SHORT COMMUNICATION

Farmers' opinions on chestnut (*Castanea sativa* Mill.) supply chain development strategies: A case study in Central Italy

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Abstract

Aim of the study: To identify the priority strategy for the strengthening of the chestnut supply chain through a participatory approach.

Area of study: Mugello-Val di Sieve in Tuscany region (Italy).

Material and methods: The data were collected by administering a questionnaire to a sample of 126 chestnut growers (83 chestnut growers enrolled and 43 not enrolled in the Consortium of 'Marrone del Mugello Protected Geographical Indication') to identify the priority objectives and activities to develop the chestnut supply chain.

Main results: It is necessary to develop a diversified strategy to stimulate the chestnut production and simultaneously enhance the marketing of the product in order to revive the chestnut cultivation in Tuscany region. The main activities to be pursued are the implementation of silvicultural treatments of chestnut orchards and the integrated fight against chestnut gall wasp to increase the productivity and strengthen the 'Marrone del Mugello Protected Geographical Indication' brand.

Research highlights: Participatory approach is a fundamental instrument to define a common strategy to strengthen chestnut supply chain at local level.

Additional keywords: rural development; chestnut growers; questionnaire survey; forest governance.

Introduction

In Italy, chestnut (*Castanea sativa* Mill.) cultivation has a long cultural and historical tradition being for centuries the main staple food for the population living on hilly-mountainous areas (Castellini *et al.*, 2011). At the beginning of the twentieth century, the chestnut cultivation covered an area of about 800,000 ha with an average production of 913,000 t/yr (ISTAT, 2010). After 1914, cultivated area started to decrease due to the depopulation of the Italian mountains, the change of food habits and the diffusion of new diseases as chestnut blight, chestnut bark disease, and ink disease (Amorini *et al.*, 2001). Recently, the chestnut gall wasp has caused an additional reduction of the production, with a heavy impact on the productive chain. In the decade 1990-2000 the chestnut production was always above 65,000 t/yr (FAOSTAT, 1998), while after 2002

the chestnut production progressively dropped down up to 18,000 t in 2014.

In order to overcome the current crisis of the chestnut sector in Italy, the aim of the study was to identify strategies for the strengthening of the chestnut supply chain through a participatory approach. The study was developed in a case study in Central Italy (Mugello-Val di Sieve area, Tuscany region) where the production of chestnuts is crucial for the development of local economy and where the chestnut gall wasp has severely hit the production. In the study area, the designation of origin 'Marrone del Mugello Protected Geographical Indication (PGI)' is organized in a Consortium of 96 members that brings together the various actors of the supply chestnut chain (Focacci *et al.*, 2018). In this study, both members and non-members of 'Marrone del Mugello PGI' were involved in the survey.

Material and methods

The study was structured in four main steps developed from February to December 2014: (1) identification of the objectives and the activities to strengthen the chestnut supply chain; (2) identification of the chestnut growers; (3) interviews with the chestnut growers; and (4) elaboration of the collected data.

During the first step, a set of objectives aimed to strengthen the chestnut supply chain were established in collaboration with local experts. During two brainstorming sessions projects' researchers and local experts identified four objectives (O1, Improving chestnut production; O2, Improving product sales; O3, Strengthening the PGI brand; O4, Differentiating products and sales markets) and nine activities (A1, Implementation of the silvicultural treatments in the chestnut orchards; A2, Integrated fight against the chestnut gall wasp; A3, Introduction of technological innovation and purchase of machinery; A4, Coordination among actors of chestnut supply chain to improve the efficiency; A5, Identification of new market channels; A6, Identification of new products for market niches; A7, Participation in national fairs; A8, Implementation of marketing activities in order to promote local products; A9, Identification of new chestnut by-products) aimed at improving the chestnut supply chain in Tuscany region with special regards to the Mugello-Val di Sieve area.

In the second step, the chestnut growers in the Mugello-Val di Sieve area were identified. The total number of chestnut growers in the study area is around 300, one third belonging to the 'Marrone del Mugello PGI' Consortium. At the end of the described step, 126 chestnut growers (more than 40% of total chestnut growers) were involved in the survey: 83 members of the 'Marrone del Mugello PGI' Consortium and 43 non-members. The response rate was 90% (126 respondents on 140 farmers contacted). This response rate can be considered satisfactory to frame the situation of chestnut sector in the study area.

In the third step, a questionnaire was developed and pre-tested with two chestnut growers external to the study area. In the final version of the questionnaire, the respondents were requested to compare in pairs the importance of four objectives (pairwise comparison) and to assign a level of importance to each activities in order to achieve the single objective using a 5-point Likert scale format (from 1 = not important to 5 = very important).

In the fourth step, the data concerning the chestnut growers' opinions were analyzed to identify two priority objectives and three priority activities to achieve them. The idea of considering only two objectives and three activities for each objective was tied to the limited financial resources allocated to the regional agro-forestry sector, in particular to the chestnut supply chain, and the consequent need to propose a sub-set of objectives and activities to the decision makers. In order to identify the two priority objectives in accordance with the chestnut growers' opinions, the Analytic Hierarchy Process (AHP) method was applied (Saaty, 1987). The priority value of objectives was used in order to identify the two most important objectives for the chestnut growers of the Mugello-Val di Sieve area distinguishing between members and non-members of the 'Marrone del Mugello PGI' Consortium. The most suitable activities to achieve the different objectives were identified considering the average value calculated based on preferences expressed using 5-point Likert scale format.

Results and discussion

The results of pairwise comparison (Table 1) show that the improvement of the chestnut production (O1 - priority score of 0.42) was the most important objective for the chestnut growers of the Mugello-Val di Sieve area, followed by strengthening of the PGI brand (O3 - priority score 0.23) and the improvement of product sales (O2 - priority score 0.22).

The results by group of chestnut growers highlight interesting differences within the same order of priorities. The strengthening of the PGI brand (O3) was considered more important for the chestnut growers enrolled in the Consortium than for those not enrolled (priority score 0.25 and 0.19, respectively). Conversely,

Table 1. Priority scores of the objectives to strengthen the chestnut supply chain by group of farmers.

Objective/Group	Members (n=83)	Non-members (n=43)	Total (n=126)
O1 - Production	0.4126	0.4331	0.4201
O2 - Sales	0.2113	0.2256	0.2163
O3 - PGI brand	0.2547	0.1942	0.2342
O4 - Differentiating	0.1214	0.1471	0.1294

the chestnut growers not enrolled in the Consortium assigned a higher value to the improvement of chestnut production (O1) than those enrolled (priority score 0.43 and 0.41, respectively). The last objective (O4 - differentiation of products and sales markets) was considered marginal for both groups of farmers.

The relationships between objectives and activities as stated by respondents are shown in Table 2. The results show that in order to improve chestnut production (O1) the most important activity is the integrated fight against chestnut gall wasp (A2), followed by the implementation of silvicultural treatments in the chestnut orchards (A1) and the technological innovation and acquisition of machineries (A3).

The farmers highlight that in order to improve the product sales (O2) and to strengthen the PGI brand (O3) the two key activities are the implementation of silvicultural treatments in the chestnut orchards (A2), and the integrated fight against chestnut gall wasp (A1). The third activity in order of importance is the coordination of actors within the chestnut supply chain (A4) for the O2, and the identification of new product sale market niches (A6) for the O3.

In order to differentiate the products and sales markets (O4) the respondents evidence as the most suitable activities the implementation of the integrated fight against chestnut gall wasp (A2), followed by the identification of new products for market niches (A6) and the identification of new by-products (A9).

Finally, the data collected were aggregated in order to identify possible strategies to strengthen chestnut supply chain distinguishing between members and non-members of the Consortium. The results show that for the members of the Consortium the best strategy

to develop the chestnut supply chain is to pursue two objectives through three activities. For this group of farmers the activities A1 (Silvicultural treatments of chestnut orchards), A2 (Integrated fight against chestnut gall wasp) and A6 (Identification of new products for market niches) can simultaneously achieve the two main objectives concerning the improvement of chestnut production (O1) and the strengthening of PGI brand (O3).

The best strategy identified by non-members consists of two objectives through four activities. This strategy envisages a higher diversification of activities. In fact, two activities (A1 and A2) are the same for the two main objectives: improve the chestnut production (O1) and improve the product sales (O2). Other two activities are specific for the two main objectives: introduction of technological innovation (A3) to improve the chestnut production (O1) and coordination of actors of chestnut supply chain (A4) to improve the product sales (O2).

The opinions of the two groups of farmers were aggregated to produce the best overall strategy for all chestnut growers of the Mugello-Val di Sieve (Fig. 1). The best strategy is the achievement of objective O1 (Improvement of chestnut production) and O3 (Strengthening of PGI brand) through four activities: A1 (Silvicultural treatments of chestnut orchards), A2 (Integrated fight against chestnut gall wasp), A3 (Introduction of technological innovation), and A6 (Identification of new products for market niches).

The results of the study showed a very fragmented chestnut supply chain for the Mugello-Val di Sieve area, with interesting differences between members or non-members of the 'Marrone del Mugello PGI' Consortium. The farmers who were associated to the Consortium

Table 2. Relationships between objectives and activities to develop the chestnut supply chain in Mugello-Val di Sieve area (mean). In grey the three most important activities for each objective.

Activity/Objective	O1 Production	O2 Sales	O3 PGI brand	O4 Differentiating
A1 - Silvicultural treatments of chestnut orchards	2.75	2.59	2.46	1.95
A2 - Integrated fight against chestnut gall wasp	2.83	2.67	2.51	2.10
A3 - Technological innovation and acquisition of machineries	2.21	1.84	1.76	1.93
A4 - Coordination of the actors of the chestnut supply chain	1.71	2.25	2.11	1.74
A5 - New product sales (foreign) markets	1.64	1.93	1.92	1.84
A6 - New products for market niches	1.93	2.23	2.23	2.02
A7 - Participation in national fairs	1.70	2.15	2.17	2.00
A8 - Marketing activities	1.53	1.99	2.02	1.78
A9 - New by-products	1.67	1.95	1.92	2.01
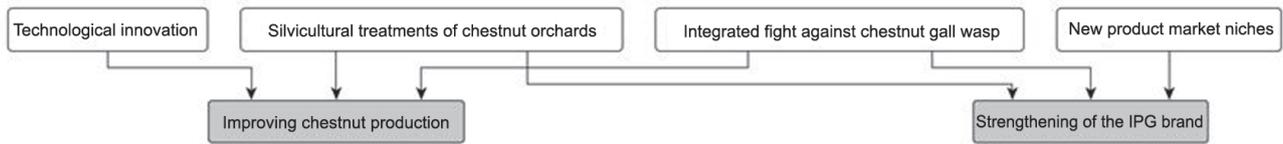
Figure 1. Strategy for all chestnut growers of the Mugello-Val di Sieve area (in grey, objectives; in white, activities).

demonstrate a high level of entrepreneurship mindset, believe in the importance of the product certification and have the main income by chestnut cultivation. Additionally, the study highlighted that the improvement of chestnut production was the most important objective for all growers and the integrated fight against chestnut gall wasp was recognized as the most important activity to pursue this objective. This is because the decline in chestnut productivity after the diffusion of chestnut gall wasp was -73% of initial productivity in the study area (period 2012-2016). In fact, in accordance with the farmers' declarations, the average productivity before the diffusion of chestnut gall wasp was about 950 kg/ha, while after the diffusion of chestnut gall wasp dropped down to 260 kg/ha.

The present study shows a procedure in order to identify strategies for the improvement and strengthening of chestnut supply chain in Tuscany. The application to the case study of the Mugello-Val di Sieve area firstly shows that in order to revive the chestnut cultivation in the region is necessary to develop a diversified management strategy. The latter should aim at stimulating chestnut production and simultaneously enhance the marketing of the product with PGI brand.

From the productive point of view, the structural weaknesses of the Italian chestnut supply chain, associated with problems due to the diffusion of the chestnut gall wasp, can be overcome through the implementation of forest management practices (silvicultural treatments) aimed at increasing productivity together with a systematic integrated fight against chestnut gall wasp. The main purpose of these activities should be to restore the productivity of chestnut orchards to levels prior the diffusion of chestnut gall wasp.

From the marketing point of view, strategic objectives are to enhance the present market of the product and to identify new sales markets. For the quality product (brown chestnuts with PGI brand) would be appropriate to identify new niche markets or new customers. The new customers could be identified within the Tuscany region, but also in other Italian regions or European countries. The potential customers should be identified through a market survey focused on the consumption of fresh product and/or processed product. At the same time, it would be important to implement a territorial marketing strategy able to enhance the chestnut sector as a whole through the creation of an integrated supply chain from producer to consumer. The territorial marketing strategy should involve - in addition to the producers - transformers and packagers but also restaurants, hotels and shops of local products.

Finally, the definition of a promotion strategy of product associated with a broader marketing of the territory could have a positive impact to the local economy in the medium-long period.

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