are statistically significant are related to the role of EPAM network to transfer and co-create knowledge. Farmers that do not package and brank their product perceive the network as being more relevant. This suggests that farmers with "less advanced" marketing strategies depend more on the EPAM project to access and co-create scientific and technical knowledge. One possible explanation for this is the use of networks to compensate for the lack of internal competencies, as companies with more "ambitious strategies" may already have developed a wider range of competencies related to knowledge creation.

Tab 3. Comparing farms that do packaging and branding with farms that do not. Source: author's own elaboration

Variable	Mann-Whitney U	Do – Average (N=18)	Do not – Average (N=16)
Transfer knowledge	86.5**	3.0000	**3.8125**
Co-create knowledge	96.5*	2.9444	**4.0000**

*** p < 0.01; ** p < 0.05; * p < 0.1

Finally, we consider the subset of companies that do transformation and assess the existence of difference between farmers that package and brand their products and those that do not. It was also possible to find some statistically significant differences (Table 4).

Tab 4. Comparing farms that do transformation with firms that also do packaging and branding. Source: author's own elaboration

Variable	Mann-Whitney U	Only transformation – Average (N=13)	Packaging and branding – Average (N=18)
Build credibility	78.5*	**4.0000**	3.2778
Transfer knowledge	74.0*	**3.9231**	2.9444
Business – local firms	75.5*	**4.0000**	3.1667
Business – national government	77.0	**3.5385**	2.8889

*** p < 0.01; ** p < 0.05; * p < 0.1

5. Conclusion

This paper addressed the question of how networking can contribute to the development of an agri-food value-chain by helping farmers to overcome barriers related to their size (smallness) and location (remoteness). The research focused on MAP, a sector with relevance in a multidimensional perspective. The economic, social, ecological, and cultural importance of MAP, both in developed and developing countries, justifies the attention to this product and its development.

Previous research has highlighted some of the challenges faced by the MAP producers and suggested the importance of networking and collaboration processes to overcome them (Di Vita *et al,* 2023; Spina *et al*, 2023; Taghouti *et al*, 2022). This paper draws on the literature on the benefits of networks for

business development – namely in terms of access to knowledge and information, access to markets and access to counselling – to gain knowledge on how networking contributes to overcome some barriers in the development of the Portuguese MAP value-chain. The empirical studied addressed farmers that are affiliated with an important national initiative to promote the MAP value-chain: the EPAM project.

The results are in line with previous research, confirming the small dimension of the farms, as well as the familiar nature of the production (and transformation) of MAP (e.g., Xhoxhi *et al.*, 2020; Imani *et al.*, 2015). The rural location of most of the farmers that responded to the questionnaire applied in the research is also a common trait of MAP producers in different geographies (e.g., Kwankhao et al., 2020; Borimnejad, 2008).

Moreover, the results suggest that these farmers are adopting new business models that enable them to be both competitive and sustainable. The practice of organic farming and the existence of formal certification by the respondents introduce evidence of important contributions of the sector towards sustainability and the application of mandatory quality procedures. This points to the idea that the cultivation of MAP can contribute to the sector's sustainability (Marshall, 2011). Also, the use of online commercialization is also an interesting aspect of the modernization of the sector by using digital tools that enable access to distant markets, enabling these small firms to be less dependent on intermediaries (Ferreiro and Sousa, 2019; Henchion and McIntyre, 2005). This direct commercialization can be a strategy to overcome the high bargaining power of retailers and distributers, which has been identified as a challenge to the development of the value-chain (Di Vita et al., 2023).

The results confirm the importance of the sectoral network addressed in the research, the EPAM project network, in the development of these small business, namely by providing commercial opportunities and technical knowledge. This stresses the role of collective action to develop agricultural value-chains and clusters (Musso and Francioni, 2015; Ferreiro and Sousa, 2019) and the importance of horizontal integration among MAP producers (Di Vita et al., 2023). They also stress the importance of networking with other firms, but also other actors, such as universities and government entities, confirming the importance of multi-actor and multi-scale networks for agri-food business development, particularly in the MAP sector (Sultan, 2020).

The paper also provides a more fine-grained analysis, by detecting differences in the importance of network for business development of farmers with different profiles, namely in terms of location and positioning in the value-chain. The results indicate that both the consideration of the farmers' location in rural and non-rural areas, the length of the value-chain, and the presence of package and marketing actions in the farms introduces variety in the way farmers assess the importance of networks. Differences are particularly numerous when we considered the position in the value-chain, highlighting the fact that famers that integrate transformation activities value more networks for a diversity of purposes and with a more varied set of actors (both in terms of types and location).

Though the paper offers relevant insights on how networking and collaboration processes are enabling the development of the MAP value-chain in Portugal, the approach adopted is not free of limitations. In particular, it relies on a small sized sample. Although this is common in studies that address the MAP sector, due to the absence of secondary data and the difficulty to collect large sets of data given the low number of actors active in each country and the difficulty in recruiting stakeholders (Di Vita et al., 2023), it prevents the generalization of results. Moreover, the analytical approach was based on an explorative and quite descriptive analysis, given the small size of the sample.

Despite these limitations the results suggest some recommendations for MAP farmers, sector associations and policymakers. The participation in formal networks, such as the one promoted by the EPAM project, enables access to resources that are crucial for business development. However, collaboration needs to go beyond producers and local actors and to involve a wide set of stakeholders and geographies.

Moreover, the fine-grained analysis, based on considering several types of MAP producers, suggests that the importance of networks for business development is not a monolithic reality, a fact that needs to be considered in the design of measures to support the value chain. The relation between them has complex nature, depending on the location but, mainly, of the value-chain position of the farms. This complexity

allows the interpretation of results and the launch of new paths of research on this relevant sector within current societal challenges such as climatic changes and food security.

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Annex – Variables description

Variable	Type	Description	Average	Minimum	Maximum
Only cultivation	Binary	The farmer only cultivates and harvests			
Transformation	Binary	The farmer does any transformation activity			
Packaging and branding	Binary	The farmer does packaging and branding			
Certification	Binary	The farmer has an organic farming certificate			
E-store	Binary	The famer sells the products through a website			
Rural territory	Binary	The farm is located in a parish that has a population density less than 150 inhabitants per km^2			
Find research partners	Ordinal	Importance of EPAM network to find new research partners – 5-point Likert scale	3.1765	1	5
Find business partners	Ordinal	Importance of EPAM network to find new business partners – 5-point Likert scale	4.0294	1	5
Find other producers	Ordinal	Importance of EPAM network to find other producers – 5-point Likert scale	3.8529	1	5
Find market/customer information	Ordinal	Importance of EPAM network to find and get information about markets/customers – 5-point Likert scale	4.0882	1	5
Find funding information	Ordinal	Importance of EPAM network to find and get information about funding/ incentive schemes/support programmes – 5-point Likert scale	3.6471	1	5
Find regulation information	Ordinal	Importance of EPAM network to find and get information about regulatory processes – 5-point Likert scale	3.5000	1	5
Access scientific and technical knowledge	Ordinal	Importance of EPAM network to access scientific and technical knowledge – 5-point Likert scale	3.8529	1	5
Create new business opportunities	Ordinal	Importance of EPAM network to create new business opportunities – 5-point Likert scale	3.7059	1	5
Collaborative selling	Ordinal	Importance of EPAM network to engage on collaborative selling – 5-point Likert scale	3.4412	1	5
Promote the business	Ordinal	Importance of EPAM network to promote the farm and/or its products – 5-point Likert scale	3.6176	1	5
Build credibility	Ordinal	Importance of EPAM network to build credibility – 5-point Likert scale	3.5588	1	5

Cocreate knowledge	Ordinal	Importance of EPAM network to cocreate knowledge – 5-point Likert scale	3.3824	1	5
Transfer knowledge	Ordinal	Importance of EPAM network to transfer knowledge – 5-point Likert scale	3.4412	1	5
Define strategy	Ordinal	Importance of EPAM network to define the strategy – 5-point Likert scale	3.1765	1	5
Develop personal relationships	Ordinal	Importance of EPAM network to develop personal relationships – 5-point Likert scale	3.4412	1	5
Business – national universities	Ordinal	Importance of national universities for the identification and exploitation of new business opportunities – 5-point Likert scale	3.3529	1	5
Business – international universities	Ordinal	Importance of national universities for the identification and exploitation of new business opportunities – 5-point Likert scale	3.0000	1	5
Business – EPAM partners	Ordinal	Importance of EPAM project partners for the identification and exploitation of new business opportunities – 5-point Likert scale	4.0000	2	5
Business – local firms	Ordinal	Importance of local firms for the identification and exploitation of new business opportunities – 5-point Likert scale	3.4706	1	5
Business – national firms	Ordinal	Importance of national firms for the identification and exploitation of new business opportunities – 5-point Likert scale	3.8529	2	5
Business – international firms	Ordinal	Importance of international firms for the identification and exploitation of new business opportunities – 5-point Likert scale	3.9706	2	5
Business – LDA	Ordinal	Importance of local development associations for the identification and exploitation of new business opportunities – 5-point Likert scale	3.5000	1	5
Business – municipality	Ordinal	Importance of municipalities for the identification and exploitation of new business opportunities – 5-point Likert scale	3.0882	1	5
Business – government agriculture	Ordinal	Importance of government organizations related to agriculture for the identification and exploitation of new business opportunities – 5-point Likert scale	3.4706	1	5
Business – national government	Ordinal	Importance of national government organizations for the identification and exploitation of new business opportunities – 5-point Likert scale	2.9706	1	5

Business – international government	Ordinal	Importance of international government organizations for the identification and exploitation of new business opportunities – 5-point Likert scale	2.8824	1	5
Knowledge – national universities	Ordinal	Importance of national universities for the development and/or access to scientific and technical knowledge – 5-point Likert scale	3.7059	2	5
Knowledge – international universities	Ordinal	Importance of national universities for the development and/or access to scientific and technical knowledge – 5-point Likert scale	3.0882	1	5
Knowledge – EPAM partners	Ordinal	Importance of EPAM project partners for the development and/or access to scientific and technical knowledge – 5-point Likert scale	3.9118	2	5
Knowledge – local firms	Ordinal	Importance of local firms for the development and/or access to scientific and technical knowledge – 5-point Likert scale	3.2647	1	5
Knowledge – national firms	Ordinal	Importance of national firms for the development and/or access to scientific and technical knowledge – 5-point Likert scale	3.4706	1	5
Knowledge – international firms	Ordinal	Importance of international firms for the development and/or access to scientific and technical knowledge – 5-point Likert scale	3.3824	1	5
Knowledge – LDA	Ordinal	Importance of local development associations for the development and/or access to scientific and technical knowledge – 5-point Likert scale	2.8824	1	5
Knowledge – municipality	Ordinal	Importance of municipalities for the development and/or access to scientific and technical knowledge – 5-point Likert scale	2.4706	1	5
Knowledge – government agriculture	Ordinal	Importance of government organizations related to agriculture for the development and/or access to scientific and technical knowledge – 5-point Likert scale	3.2941	1	5
Knowledge – national government	Ordinal	Importance of national government organizations for the development and/or access to scientific and technical knowledge – 5-point Likert scale	2.7353	1	5
Knowledge – international government	Ordinal	Importance of international government organizations for the development and/or access to scientific and technical knowledge – 5-point Likert scale	2.7353	1	5
Counseling – national universities	Ordinal	Importance of national universities to get strategic counseling – 5-point Likert scale	2.9412	1	5

Counseling – international universities	Ordinal	Importance of national universities to get strategic counseling – 5-point Likert scale	2.5882	1	5
Counseling – EPAM partners	Ordinal	Importance of EPAM project partners to get strategic counseling – 5-point Likert scale	3.4706	1	5
Counseling – local firms	Ordinal	Importance of local firms to get strategic counseling – 5-point Likert scale	3.0882	1	5
Counseling – national firms	Ordinal	Importance of national firms to get strategic counseling – 5-point Likert scale	3.2941	1	5
Counseling – international firms	Ordinal	Importance of international firms to get strategic counseling – 5-point Likert scale	3.1765	1	5
Counseling – LDA	Ordinal	Importance of local development associations to get strategic counseling – 5-point Likert scale	2.7353	1	5
Counseling – municipality	Ordinal	Importance of municipalities to get strategic counseling – 5-point Likert scale	2.4706	1	5
Counseling – government agriculture	Ordinal	Importance of government organizations related to agriculture to get strategic counseling – 5-point Likert scale	2.7059	1	5
Counseling – national government	Ordinal	Importance of national government organizations to get strategic counseling – 5-point Likert scale	2.7059	1	5
Counseling – international government	Ordinal	Importance of international government organizations to get strategic counseling – 5-point Likert scale	2.6176	1	5