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Enhancing the extended value chain of the aromatic plant sector in Italy: a multiple correspondence analysis based on stakeholders' opinions

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Abstract

The aim of the study has been to understand the stakeholders' stance, with respect to the different stages of Porter's value chain, to learn what activities could create the most value to the future competitiveness of the Italian aromatic sector. The main challenges faced by stakeholders and possible future strategies have been investigated. A survey, consisting of four subsequent phases: creation of a focus group, identification of actors and experts, gathering of data, and processing of the data using descriptive statistics and Multiple Correspondence Analysis (MCA), has been performed. The stakeholders agreed that the Italian aromatic sector needs to enhance its value chain, but there is a polarisation of importance especially towards processors and retailers. Processors consider operations and outbound logistics as the most relevant primary activities, while retailers consider marketing and sales. Firm infrastructure and technology development are the more relevant support activities for retailers, while human resource management for processors. Farmers are apprehensive of imports, while processors agree that priority should be given to the bargaining power of retailers. Training of professionals emerges as an important future strategy to improve the extended value chain of the sector. The article investigates the extended value chain of the aromatic plant sector, according to Porter's model, in combination with a multivariate explorative tool (MCA). The results represent preliminary insights that can be used to diversify the role and sensitivity of different stakeholders, with respect to supply chain competitiveness and innovation.

Keywords: Multiple Correspondence Analysis, Extended value chain, Porter's model, Aromatic plants, MAPs, Italy

Introduction

A situation in which several economic actors are involved in organisation activities is often referred to as an extended value chain, and such a chain contrasts with the linear production line of the supply chain (Sundbo 2011). The value chains of organisations include several steps and different upstream and downstream business relationships of

the organisation itself (Kovács 2008; León-Bravo et al. 2017; Knez et al. 2021). Indeed, the boundaries of value creation are becoming more and more extended, and there have been several attempts to study and analyse the role of different business activities in creating value in several contexts and for different productions (Sadovska et al. 2020; Hedman and Henningson 2008; Zarbà et al. 2013).

An integrated approach involving the main economic agents throughout the value chain can contribute to the generation of new market opportunities for firms, thus improving their connection with other businesses and strengthening local food supply chains (Thomas-Francois 2018). Collaborations and development of relationship among actors have been suggested as an important component for the success of value chains (Hastings et al. 2016). Indeed, establishing an inclusive supply chain among small enterprises, big firms and communities can sustain rural development and improve food security (Teklehaimanot et al. 2017). The development of the supply chain seems to be a strategic point, but it needs the support of policy makers, as focusing on the extended value chain can provide more benefit rather than a specific product or process (Fagioli et al. 2017). Although the benefits of awareness raising, support, development, and investment are important, several aspects are still unsettled, since there is a lack of inclusion and collaboration at the base of the value chain, which leads to difficulties in managing the extended value chain (Chamberlain et al. 2019; Hernandez-Cazares et al. 2020). However, this critical point provides opportunities for further research. In light of previous considerations, the starting hypothesis of the present work is that not all activities contribute equally to generating value in the extended agricultural chain. For this reason, this study has focused on the aromatic plant sector as a case study to implement an analysis of such activities from an extended value chain perspective. The aromatic plant sector was chosen because of its economic importance, the high environmental sustainability of its productions, and its multiplicity of food-non-food uses. With this respect, there is currently a considerable demand for aromatic plants, which is probably driven by an increased attention towards healthier and more traditional diets (Güney 2019; Pardo-de-Santayana et al. 2007; Seeland et al. 2007). Moreover, aromatic plants (APs) contribute to the well-being of society in many ways and are considered part of the cultural heritage of the Mediterranean area (Martínez de Arano et al. 2021; Taghouti et al. 2022), including the Italian territory, which represents an important production and commercial hub. In this regard, recent official statistics indicate that in 2022 cultivated aromatic plants covered approximately 7,300 hectares in Italy. The harvested production of aromatic plants in Italy amounted to around 4,000 tons, while over 3,000 farmers were involved in the primary production of the sector. The value of the raw production intended for processing was estimated to be around 235 million euros in 2022, while the export value of the spices, aromatic and pharmaceutical plants amounted to almost 82 million euros (FIPPO 2022; ISTAT 2023; MAECI 2023).

Furthermore, in terms of sustainability, aromatic plants can be considered low-input crops because they do not require large quantities of water or fertilisers. Consequently, the ecology of a territory can benefit from their cultivation, and they can also play a role, in terms of ecosystem services, by protecting slopes from erosion and by conserving biodiversity (Rao et al. 2004). However, climate change represents an important threat for the cultivated and wild species in this sector. In fact, it may cause changes in the

distribution and adaptation of species, thus increasing the risks pertaining to investments in the sector (Das et al. 2016).

Finally, these plants are of considerable interest for industry, due to the variety of products that are available. Their industrial uses are very diversified; they are suitable for processing in the pharmaceutical industry, for health care articles, cosmetics and organic food (Solomou et al. 2016).

Since interest in agro-food systems concerning aspects related to an extended value chain is still limited (Knez et al. 2021), understanding the critical aspects and challenges evidenced by the main supply chain actors becomes crucial to reveal strategies and actions that can be introduced to improve future policies and technical decisions.

Indeed, the entire Italian aromatic and medicinal plant sector is dictated and influenced by different strategies implemented by all the companies present throughout the Italian territory. Thus, the whole structure depends on business strategies, which in turn depend on the traditions and goals of the individual companies (Nagy et al. 2018). For these reasons, this study was structured to obtain a deeper understanding of the three different phases of the sector (production, processing and distribution), on the basis of Porters' value chain model, as reported in the subsection below.

The remainder of the paper is structured in five sections. Sect. "Theoretical background, objectives and research questions" briefly describes the theoretical background of Porter's extended value chain model and sets the objectives and research questions. Sect. "Research design" deeply describes the research design and Sect. "Results and discussion" presents and discusses the main results. Finally, the main conclusions are drawn in the last section.

Theoretical background, objectives and research questions

Theoretical background

Several frameworks have been developed in management literature to examine the operations of a company, all of which were designed to improve business performance: among these, the value chain framework (Porter 1985) is one that considers the value chain holistically by including both primary activities, such as logistics or production, and supporting activities such as human resource (HR) management or accounting, while adopting a more operational and process-oriented perspective (Eisenreich et al. 2022).

As shown in Fig. 1, such primary activities include inbound logistics (reception, storage and distribution of raw materials), operations (transformation of inputs into final products), outbound logistics (collection, storage and distributions of the final products), marketing and sales (attracting customers and allowing them to purchase the product) and service (maintaining or enhancing the value of a product). Support activities include procurement (purchasing of inputs for all the activities), technology development (improving the product and the processes of an enterprise), HR management (activities related to the staff of a company) and firm infrastructure (overarching activities, such as general management, finance and accounting, and legal affairs) (Eisenreich et al. 2022; Porter 1985). Finally, margin is the measure of the total profitability that an enterprise has been able to generate through an original combination of the value-creating activities (Baroncelli & Serio 2013).

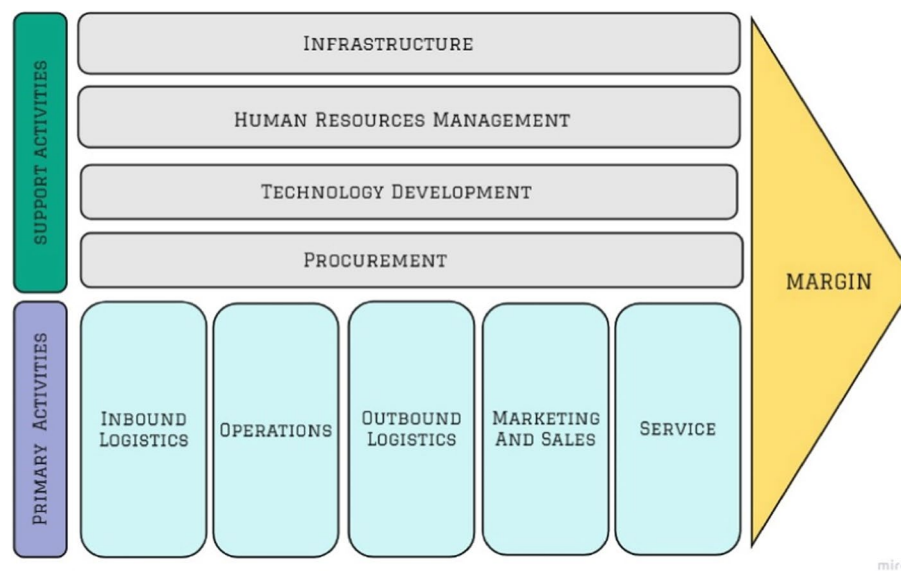


Fig. 1 A value chain model adapted from Porter (1985)

When a system generates a value of its goods or service, income is created, and the amount of this income must necessarily be much higher than the cost faced to obtain a given goods or service (Nagy et al. 2018). A cost analysis of each enterprise activity (primary and supporting) should be performed and monitored to develop a competitive advantage: each operation carried out by the enterprise, with the intention of creating value, implies the inclusion of a cost that the enterprise must bear, while a margin is achieved when customers pay more than the cost of various enterprise activities (Ruan 2020).

It is possible, through the Porter (1985) Value Chain model, to define the aromatic and medicinal plant supply chain areas that create the greatest value for the final products/services, as well as to comprehend the main critical issues and opportunities for improvement of the entire sector. Moreover, a general study is not sufficient to understand the competitive advantage of a company/sector, and the individual elements that comprise the whole structure must be known, since they ultimately make up the product/service (Porter 1985).

The value chain of such an organisation includes several steps and different upstream and downstream business relationships of the same organisation. Thus, it is important to analyse the different business activities involved in value creation, while bearing in mind that the boundaries of value-creating activities are stretched and blurred. In fact, in the real world, value chains are much more complex, because there tend to be several links in the chain (Kovács 2008; León-Bravo et al. 2017). A product passes through various intermediary stages, the number of which depends on which market is served, until it finally reaches the customer, who, after use, consigns the spent products to recycling (Nang'ole et al. 2011).

Thus, a value chain analysis can be viewed in either a narrow or broad sense. In the narrow sense, a value chain focuses on a single enterprise, while the broad approach looks at the range of activities implemented by various actors in an enterprise that

lead a raw material to the final product, which also include links with other actors engaged in activities such as trading, assembling, processing and the provision of development services, including all the connections up to the level where the produced raw material is linked to the end consumers (van den Berg et al. 2008; Sundbo 2011). From this perspective, the creation and sustainability of a competitive advantage depends not only on an understanding of a firm's value chain, but also on the interaction that this firm is able to ensure with all the other actors that contribute to creating value for the customer (Baroncelli & Serio 2013). Today, this approach is essential to enable innovation (Sundbo 2011), which involves bringing together different actors at various levels, ranging from individual, group, organisational, and inter-organizational levels (Ringen et al. 2020). Indeed, the value chain approach has been refined and extended over time to include, for example, the life cycle of products and services (Klöpffer 1997), extended producer responsibility during production, processing, distribution, use, and disposal activities (Atasu & Subramanian 2012), and, more recently, to facilitate an extended implementation of sustainable development goals along the value chain (Montiel et al. 2021). Therefore, the authors consider it necessary, in order to enable the development of the entire aromatic plant sector in Italy, to consider not only the individual value chain, but also the extended value chain comprising the main actors involved in value creation along the supply chain. This approach highlights common challenges and opportunities, resulting from the combination and convergence of individual challenges and opportunities, which can provide a whole picture useful to support policymakers and industrial policy.

Objective and research questions

Building on previous considerations and taking into account stakeholders' opinions, it was decided to investigate and establish what activities that deliver products or services are able to generate more value in the APs sector, thus positively impacting the bottom line. In this respect, Porter's value chain model was adopted, in its extended form, and included in an explorative factor analysis. The extended value chain was then analysed by considering three different phases: production, processing and retail. Figure 2 shows the extended value chain and the relationships among the stakeholders; the continuous lines indicate the actors on which the study focused. The paper does not consider the aspects of use and disposal as mentioned by Atasu & Subramanian (2012), as the focus is on analysing the extended value chain from the perspective of primary stakeholders. Secondary stakeholders, such as academics, members of industry associations, state and regional officials, and agronomists, were involved only in the first phase of the research to define relevant phenomena for the development of the aromatic plant supply chain (see Sect. "Research design"). Consumers, although considered as secondary stakeholders, were not approached as experts in this research. However, they are considered as the final potential beneficiaries of any improvements and positive implementation in the production chain.

The general objective has been to obtain a comprehensive understanding of the primary stakeholders' stance with respect to the value chain stages, to learn what activities they consider to be the most impactful and which add the most value to the future competitiveness of the Italian aromatic sector. In addition, the main challenges faced

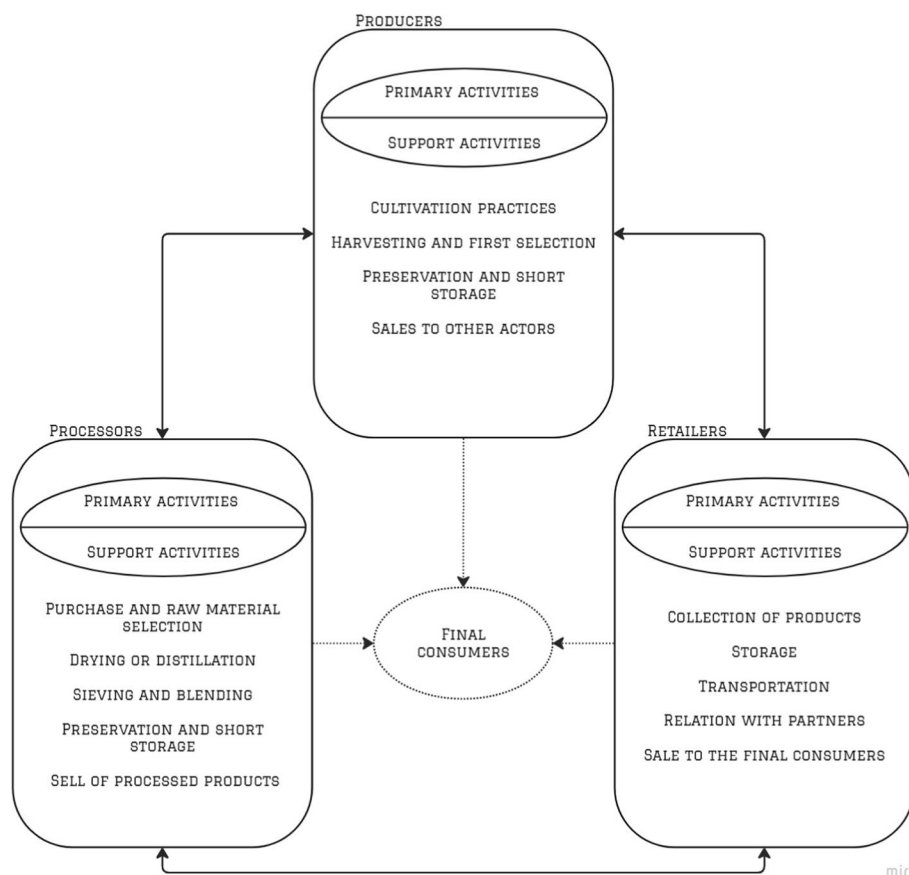


Fig. 2 Extended value chain model of the aromatic and medicinal plant sector in Italy adapted from Porter (1985)

by stakeholders and the possible strategies that could be applied in the future have also been investigated. The stakeholders’ statements were analysed using a Multiple correspondence analysis (MCA) to find potential relationships among the answers and the group of stakeholders.

Drawing on the statements of the main supply chain actors, the study aims to evaluate how the Italian aromatic sector could enhance its value chain and how companies could incorporate certain value chain factors in their future market strategies.

On the basis of these premises, the following research questions were addressed in the study:

- RQ1. Has the Italian aromatic sector been able to enhance its extended value chain in terms of efficiency?
- RQ2. How important do stakeholders consider the primary activities of an extended Porter’s value chain to be in generating values in the Italian aromatic sector?
- RQ3. How important do stakeholders consider the support activities to be in generating value in the Italian aromatic plant sector?
- RQ4. What challenges do stakeholders consider as being the most relevant to increase the competitiveness of the sector?

- RQ5. What future strategies could be adopted to improve the extended value chain of the Italian aromatic plant sector?

Research design

The survey consisted of four subsequent phases: the creation of a focus group (thematic nodes and topics), identification of actors and experts on a national scale, gathering of data (administration of questionnaire and interviews), and data processing. Figure 3 deeply explains the research design and the relation between thematic nodes and research questions.

Preliminary focus groups

The focus group technique involves the use of in-depth interviews with a group ‘focused’ on a particular topic (Thomas et al. 1995). Two online focus groups, involving experts from northern and central-southern Italy, were set up to map information and develop thematic nodes and issues by discussing the main economic and technical features of the aromatic plant supply chain in Italy.

The participants in each focus group were divided into primary and secondary stakeholders. As far as the primary stakeholders are concerned, the panel included the following: aromatic plant entrepreneurs (1); processors (2); herbalists (1); and traders (1). As for the secondary stakeholders, academics (1), national members of aromatic plant associations (2), officials from the Ministry of Agriculture (1), officials from regional agricultural departments (1), and agronomists (1) were invited to participate. Thus, a total number of 11 participants took part in the research activity. There is no unanimous opinion regarding the most suitable group size, and many scholars believe that the most effective size ranges from four to twelve participants (Krueger 1988; Krueger & Cassey 2014; Linville et al. 2003; Smithson 2008). The assumption is that the discussion should take place in groups that are small enough to allow everyone to feel comfortable in expressing and sharing their opinions and large enough to provide different points

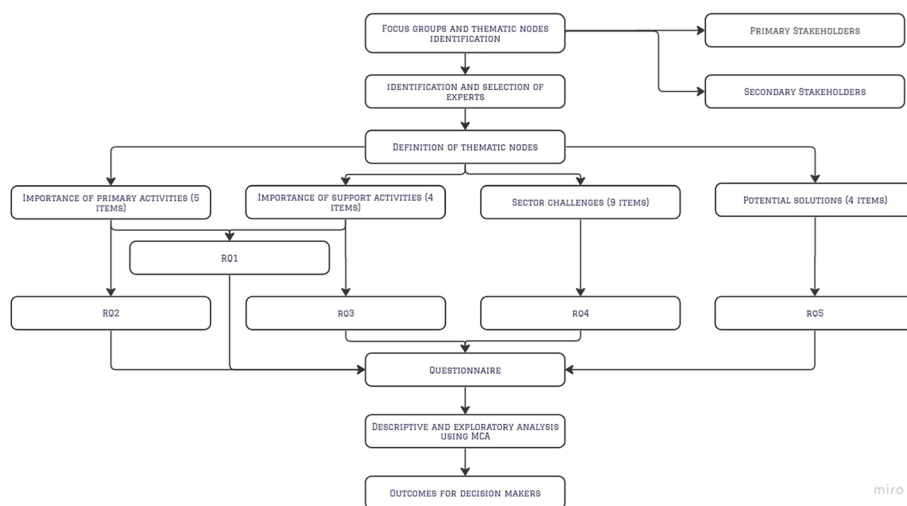


Fig. 3 Outline of the stages of research design followed in the present research

of view (Morgan et al. 1998). Starting from the main issues derived from the existing literature, and based on the economic trends of the aromatic plant market, the moderator of the focus groups led the participants in identifying the subjects of interest and the topics of discussion. A moderator plays a key role in focus groups (Allen et al. 2004), and the value of a focus group discussion is often directly related to his or her skills and background (Krueger and Cassey 2014). In the present study, the researcher who conducted the focus groups clarified the research topic before starting the discussion and tried to make all the participants feel comfortable. Best practice facilitation suggestions, as recommended by other scholars (Morgan et al. 1998; Sim and Waterfield 2019), such as: keeping the conversation moving, maintaining eye contact, balancing opinions in the group, understanding when to move onto a new topic, and encouraging participation, were considered throughout the process.

The participants in each focus group were asked to describe their current economic and production scenarios and to forecast future trends regarding the evolution of the entire sector (Di Vita et al. 2015). This was done in order to identify the relevant phenomena for the development of the aromatic plant supply chain in Italy, as well as to discuss problems, opportunities, needs, innovative actions and strategies for the improvement of the production, processing and retail phases of the supply chain. Thematic nodes linked to relevant issues, such as sustainability, competitiveness, profitability, opportunities and challenges of the sector (Massey 2011; Spaulding 2016; Timpanaro et al. 2013), were debated and discussed. Both focus group meetings lasted about 90 min. All the participants were notified in advance about their time commitment. Since the interviews were conducted online, the quality of the transmission was checked before each connection to avoid problems, and each participant was asked to grant permission to record the discussion. The recordings served to analyse, later and more carefully, what had been discussed earlier on.

The focus group discussion was conducted through semi-structured open-ended question interviews. The questions, 25 in all, covered, on the one hand, the three stages of the aromatic plant supply chain: production, processing and retail, and, on the other hand, the perception of its potential for economic development, the bottlenecks along the supply chain that could be a constraint to improving the current market trend and strategies to be able to adequately address future challenges. The most significant results were then incorporated in a structured questionnaire which was drawn up on the basis of the outcomes of the focus groups, and in light of the existing literature (Chandra and Kumar 2021; Zrira 2013; Sultan 2020; Imami et al. 2015; Ruff et al. 2005).

Identification and selection of experts

The second part of the survey was addressed to selecting the participants in the survey, and this was conducted through the identification of the primary stakeholders who were able to represent a purposive sample of the entire national territory.

The selection and recruitment of experts is certainly one of the most critical phases in the initial stage of a planning process (Etikan 2016); for this reason, the recruitment was based on the expertise of the participants and on their willingness to cooperate. In fact, research based on multiple cases allows richer and better quality of data that can counteract the absence of representativeness (Hutchinson et al. 2007).

The selection of participants aimed to find individuals who are most useful for the research scope. The inclusion criteria were based on the geographical areas and economic agents' categories. As regards the geographic area, it was decided to recruit participants from northern, central and southern Italy. With respect to the agents' categories, it was firstly decided to circumscribe the investigation to the most relevant activities all along the aromatic plants supply chain such as agricultural primary production, processing industry and retailing. Consequently, the survey was addressed to identifying and selecting the primary stakeholders such as producers, processors and retailers/wholesalers, since these categories are directly impacted by primary loss (Freund and Jones 2015). Other stakeholders supporting the whole system, such as research actors, policy makers, trade associations and technical consultants, were excluded from the analysis. Since the size of a sample is not so crucial in qualitative studies (Boddy 2016), it was decided that a sample of 26 respondents, chosen from among farmers, processors and retailers, was sufficient to respond to our research questions.

A total sample of 26 experts from all over the country was collected, divided into three categories: 9 producers, 9 processors and 8 retailers/wholesalers. A non-probabilistic sampling was employed given the qualitative approach of the study. Respondents were identified according to their expertise and business size in each of three geographic areas by adopting a purposive sampling. The experts were included based on their specific skill sets and more than 10 years of involvement in relevant activities, as a measure of their expertise and knowledge. Conversely entrepreneurial size level was measured consistently with the specific features of each stakeholder.

Concerning the producers, 3 specialised farms were selected for each area (north, south and centre), to ensure the representation of the different pedo-climatic conditions and characteristics of the entire national territory. To this end, it was decided to include in the survey only small and medium-sized farms, characterised by modern plant cultivations and a medium–high level of agricultural mechanisation. A total amount of 9 aromatic plant producers was recruited and, consistently with a previous study (Di Vita et al. 2014), the producers were stratified into three size categories: less than 2 hectares (3 farms), 2–5 hectares (3 farms) and more than 5 hectares (3 farms). Regarding the processors, the recruitment also took place in three different study areas, and the selection process was based on different enterprise sizes. Following the definition of enterprise size classes outlined in Commission Recommendation 361/2003/EC (2003), we included 6 micro-enterprises and 3 small enterprises in our survey. Micro-enterprises were defined as having 1 to 9 employees, while small enterprises had 10 to 49 employees. As for retailers, big trade companies were excluded, and the selection criteria were to include reputable retailers and wholesalers, with a limited market share, operating in domestic and international markets and with more than 10 years of involvement in such activities. The sample included two marketing companies, operating mainly in the international area with a turnover > 2,500,000, as well as 3 traders and 3 wholesalers, one for each of three different areas, belonging to different turnover classes: < 500,000 euros and between 500,000 and one million euros, respectively. Once the experts had been identified, individual interviews, based on a structured questionnaire, were carried out.

Data collection

A questionnaire was then developed, including questions about primary and support activities following Porter's model, to further investigate the entire structure of the aromatic supply chain.

The interviews were conducted both *de visu* and remotely (video-call via Google Meet, Webex) and involved the primary stakeholders who had previously been selected because of their expertise and experience of the aromatic and officinal plant supply chain in Italy.

Subsequently, a closed-form questionnaire was sent to the 26 experts, using the experience gained during the previous focus groups as a reference, but focusing more on Porter's Value Chain model. The pool of experts was asked how relevant or important they considered each stage of the value chain for the future competitiveness of a firm in the aromatic plant sector, distinguishing and replicating each question for the production, processing and retail phases. Moreover, some questions concerning the main challenges and potential strategies to adopt for the critical issues that had previously emerged in the focus groups were added. All the questions were presented using a Likert scale ranging from 1 (not relevant) to 5 (very relevant).

Descriptive statistics and Correspondence Analysis

Descriptive statistics, based on mean and standard deviation (SD), and Multiple Correspondence Analysis (MCA), were used as methodological tools to describe and explore the associations that existed between the stakeholders along the supply chain (producers, processors and retailers) and the different stages of the value chain, including the primary and supporting activities. MCA was widely used in the past in business and marketing research as an exploratory tool to investigate non-causal relationships among categorical variables (Anderson et al. 2012; Michaelidou et al. 2022; Morel et al. 2020; Rodrigues et al. 2022; Sánchez-Chaparro et al. 2022). MCA is a factorial analysis that can be used as an exploratory multivariate statistics technique which allows associations to be identified between more than two categorical variables, and is usually seen as an extension of the Correspondence Analysis (CA), as well as a generalisation of principal component analysis (PCA), in which the variables that have to be analysed are categorical rather than quantitative (Greenacre 1991; van Kerm 1998). This method allows the relationships among categorical variables to be analysed by transforming a multi-way contingency table into a Burt matrix, thus allowing a Correspondence Analysis of the new matrix to be performed (Kamalja & Khangar 2017).

MCA can also be used for quantitative variables, as it recodes them as "bins" (Abdi & Valentin 2007). In this research, variables collected on a 1–5 scale were recoded as variables 0 and 1, where the median was used as the midpoint of the non-normal distribution and included in coding 1. The variables were represented in a generally two-dimensional space, and the total inertia was considered representative if it reached at least 70% (Higgs 1991). These spaces are called Biplot and are used in MCA to graphically identify the relationships among variables. Moreover, they are considered as a generalisation of a two-variable scatterplot. In this way, variables are plotted as coordinates in the new factorial spaces that consist of the dimensions obtained from the MCA (Kamalja and

Khangar 2017). The biplots are presented in the text to easily visualise the relationships among the variables, while the coordinates are provided as an additional file (Additional file 1). As regards data processing, the main stakeholders in the aromatic plant supply chain were divided into three different key figures: (a) farmers (agricultural operator) who supply their products (grasses, roots, grain) to wholesale processing companies or to specialised brokers (b) processors who transform raw materials into output products and (c) retailers, a group that includes marketing companies, traders and wholesalers (Fig. 2).

Results and discussion

This section presents the results and discussions whereby the primary and supporting activities are considered according to the Porter model (Porter 1985). It also presents and discusses other thematic nodes that emerged from the focus groups, such as the major challenges and future strategies, as identified by the experts.

Primary activities

According to Porter's (1985) Value Chain model, primary activities include inbound logistics, operations, outbound logistics, marketing, and sales and service operations, while support activities comprehend a firm's infrastructure, human resource management, technology development, and procurement. As shown in Table 1, each primary activity was considered important by the stakeholders, since the mean values are always at least greater than 3, but the importance given to each activity is different. Indeed, processors seem to be more sensitive to aspects related to primary activities where they obtain higher scores. The producers and retailers gained similar scores, but the variability expressed by the producers is higher in terms of standard deviation, thus suggesting that retailers are more likely to stabilise around medium-to-high values for the different considered aspects.

When comparing the mean score of the stakeholders, it appears that processors consider operations and outbound logistics as being the most relevant stages for the future competitiveness of the supply chain. Marketing and sales are considered particularly important for retailers, while service shows the highest scores for producers.

As far as the explorative multiple correspondence analysis of the primary activities is concerned, the model identified two dimensions, and a total inertia of 82.4%, which is considered statistically representative (Fig. 4). However, since the first dimension

Table 1 Descriptive results of the primary activities

Primary activities	Producers Mean (SD)	Processors Mean (SD)	Retailers Mean (SD)
Inbound logistics	3.89 (1.269)	4.50 (0.756)	4.00 (0.707)
Operations	4.11 (1.054)	4.75 (0.707)	4.00 (0.866)
Outbound logistics	4.22 (1.201)	4.50 (0.756)	4.22 (0.833)
Marketing and sales	4.11 (1.054)	4.62 (0.744)	4.67 (0.500)
Services	4.11 (0.781)	3.75 (1.035)	4.00 (1.035)

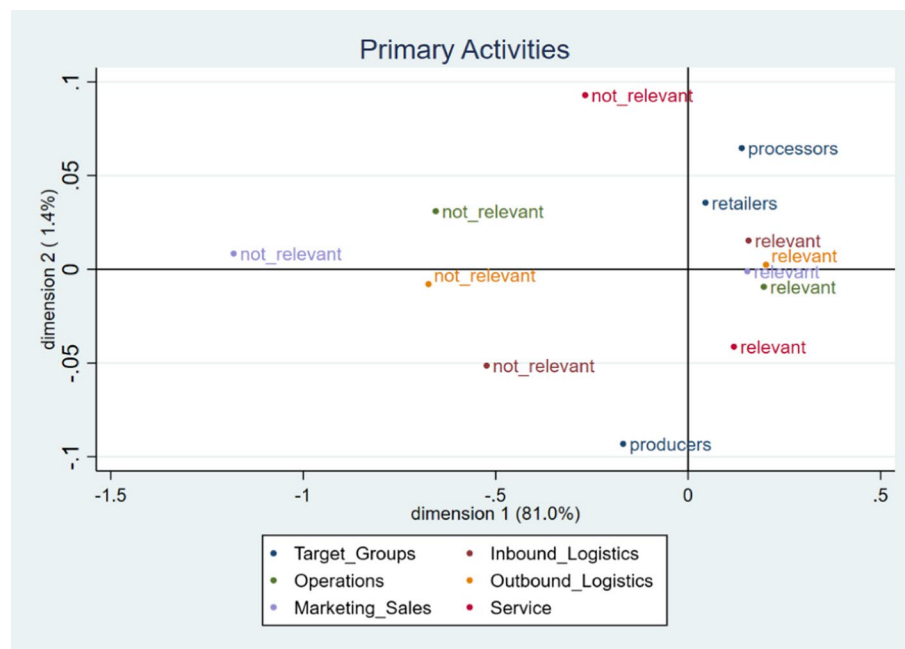


Fig. 4 Multiple correspondence analysis performed on primary activities and supply chain stakeholders

explains 81% of the inertia, the interpretation of the model should mainly be focused on this vector.

Therefore, according to this interpretation key, the results provided by MCA are in line with the descriptive analysis, but they provide more information because of the relationships represented on the factorial plane. Processors and retailers are associated more with the relevance of the considered aspects, thus suggesting that these two types of stakeholders are more attentive to supply chain aspects and consider them for future market developments. In line with the descriptive outcomes, producers are mainly focused on services, while they can be negatively related to inbound logistics. As might be expected, each stakeholder attaches great importance to the primary activities in the value chain that are central to their business, thus retailers place less value on primary activities than producers and processors, but they are mainly focused on marketing and sales. Usually many manufacturing companies do not have control over the distribution chain, and find it difficult to have detailed information for their own improvement (Gmelin & Seuring 2014), innovation (Ringgen et al. 2020), and sustainability (Montiel et al. 2021). This brings to light the need for greater collaboration among value chain actors, considering that each individual actor adds value and can contribute to increasing the competitiveness of the industry. For example, Industry 4.0 technologies could be a possible answer to improve collaboration with stakeholders by sharing production resources or improving demand management with the customer (Eisenreich et al. 2022), and it is strongly connected with all the value chain activities (Nagy et al. 2018).

Support activities

The support activities are related to the infrastructure of a firm, human resource management, technology development and procurement (Table 2). Overall, stakeholders

Table 2 Descriptive results of the support activities

Support activities	Producers Mean (SD)	Processors Mean (SD)	Retailers Mean (SD)
Firm Infrastructure	4.11 (0.928)	3.87 (0.990)	4.22 (0.891)
Human resource management	3.89 (1.054)	4.50 (0.756)	4.11 (0.601)
Technology development	3.67 (1.120)	4.12 (0.834)	4.22 (0.667)
Procurement	3.88 (1.166)	3.75 (0.886)	3.85 (0.925)

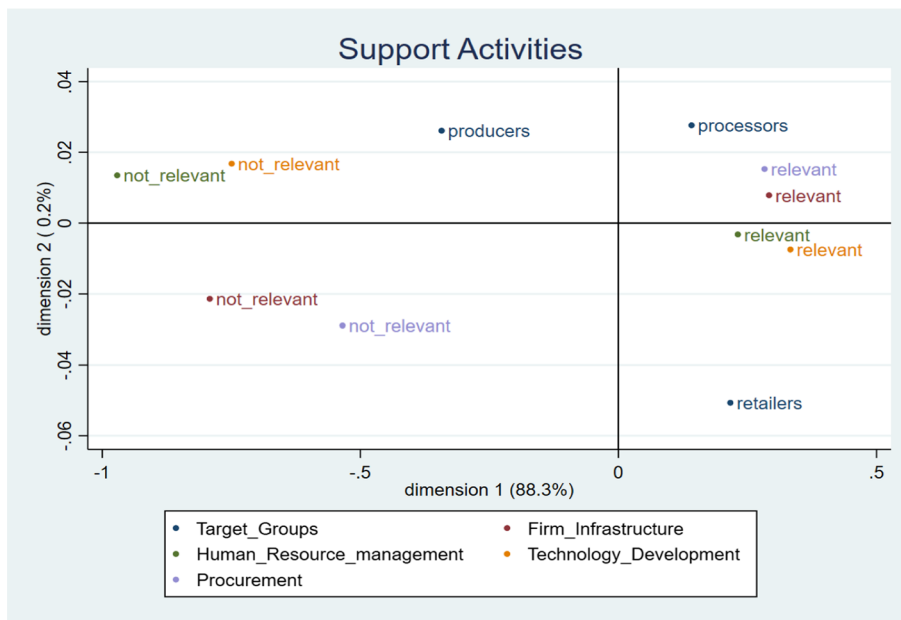


Fig. 5 Multiple correspondence analysis performed on the support activities and supply chain stakeholders

assigned lower relevance scores to these activities, although the mean values all tended to be above 3, as for the primary activities. Moreover, certain similarities with the primary activities can be noted; in fact, the highest scores are ascribable to processors and retailers, with a lower observed variability in terms of standard deviation.

Retailers on average consider the activities related to the infrastructure and technology development of a firm as being more relevant than the other stakeholders do. On the other hand, processors consider human resource management more important while procurements have a very similar score among the stakeholders.

The correspondence analysis also identified two dimensions and a total inertia of 88.5% (Fig. 5). Moreover, since this inertia is mainly related to the first dimension, it is possible to describe the relationships among the stakeholders and support activities on the basis of this vector.

As a general trend, processors and retailers show the highest association with the different aspects of the support activities. Conversely, producers are distinguished by the fact they attribute scarce importance to such activities. The relationship is in fact stronger between retailers and technology development and firm infrastructure, in line with the results of the descriptive statistics. Processors seem to be related more

closely to procurement and human resource management, thus partially confirming the descriptive outcomes. Indeed, the results of a research on the impact of Industry 4.0 and internet of things on value chain performance has shown that the availability of analytical tools and methods can have a significant impact on the overall competitiveness of a company and can also positively affect primary logistics activities (Nagy et al. 2018). Moreover, it can also foster the circular economy (Eisenreich et al. 2022). It is not surprising that processors and distributors place greater emphasis on these aspects, since they are involved in more complex processes and logistics flows and much of their activity involves the use of technological and IT tools compared to field work. However, the importance reported by producers with respect to procurement and human resources management is not very distant from technological development in an extended value chain. Being open while not forgetting the core of the company fosters innovation at the organisational and inter-organizational levels (Ringgen et al. 2020).

Challenges

The producers, processors, and retailers were also asked to choose what they considered were the main critical issues and future challenges for the supply chain from between an increase in foreign imports, a high bargaining power of retailers, a low selling prices, a lack of horizontal integration among producers, and the involved stakeholders' lack of knowledge of the supply chain. Moreover, they were asked how ready they considered the aromatic plant supply chain to be for an ecological transition, in terms of production, processing, and the trade and retail sectors (Table 3).

When observing the descriptive results, it can be noted that all the presented challenges are considered important for the future of the supply chain, since the scores are generally high.

All the stakeholders on average assigned the highest score to a lack of horizontal integration among producers, which was thus identified as the most important challenge. This result is in line with previous research that suggested that experts consider the development of associations in the value chain an important challenge for the future market development of Medical Aromatic Plants (MAPs) (Taghouti et al. 2022). The second factor, in terms of importance for producers and processors, emerged to be poor knowledge of the supply chain actors, while an increase in foreign imports emerged for retailers. Poor knowledge concerns knowledge about the technical, agronomic and

Table 3 Descriptive results of the main future challenges of the supply chain

Challenges	Producers Mean (SD)	Processors Mean (SD)	Retailers Mean (SD)
Imports	3.33 (1.118)	2.62 (1.302)	3.22 (0.972)
Low bargaining power	3.00 (1.118)	3.12 (0.991)	2.67 (0.500)
Low sale prices	3.44 (1.236)	3.25 (1.282)	2.77 (0.972)
Lack of horizontal integration	3.67 (1.225)	4.00 (1.069)	3.44 (1.236)
Poor knowledge of the supply chain	3.67 (1.581)	3.75 (1.165)	3.00 (1.000)
Lack of agreements in the supply chain	3.55 (1.054)	3.62 (1.060)	3.11 (1.054)
Ecological transition of production	2.44 (1.130)	2.75 (1.389)	2.89 (1.691)
Ecological transition of processing	2.55 (1.236)	2.87 (1.246)	2.66 (1.118)
Ecological transition of retail	2.78 (1.394)	3.37 (1.188)	2.55 (1.130)

economic aspects of the supply chain. These aspects include technical and agronomic knowledge about the stages of the cultivation process, with particular regard to varietal quality, propagation material, nutrition, defence, harvesting and post-harvest methods, as well as to the presence of scant and fragmented economic information regarding the supply chain. All these factors in fact also emerged as weaknesses in the aromatic and medicinal plant sector plan drawn up by the Italian Ministry of Agriculture Food and Forestry for the period from 2014 to 2016 (Mipaaf 2016).

Producers and processors are more sensitive to future challenges, and they gave higher scores than retailers. This is an interesting aspect for the Italian context, where this result seems to be justified by the imported volume that is very high and can have an important effect on market prices (Riaz et al. 2021). Indeed, farmers consider the import flows of foreign products and low sales prices as critical factors, thus confirming an existing disparity in the prices of producers, processors and retailers all over the chain (Malak-Rawlikowska et al. 2019; Shokoohi et al. 2019; Velázquez et al. 2017). It also confirms the exposure of small-scale producers to the competition exerted by imported foreign agricultural commodities (Gulati et al. 2022). Conversely, processors are more attentive to the bargaining power of retailers, a lack of producers' horizontal integration, poor knowledge and a lack of agreements over the supply chain. In fact, industry would benefit upstream from a greater concentration of production, higher production volumes and trade agreements (i.e., contract manufacturing), while, downstream, it is suffering from the power of the distribution and retail sector, as has widely been confirmed in literature (Hayashida 2018). Therefore, once again, the need to enter binding contract farming has been confirmed; such contracts will in fact generate adequate assurances for small-scale producers to help them manage the aggregate supply and price risk (Federgruen et al. 2019; Forsman 2004).

The opinion of stakeholders about the readiness of the main actors in the supply chain was tested as regards ecological transition. Generally, the scores appeared lower than those given to the primary and support activities, and even lower than those given to the other challenges.

This highlights the existence of a lack of involvement with respect to this important priority. In line with previous results, producers are the most critical about the readiness of the supply chain for an ecological transition, since they are the stakeholders who gave the lowest scores to this aspect. This can reasonably be explained by considering the barriers that farmers can encounter when adopting agricultural practices oriented more towards sustainable ecosystems, and this has been confirmed in literature (Kerneck et al. 2021). Processors consider these aspects more important, as highlighted by the higher registered scores. Indeed, retailers and processors, albeit from different perspectives, on average consider the sector almost ready for the transition, while producers are less confident about their own readiness.

The conducted MCA again extrapolated two dimensions and a total variance of 73% (Fig. 6), where the first dimension accounted for 66.1% of the total inertia. As was predictable, an association emerged between producers and the relevance attributed to the lack of horizontal integration among producers and the lack of agreements in the supply chain as the main future challenges, and, although to a lesser extent, also with the increasing imports from abroad and low selling prices. Indeed, producers seem to be

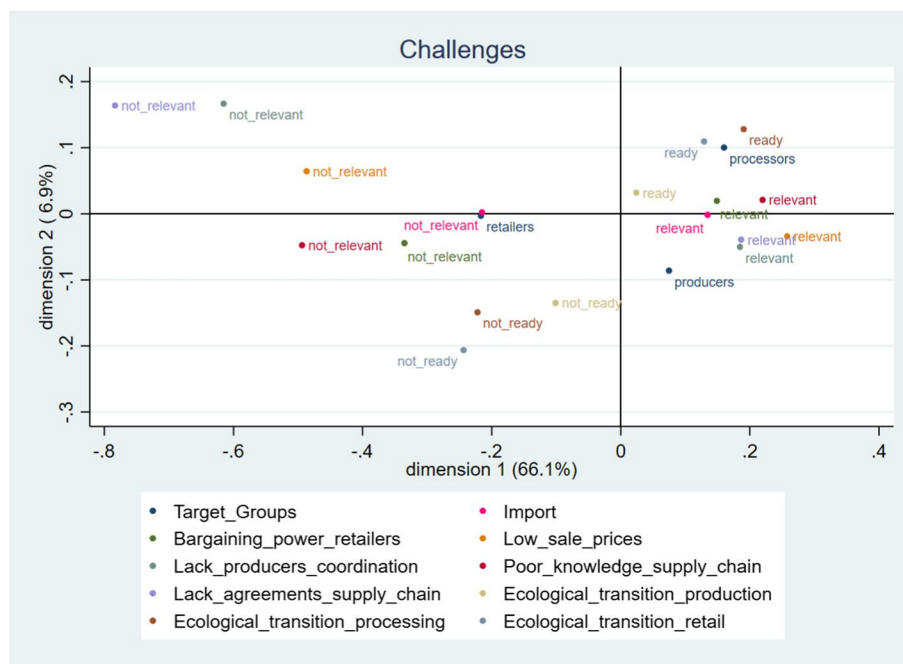


Fig. 6 Multiple correspondence analysis performed on challenges and supply chain stakeholders

the stakeholders who foresee the most critical issues for the future development of the supply chain. The importance they gave to the lack of horizontal integration among producers and the lack of agreements in the supply chain are also closely connected to each other. This result appears consistent with previous studies on stakeholders, as in the case of ornamental plant farmers (Di Vita et al. 2015; Zarbà et al. 2013).

Furthermore, an association has emerged between processors and the relevance given to the bargaining power of retailers and the poor knowledge of the supply chain.

The bargaining power of retailers versus farmers has broadly been confirmed in several studies pertaining to different agricultural sectors, such as the dairy and ornamental plant sectors (Di Vita et al. 2015; Velázquez et al. 2017).

These findings are somewhat in line with another study that performed a SWOT analysis of the MAPs supply chain in four Mediterranean countries, which emphasised the importance of creating associations between local producers and processors to break down the main market access barriers (Taghouti et al. 2022). Conversely, the retailers do not consider these latter elements to be relevant. Moreover, the strength of the relationships among processors and the stated readiness for an ecological transition has also been highlighted. Processors consider the retail sector in particular to be ready for an ecological transition, followed by the processing sector, but also by the production sector, although to a lesser extent. On the other hand, retailers do not believe the aforementioned challenges are relevant for the future development of the supply chain and, similarly, they do not consider the Italian aromatic supply chain to be ready for an ecological transition, despite the weak highlighted association. Finally, our analysis reveals the importance of investing in the education of the supply chain actors, an aspect which often appears to be lacking and which has been considered the basis for the development of the sector. Indeed, the low scores given to all the considered challenges by the

retailers highlights the diverse perception that they have of the previous steps of the chain and underlines that education programmes and better cooperation could actually help the involved stakeholders, and producers in particular. The obtained results reflect those highlighted in a study on the Italian MAPs supply chain, which emphasised how the creation of consortia or producers' cooperatives can help to differentiate production, as more innovative species can be grown, as well as to raise the supplied quantity of traditional aromatic crops (Mipaaf 2016).

Furthermore, the importance of the organisation and programming of the training processes for agricultural operators (and all stakeholders), through appropriate synergies between the relevant institutions at the local level is an essential need. This latter outcome appears somewhat in line with previous research on the motivation of the owners of small-sized family farms (Di Vita et al. 2019). In fact, considering that the majority of aromatic farms are small in size, it is difficult for them to conduct self-training. Consequently, involving experts from research institutions in this type of programming represents a priority, due to the high specificity and diversification of the topics that have to be covered (Di Vita et al. 2019; Mipaaf 2016).

Future strategies

Finally, the stakeholders were asked what tools or actions they considered the most important for future strategies to improve the aromatic plant supply chain in Italy (Table 4). On average, all the stakeholders gave the highest score to a greater cooperation among producers and a better training of professionals, which they considered to be the most desirable options for the future. Among the stakeholders, the processors showed the highest scores for the different strategies that were proposed. This outcome suggests the proactive role that processors play in the development of the MAPs value chain. These actors could in fact be important to develop a vertical integration by increasing security and mitigating risks in the sector (Leat and Revoredo-Giha 2013).

As shown in Fig. 7, the MCA explained 76.9% of the variance in the first two dimensions, and a total of 72.7 explained inertia for the former. It was mainly the processors who assigned a greater relevance to a closed supply chain and to digital innovation as the main future strategies. Moreover, the processors considered both an increased cooperation among producers and a better training of professionals as being relevant, as was also highlighted in the descriptive findings, and this correlation also appeared to be associated with the producers' answers. This outcome is consistent and fully corroborates with previous literature (Noor 2011, Di Vita et al. 2019).

Table 4 Descriptive results of the future strategies (solutions) for the development of the supply chain

Strategies	Producers Mean (SD)	Processors Mean (SD)	Retailers Mean (SD)
Closed supply chain	2.78 (1.202)	3.50 (1.069)	2.44 (0.726)
Cooperation among producers	3.89 (0.928)	4.37 (0.744)	3.67 (1.500)
Training of professionals	3.89 (1.054)	4.50 (0.756)	3.33 (1.323)
Digital innovation	3.22 (1.302)	4.00 (1.195)	3.22 (0.972)

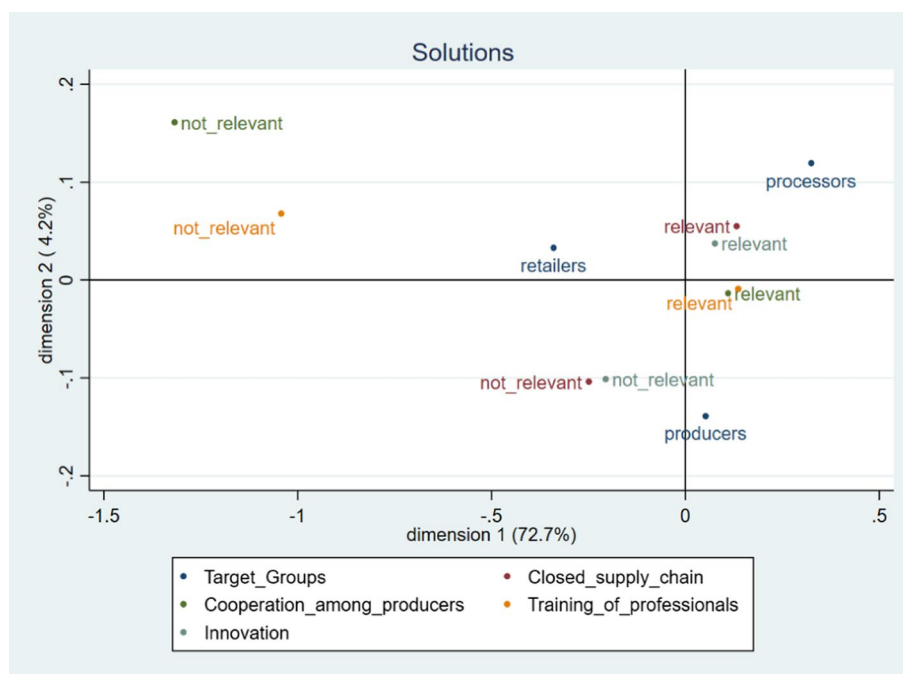


Fig. 7 Multiple correspondence analysis performed on future strategies (solutions) and supply chain stakeholder

As has already emerged with regards to the major challenges faced by stakeholders, the lack of cooperation between the actors in the supply chain and poor knowledge are the main critical issues that have emerged, thus investing in these directions also emerges as the best strategy, as identified by the stakeholders, to enable the future development of the supply chain. Other studies have pointed out that farmers' activities are also affected by agro-environmental conditions and by the costs derived from investments in the machinery that is necessary to improve the producers' profitability (Dajic Stevanovic and Pljevljakusic 2015). In this context, stakeholders identified producers' cooperatives and associations as an important challenge to expand the market in the future (Taghouti et al. 2022). The development of producers' organisations could be important to mitigate the risk of investments and to share technologies and knowledge. Moreover, the need to work on a closed supply chain and the need for investment in digital innovation and high technology have both been considered particularly relevant, especially by processors. The importance of sustainable innovation has recently been confirmed in a study that analysed the need to use coordinated tools, such as cooperative relationships, as well as the role of policies and governance for a better management of the wheat supply chain. In addition, it was also found that a sustainable supply chain helps to make production processes more efficient and contributes to improving the economic performance of companies and reinforcing their market position (Stanco et al. 2020). However, access to digital and high-tech innovation equipment is not possible if these tools are not present. Similarly, a better cooperation is necessary for the implementation of a closed supply chain.

Indeed, the difference between forward and closed-loop supply chains is related to the direction of the flow of the material: in the former case, the flow is unidirectional from producers to the end consumers, while in the latter case, there are reverse flows of used products which return to the producers (Souza 2013). To have closed-loop supply chains do so, as already demonstrated for the textile supply chain (Alonso-Muñoz et al. 2022), innovative technologies that allow a reduction of wastes and an increase in efficiency are needed, along with the introduction of circular economy principles in all the different phases through reverse logistics.

Concluding remarks

This study, which is based on the opinions of stakeholders, has been conducted to enhance the extended value chain of the aromatic plant sector in Italy. This paper, through descriptive statistics and a Multiple Correspondence Analysis, has analysed the importance of primary and support activities, and has identified the challenges and future strategies that are necessary to relaunch the competitiveness of the sector.

RQ1. In light of the above, as far as the first research question is concerned, it has emerged that all three groups agree that the Italian aromatic sector needs to enhance its value chain and believe that an increase in all the activities, in terms of efficiency, is desirable. However, only processors and retailers believe that there is still much to do in terms of increasing efficiency. RQ2. In addition, this study has allowed us to identify how primary and support activities are both relevant in adding more value for the future competitiveness of the Italian aromatic sector. Different degrees of importance have been given to each activity. Processors consider operations and outbound logistics as the most relevant, retailers consider marketing and sales particularly important, while producers gave the highest scores to services. Nevertheless, processors and retailers are more involved in gaining competitiveness and as such are mainly focused on enhancing value and on future market developments.

RQ3. The support activities were deemed as less relevant, in terms of value enhancement. Even in this case, a certain polarisation of importance towards processors and retailers has emerged. However, the infrastructure and technology development of a firm are considered more relevant for retailers, while processors attach more importance to human resource management. Producers seem less interested in enhancing the support activities, with the only exception being of a firm's infrastructure.

The main challenges faced by stakeholders and the possible strategies that could be applied in the future have also been investigated.

RQ4. As regards the main challenges that the Italian aromatic supply chain has to face, according to the stakeholders, it has emerged that the priorities are distributed in a markedly different way. In fact, farmers are apprehensive about the competition exercised by imports, while processors agree that priority should be given to the bargaining power of retailers, and to enhancing both horizontal and vertical integration, since poor knowledge and a lack of agreements over the supply chain needs to be addressed. As regards ecological transition, only retailers and processors consider that the sector is almost ready.

RQ5. Finally, as regards the future strategies that could be adopted to improve the extended value chain of the Italian aromatic plant sector, the role of the training of professionals has emerged. In addition, wide consensus was intercepted concerning the need for a stronger horizontal integration among producers and also among processors. This seems to be the main tool that could help to increase the market share, revenues, and economies of scale, and it could also be useful to balance the bargaining power of the stakeholders, but especially of the retailers. In all the considered cases, the processors are those who regard these strategies as being of greater importance.

Novelties and implications

This article has investigated for the first time the extended value chain of aromatic plants, according to Porter's model, in combination with a multivariate explorative tool, that is MCA. This approach allowed us to identify the relationships that exist among the supply chain actors (producers, processors, and retailers) with reference to their the primary and supporting activities, in terms of competitiveness, as well as to the major challenges and solutions that could be introduced to improve the status, from a market perspective, of the aromatic plants sector. Consequently, these results represent early insights that diversify the role and sensitivity of different stakeholders with respect to topics related to supply chain competitiveness and innovation. The implications of the study are closely related to its major outcomes and to its novelties. As far as academics are concerned, our results suggest that an exploratory factor analysis is a useful tool to address the assessment of supply chains, particularly when difficulties arise concerning the data collection due to the challenges of involving supply chain actors. In addition, Porter's extended value chain is currently considered a useful framework that can guide researchers in performing stakeholder analyses, as an alternative to or in combination with other validated scales or items. The implications for stakeholders concern the information this paper provides, which could help them develop strategies and collaborations to enhance the value chain of aromatic plants. In particular, a lack of coordination and poor knowledge of the supply chain could be overcome by developing forms of associations or partnerships among different actors, which could even provide for the transfer of company know-how. Processors and retailers, who have been found to be more involved than producers in acquiring competitiveness and efficiency, could be the driving force behind innovation and supply chain improvements. And it is here that the role and implications for political institutions emerges. Since the aromatic plant supply chain is very important for the development of rural areas, but at the same time, as our results have shown, it is very fragmented, investments in the sector in different forms are desirable, not only in terms of tangible investments, but also in terms of developing partnerships, training courses and activities to engage institutions in supply chain issues. The outcomes are also important for institutions to understand the kind of support needed by different stakeholders. Producers could be supported in service development, processors in operations and outbound logistics, and retailers in marketing and sales, which are considered particularly important aspects for these actors.

Limitation and future research

The approach adopted in this paper, although useful for exploring the extended value chain, is not unaffected by certain limitations. In particular, the data analysis was conducted on a small sized sample, due to the difficulty involved in recruiting stakeholders for the survey. Another limitation of the paper is related to the analytical approach, which was based on explorative analysis, whose choice was influenced to a great extent by the number of available respondents. An inferential approach would instead be interesting to describe the differences among stakeholders, in terms of probability, but the reliability of the estimates would be affected significantly by the size of the sample.

However, different future perspectives are possible for this field of research. In fact, differences among value chain stakeholders could be highlighted with inferential and predictive statistics using other econometric models to overcome the limitations related to explorative statistics. The extended value chain was here studied by applying Porter's framework. Other models could be applied and described using exploratory and confirmatory factor analysis, with the support of validated scales to capture the behaviour of aromatic plant stakeholders. Finally, the same analysis could be repeated on other value chains or in other countries to obtain a deeper understanding of the stakeholders' needs and to produce effective political actions to help support them.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40100-023-00257-8>.

Additional file 1. MCA factorial coordinates for primary activities, support activities, challenges and future strategies.

Author contributions

GDV: conceptualization, funding acquisition, writing—original draft, writing—review and editing, supervision, methodology, validation; DS: investigation, data curation, writing—original draft; RC: investigation, data curation, writing—original draft; RDC: data curation, methodology, visualisation, writing—original draft, writing—review and editing, formal analysis; MDA: supervision, project administration, resources; RZ: methodology, formal analysis, writing—original draft, writing—review and editing, supervision. All authors read and approved the final manuscript.

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Declarations

Ethics approval and consent to participate

This manuscript is an original contribution and has not been published elsewhere, nor has it been submitted simultaneously for publication elsewhere.

Competing interests

There are no known conflicts of interest associated with this publication.

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