Implementing Participatory Processes in Forestry Training Using Social Network Analysis Techniques

Simone Blanc [1,*] [ID]**, Federico Lingua** [1] [ID]**, Livio Bioglio** [2]**, Ruggero G. Pensa** [2]**, Filippo Brun** [1] [ID] **and Angela Mosso** [1]

[1] Department of Agricultural, Forest and Food Sciences (DISAFA), University of Torino, 10095 Grugliasco, Italy; federico.lingua@unito.it (F.L.); filippo.brun@unito.it (F.B.); angela.mosso@unito.it (A.M.)

[2] Department of Computer Science, University of Torino, 10149 Torino, Italy; livio.bioglio@unito.it (L.B.); ruggero.pensa@unito.it (R.G.P.)

*   Correspondence: simone.blanc@unito.it; Tel.: +39-011-6708684

check for updates

Abstract: Public participation has become an important driver in increasing public acceptance of policy decisions, especially in the forestry sector, where conflicting interests among the actors are frequent. Stakeholder Analysis, complemented by Social Network Analysis techniques, was used to support the participatory process and to understand the complex relationships and the strong interactions among actors. This study identifies the forestry training sector stakeholders in the Western Italian Alps and describes their characteristics and priorities, in relation to training activities on entrepreneurial topics for forestry loggers. The hierarchy among actors has been identified, highlighting their respective roles and influence in decision-making processes. A lack of mutual communication among different and well-separated categories of actors has been identified, while good connections between stakeholders, operating in different territories, despite the presence of administrative and logistical barriers, have been observed. Training is a topic involving actors with different roles and interests. Nevertheless, all actors consider training about how to improve yields of forest operations and how to assess investments, particularly in innovative machinery, to be crucially important and conducive to a better comprehension of the wood supply chain and the enhancement of the raw material.

Keywords: entrepreneurial education; forestry training; innovative training; participatory process; social network analysis; stakeholder analysis

1. Introduction

Since the UN Conference on Environment and Development, held in Rio de Janeiro in 1992, the idea that the route towards the sustainable exploitation of forestry resources should follow a participatory approach, even in the forest planning phase, has been openly acknowledged [1,2]. In fact, public participation is expected to produce better plans by fostering the exchange of information and views between stakeholders [3]. The new EU forest strategy [4] set out how the participation of different stakeholders has become an important driver in increasing the public acceptance of policy decisions and in creating an inclusive platform for constructive discussions [5].

This participative process is especially important in the forestry sector, which includes a multitude of conflicting interests among the actors [6].

As stated by Ananda and Herath [7], environmental policy cannot be separated from public participation in the decision-making process, however, there is a lack of proven methods that explicitly integrate the beliefs of stakeholders.

One of the fundamental tools for supporting the participatory process is Stakeholder Analysis (SA) [8,9], a technique based on studies of the dynamics of social interaction, introduced for the first time in the 1930s. This technique was developed for the sake of understanding the different roles played by stakeholders with respect to the various interests represented [10]. Stakeholder Analysis is a technique that can be applied in several research areas of the forestry sector and wherever stakeholders are present, i.e., it analyses stakeholders interested in ecosystem services [11], mapping actors who participate in the planning of natural resource management [12] and assessing the participatory process in environmental management and governance [13].

Despite being widely applied, SA has been criticized for several weaknesses regarding analytic, qualitative and academic rigor [8]. Hence, in recent years, SA has frequently been complemented by Social Network Analysis (SNA) techniques [14]. The joint use of these techniques is particularly useful for understanding the complex relationships and strong interactions between actors that are typical of environmental policy processes.

SNA offers a quantitative approach to investigate collaborative processes, given that the analysis unit is the relationship between two entities and not the entity itself [15], considering that the networks consist of mechanisms and patterns of connections [16], measured through communications or exchanges among actors [17].

Using SNA and SA at the same time has been shown to have an impressive potential in generating complimentary results [14], where SNA requires more rigorous data collection and supplies quantitative results, and SA has a qualitative approach, providing fine-grained insights into stakeholders' preferences and characteristics.

Thanks to the positive effects of a combined use of SA and SNA, both were applied in our research to analyze the forestry sector network in the Western Italian Alps, focusing on the actors involved in the training activities of forestry workers.

The need to investigate this sector in depth is also indicated by other authors. For instance, a recent survey [18] has shown that Italian forestry enterprises have a worrying economic instability, mainly due to the low profitability of forestry operations. As stated by Morat [19], one of the suggested strategies to overcome this issue is the introduction of training courses focusing on entrepreneurial topics, such as economics, management, market, performance and quality. In reality, training is the most effective way to increase innovativeness [20], and the development of innovativeness could give loggers competitive advantages [21].

The design of training courses that target forestry workers is at the same time a challenging and an essential task that requires careful consideration.

The study area includes three administrative regions, located in the Western Italian Alps, Piedmont, Liguria and the Aosta Valley, which are representative of Alpine forest resources, as woodlands cover almost 40% (1,359,000 ha) of the territory (in the Alps, forests cover approximately 45% of the terrain) [22].

In this area, there are approximately 3000 forestry workers [23], and training courses have been implemented in recent years. Generally, the enterprises are characterized by small dimensions and small logging volumes [18]. This peculiarity should represent a stimulus for institutions to increase the forestry training offer, as small enterprises show a pronounced ability to adopt new business scenarios [24].

Loggers have shown a high interest in the training courses provided over the last decade, in fact, in this area, between 2007 and 2015, more than 350 courses have taken place, attended by over 2500 participants [25]. Most of the courses focused on technical topics, such as safety and use of exploitation techniques, while only a minor part dealt with managerial and entrepreneurial issues. The gap between the offer of technical and entrepreneurial training courses is evident, and this trend shows no sign of a reversal. Therefore, it is imperative to investigate the stakeholders involved in the forestry sector, with specific reference to those involved in the design and execution of training courses. Specifically, the goals of this study were to identify and to describe: (i) The forestry training sector stakeholders and

their characteristics; (ii) the features of their network; (iii) the opinions and priorities of the different stakeholders concerning training activities on entrepreneurial topics for forestry loggers.

2. Materials and Methods

The analyses can be divided into three main steps: (i) Identification and classification of stakeholders involved in the forestry sector with interests in training; (ii) investigation of the stakeholder network and collection of their interest on entrepreneurial forestry training; (iii) gaining an insight into stakeholders' opinions on entrepreneurial forestry training and their mutual cooperation.

2.1. Initial Stakeholder Analysis

The first step of stakeholder analysis is the identification of the actors involved in the network [8]: During this process, all the interested parties, who influence or are influenced by the policies, decisions and actions, are contacted.

In Italy, each administrative region autonomously defines the contents and rules of professional training, in compliance with national guidelines. In order to identify the stakeholders involved in forestry training in the study area, an initial questionnaire was submitted to the Regional Forestry Offices of the three administrative Regions involved in the study. Thanks to this first survey, an initial group, formed by 24 stakeholders who have direct relations with the offices of public institutions, was identified.

Then a snowball sampling technique was applied: This technique consists in asking the actors to list additional people and institutions, involved in the sector, to be interviewed [26,27]. Finally, a list of 54 stakeholders was obtained.

The second step of SA is the stakeholder classification. In this study area, the classification of actors is relatively straightforward. This is because the forestry sector is rather small-scale and not particularly dynamic, where the stakeholders' knowledge of education and training is balanced, and the role they play in the forestry sector is relevant.

The stakeholder classification was carried out by a focus group composed of the authors and officials of the three regional institutions involved in the study. The composition of the focus group was defined, considering the high level of knowledge that each participant has of all the other stakeholders present in the network.

Initially, each participant of the focus group autonomously indicated their classification proposal on the basis of their experience. Subsequently, all the proposals were shared and discussed, in order to obtain the definitive classification.

On the basis of the interest pursued (hereinafter "interest"), the original classification proposed by Lienert et al. [14] was adapted to the studied context, identifying six main stakeholder categories: Economic, education and research, environmental, legal, political and, finally, technical.

On the basis of the stakeholder role in forestry training (hereinafter "class"), the stakeholders were classified, adapting the original classification by Paletto [5] into: Actors of the forest-wood chain, associations, owner associations, public administrations, research institutes, training centers and others.

2.2. Identification of Stakeholder Network and Their Interests in Entrepreneurial Forestry Training

In the second step, a questionnaire was submitted in order to investigate the stakeholders' interest in entrepreneurial forestry training.

This questionnaire was divided into two parts: The first section investigated the collaboration between the different stakeholders, attempting to understand the shape of the network, thanks to their relationships. A list of stakeholders, obtained through the initial SA, was included in the questionnaire in order to investigate the cooperation between actors. The same actors were then asked to indicate with whom they cooperated and to specify the kind of cooperation, according to Coulson [28]: (i) Frequent

collaboration, "contacts fortnightly or weekly," considered a strong tie, (ii) occasional collaboration, "one contact per month," considered a weak tie, or (iii) no contact, if less than one contact per month.

Stakeholders characterized by strong ties have similar backgrounds and views, and their communications are effective [29]. For this reason, strong ties are frequent in relationships that contribute to the growth and success of a business sector [30]. On the contrary, weak ties are typical of low emotional intensity relationships, but, on the other hand, weak ties give access to a variety of information and can build bridges between individuals [31].

In the second section, the respondents were asked to indicate the priority level of the entrepreneurial training topics.

To identify the best suited subjects for Italian forestry training, the authors designed a questionnaire, where the management skills were organized into 5 main areas, as proposed by Morat [19]. Then, each area included two specific skills, as indicated as focal for forestry entrepreneurial training by FAO [32] (Table 1).

Table 1. Management skills investigated.

Area	Skills
Economics	Accounting
	Taxation
Performance	Work organization
	Schemes of partnership and associations
Timber & Market	Marketing
	Forestry supply-chain
Quality	Due Diligence in the forestry and wood sector
	Forest certification
Management	Investments
	Information technology

Finally, each stakeholder identified the priority level of entrepreneurial training topics using a three-point Likert scale [33], where the possible answers were: "low interest," "intermediate interest" and "high interest."

2.3. Social Network Analysis

Data obtained from the survey were transferred into a matrix scheme and, subsequently, used for the analysis. In order to describe the general aspects of the social network, the following features were calculated: (i) Diameter: The longest geodesic distance in the network, namely, how many steps are necessary to get from one side of the network to the other; (ii) density: The sum of the ties divided by the number of possible ties; (iii) reciprocity: The ratio of the number of links pointing in both directions to the total number of links (only in directed networks) [34].

Then, two different measures of centrality, degree centrality and betweenness centrality were calculated in order to assess the role and importance of the various stakeholders in the network.

The degree centrality is the number of arches that link one node of the network to other nodes of the network. The Freeman degree centrality formula [35] is shown in Equation (1),

$$Cd(n_i) \ = \ \sum_{k=1}^{n} a(n_i, n_k) \, (N-1)^{-1} \tag{1}$$

where:

Cd = degree centrality

a_{ik} = arc between nodes (1 if there is a connection between n_i and n_k, and 0 if there is no connection between n_i and n_k).

Additionally, in directed networks, degree centrality can be divided into outdegree centrality (that only considers the outgoing connections) and indegree centrality (that only considers the incoming connections).

The Freeman betweenness centrality formula [35] is shown in Equation (2),

$$C_b(n_i) = \sum_{j}^{N} \sum_{k}^{N-1} \frac{D_{jk}(n_i)}{D_{jk}} \tag{2}$$

where:

C_b = betweenness centrality

D_{jk} = set of minimum paths between the nodes n_j and n_k

$D_{jk}(n_i)$ = set of minimum paths connecting the node n_j to the node n_k through the node n_i

The stakeholders with high scores in degree centrality are capable of influencing the entire network [30], however, they do not always possess the greatest decisional power [36], thus, to understand and classify the importance of the stakeholders, coupling the two measures of centrality is useful. In fact, the betweenness centrality identifies stakeholders who play an intermediary role in the decision-making process, controlling the spread of information. The two measures of centrality were used to classify the stakeholders into three groups: Key stakeholders, primary stakeholders, secondary stakeholders. This distinction was made on the basis of their importance in the decision-making process. Following the Yamaki [37] methodology, actors who have at least one centrality value in the first quartile were classified as key stakeholders, actors whose two centrality values were in the fourth quartile were classified as secondary stakeholders and the remaining actors were classified as primary stakeholders.

2.4. Combining Social Network Analysis and Stakeholders Analysis

The last phase of our analysis consisted in combining the results of SA and SNA, dividing the stakeholders by "interests" and "classes" in order to understand which groups were the most influential and which were marginal in the network.

Next, two adjacency tables, reporting the density of connections among the different "interests" and "classes," were calculated, enabling the identification of the groups who are more inclined to cooperate and where, conversely, there is a lack of communication. The density of contacts was evaluated, considering frequent contacts with a value of 1, while occasional contacts were considered to have a value of 0.5.

The final analysis performed on the survey regarded the training preferences expressed by the stakeholders and assessed the importance of each proposed area, weighted on the role of the actors in the network. This calculation was performed by multiplying the responses of the stakeholders as follows: 0.5, if the stakeholder was secondary; 1, if the stakeholder was primary; and 2, if the stakeholder was key.

3. Results

The main features of the network are displayed in Table 2, where 43 of the 54 stakeholders initially contacted responded to the questionnaire (80%). This response rate is high, compared to others obtained in previous studies [5] and may be interpreted as a sign of interest in the issues investigated in the study area. Among the 43 stakeholders, 634 connections are present, showing a low-density value (0.351), a result that is consistent with values found in similar contexts by Paletto et al. [38]. Despite the low density, the network is efficiently connected, as we can deduce from the diameter parameter value, which is only 4. On the basis of the very high score of reciprocity (0.779), it is clear that this network is mainly characterized by bidirectional links.

Table 2. The main features of network.

Feature	Value
nodes	43
edges	634
av. degree	14.744
density	0.351
diameter	4
reciprocity	0.779

As shown in Table 3, the three most influential stakeholders represent different interests—"political," "technical" and "education and research"—and belong to two different classes—"public administrations" and "research institutes". On the one hand, there is a clear political effort (RegPie) to guide choices in the field of training, with the support of both the university (UniTo) and a research center with technical functions (Ipla), in defining the contents of the courses and providing refresher courses for trainers.

Table 3. Social Network Analysis results.

ID	Name	Label	Interest	Class	Degree	Betweenness	Role
1	Piedmont Region	RegPie	POL	PUAD	**71**	**0.050**	KEY
8	Institute for Wood Plants and the Environment	Ipla	TEC	REIN	**68**	**0.067**	KEY
5	University of Turin—DISAFA	UniTo	E&R	REIN	**52**	**0.031**	KEY
24	Association of Forestry Instructors	Aifor	TEC	OTHS	**49**	0.023	KEY
17	Forest Consortium Upper Susa Valley	Cfavs	ECO	OWNS	**48**	**0.059**	KEY
11	Farmers' association—Coldiretti	Coldir	TEC	AFWC	**46**	0.008	KEY
16	Forest Association Rosa Valleys	AsRosa	ECO	OWNS	**40**	0.012	KEY
20	Canavese Forest Consortium	Cfc	ECO	OWNS	**39**	**0.136**	KEY
2	Liguria Region	RegLig	POL	PUAD	**38**	0.001	KEY
14	National Confederation of Artisans	CNA	TEC	AFWC	**36**	0.010	KEY
15	Confederation of cooperatives—FEDAGRI	Confco	TEC	AFWC	**35**	**0.038**	KEY
34	Centre for Agricultural Education and Technical Assistance	Cipaat	E&R	TRCE	**35**	0.019	PRIMARY
10	Italian Confederation of Farmers	Cia	TEC	AFWC	34	0.008	PRIMARY
38	Managers of regional protected areas and Natura 2000 sites	Rn2000	ENV	PUAD	34	0.023	PRIMARY
13	Artisanal enterprises	Confar	TEC	AFWC	33	0.006	PRIMARY
23	Piedmont's Regional Foresters Association	Areb	TEC	AFWC	32	**0.024**	KEY
32	National Board of Vocational Education—Acli	Enaip	E&R	TRCE	31	**0.037**	KEY
4	Carabinieri—Unit command for forestry, environmental and Agri-food protection	CarFor	LEG	PUAD	30	0.017	PRIMARY
22	Mountain Union Lanzo Valleys	Umvl	ECO	OWNS	30	0.006	PRIMARY
25	Orders of the Agronomic and Forest Doctors	Odaf	TEC	OTHS	30	0.008	PRIMARY
33	Training Consortium Innovation and Quality	Cfiq	E&R	TRCE	30	0.006	PRIMARY
3	Autonomous region Valle d'Aosta	RegVda	POL	PUAD	28	**0.028**	KEY
12	Farming Confederation	Confag	TEC	AFWC	28	0.009	PRIMARY
29	Cebano Monregalese Professional Training Centre	Cfp	E&R	TRCE	27	**0.070**	PRIMARY
30	Training Agency FOCUS Piedmont	Focus	E&R	TRCE	27	0.008	PRIMARY
31	Farmers' Federation Consortium GESTCOOPER	Gestco	E&R	TRCE	27	0.007	PRIMARY
7	Agricultural Research Council	Crea	E&R	REIN	26	0.016	PRIMARY
39	ProNature	Pronat	ENV	ASSO	26	0.006	PRIMARY
18	Villar Fioccardo Forestry Consortium	Cfvf	ECO	OWNS	25	0.007	PRIMARY
27	Giuseppini del Murialdo National Body	Engim	E&R	TRCE	25	0.003	PRIMARY
28	Artisan and Trades Charity Association	Cdcam	E&R	TRCE	25	0.016	PRIMARY
19	Biella Mountain Forest Consortium	Cfmb	ECO	OWNS	24	0.014	PRIMARY
21	Monte Armetta Forestry consortium	Cfma	ECO	OWNS	22	0.009	PRIMARY

Table 3. *Cont.*

ID	Name	Label	Interest	Class	Degree	Betweenness	Role
26	Federation wood industry	Federl	TEC	AFWC	22	0.009	PRIMARY
40	WWF	Wwf	ENV	ASSO	15	0.013	PRIMARY
41	Ligurian training institution—Elfo	Elfo	E&R	TRCE	14	0.009	PRIMARY
43	Gran Paradiso National Park Authority	Epngp	ENV	PUAD	12	0.002	SECONDARY
6	University of Genoa	UniGe	E&R	REIN	11	0.019	PRIMARY
9	Agricultural Experimentation and Assistance Centre	Cersaa	E&R	REIN	10	0.010	PRIMARY
37	Training Services Agency	Asf	E&R	TRCE	9	0.002	SECONDARY
35	Provincial Centre of Vocational Training G. Pastor	Cpfp	E&R	TRCE	8	0.002	SECONDARY
36	San Salvatore Youth Centre	Vrss	E&R	TRCE	8	0.002	SECONDARY
42	Arbores Domi	Arbore	E&R	REIN	8	**0.040**	KEY

Note: Numbers in bold in columns Degree and Betweenness refer to values in the first quartile. KEY: ECO: Economic, E&R: Education and research, ENV: Environmental, LEG: Legal, POL: Political and TEC: Technical; AFWC: Actors of forest–wood chain, ASSO: Associations, OWNS: Owners associations, PUAD: Public administrations, REIN: Research institutes, TRCE: Training centers and OTHS: Others.

The majority of the stakeholders (67%) are characterized by high similarity scores (over 70%) of incoming and outgoing links (Figure 1). This means that cooperation and communication in the forestry training sector are almost always mutual and are not dictated by some stakeholders to others. Furthermore, similarity is almost the same for key and secondary stakeholders. Only 1% of the actors involved in the study have a value of similarity lower than 50. Hence, it is possible to assume that the majority of forestry training stakeholders have a precise idea of their own collocation in the network.
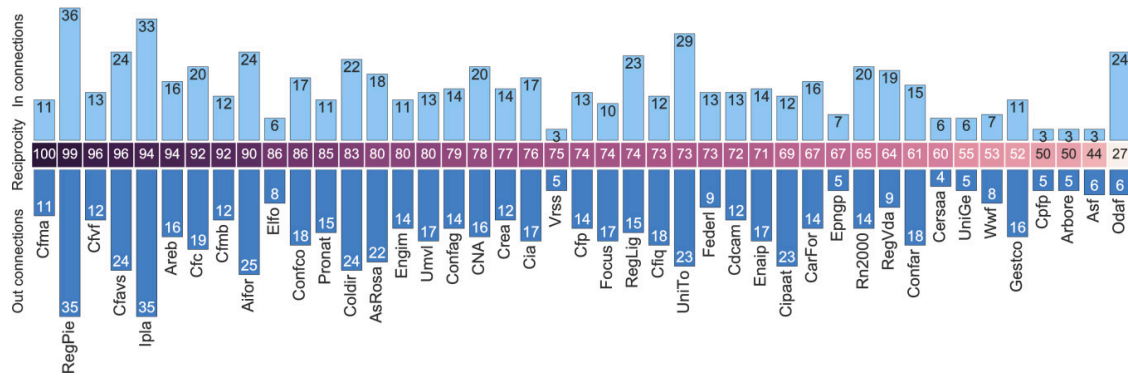
Figure 1. Similarity analysis among incoming and outgoing links.

In the two adjacency tables (Figure 2a,b), the density of connections between stakeholders who belong to the different groups is reported.
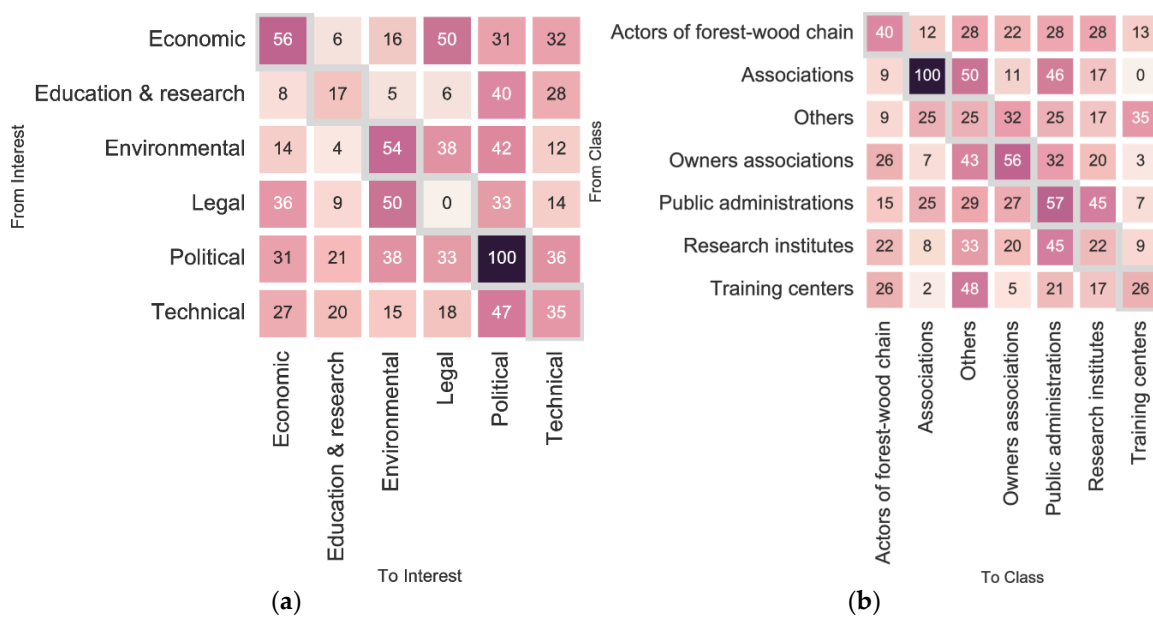
Figure 2. Connections between interests (**a**) and between classes (**b**) (in percentages).

The values of adjacency of the stakeholders, divided by interest, are displayed in Figure 2a. Following this classification, the highest values lie on the bisector, meaning that stakeholders focusing on the same aspect of the forestry training sector are more inclined to cooperate (e.g., all the stakeholders that pursue a political interest cooperate among themselves). There are some exceptions. In fact, the internal cooperation among actors whose pursued interest is education and research (17%) and technical (35%) is quite low. At the same time, the cooperation among the education and research groups, as well as the economic (8%) and environmental (5%) groups, is very low, whereas the network

between stakeholders pursuing technical and political interests (47%) has a high level of cooperation between these two categories, which, as highlighted by the SNA analyses, revealed the highest grades for both centrality indicators.

As shown in Figure 2b, the highest values lie on the bisector, meaning that the highest levels of cooperation are between stakeholders belonging to the same class, e.g., associations are characterized by a density of 100%. Interestingly, research institutes are the least connected (22%), while there is a high level of cooperation between public administrations (57%) and owner associations (56%). On the contrary, the classes characterized by internal economic competition, such as training centers and actors of the forest–wood chain, present low levels of cooperation. Finally, the density of the connections is high between public administrations and research institutes (45%), and between associations and public administrations (46%), while the lowest value is between training centers and associations.

The level of interest in entrepreneurial training is displayed in Figure 3, and we can observe how "Work organization," "Investments" and "Supply chain" are the items that show the highest scores for the actors of the forestry sector. On the contrary, "Accounting," "Marketing" and "Taxation" are topics considered unnecessary for forestry workers by the majority of the stakeholders.
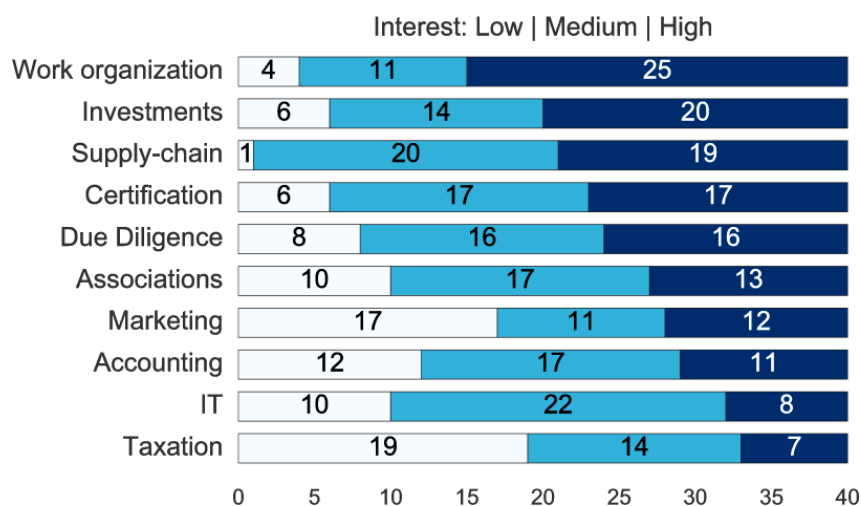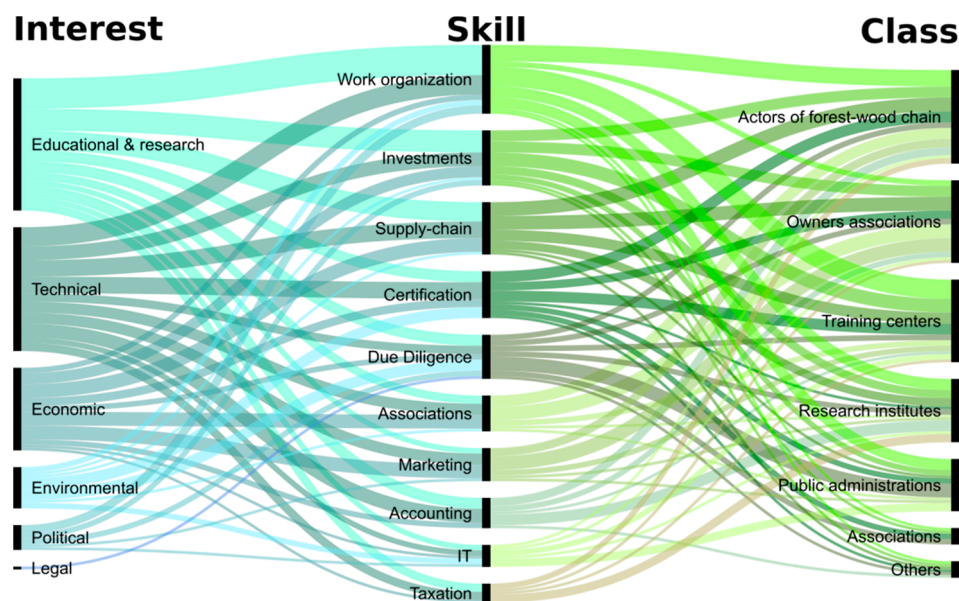

Figure 3. Stakeholder preference regarding entrepreneurial training.

With regard to management skill classes, as proposed by Morat [19], Italian stakeholders located in the Western Alps consider those skills aimed at improving the performance of companies and those relating to knowledge of the wood market and marketing tools to be fundamental. There is also a high level of interest in the qualification of the company with regard to the quality of production and to the compliance with regulations and certification. On the other hand, as far as management is concerned, the responses are divergent. It is considered necessary to train entrepreneurs in the opportunities provided by investments, although digitalization is not perceived as a binding necessity.

Only the specific accounting aspects reported a low general interest, probably because these are services that the entrepreneur does not manage directly but relies on third party professionals or professional organizations.

The preferences, expressed by the various stakeholders in relation to the issues presented, divided by interest and class, are shown in Figure 4.

Figure 4. Stakeholder preferences regarding entrepreneurial training, divided by interest and class.

These analyses were carried out using only the preferences of the stakeholders who indicated a "high" level of interest for each topic.

It is clear that, by analyzing information with an overall vision, the network expresses a high degree of coherence in the choices expressed. In fact, each of the categories that allow the network to be segmented express an interest in all the issues proposed. This absolute lack of polarization in the choices expressed is configured as an important indicator of internal consistency between the various actors in the network, but, at the same time, it expresses the need for training on many issues, highlighting the criticality of the sector from multiple management perspectives.

Here we find a reconfirmation of what emerged in Figure 3, i.e., it is clear that the actors representing the "education and research" and "technical" interests place the issues of "work organization" and "investments" in the foreground, followed by the "supply chain". In light of the findings, these three issues need to be prioritized when defining new training programmes.

4. Discussion

The importance of the stakeholder analysis, together with that of their networks and the influence of different categories in decision-making processes, has been highlighted by many authors [39,40], although the use of network analysis in the forestry sector is still in its infancy. In fact, only in the recent past have some authors applied Social Network Analysis to forestry stakeholders, for instance, Paletto et al. [38] and Yamaki [37], and this technique is deemed to be appropriate for describing small yet highly interconnected networks, such as those typically found in the forestry sector.

This study combined the Social Network Analysis with the Stakeholder Analysis, exploring the relationships among the actors involved in the training sector. The combined use of these two tools, making the best use of the specific aspects of each, made it possible to identify the networks' properties in the participatory process and, as stated by Paletto et al. [5], to recognize and measure, in an objective way, the presence of strong relationships characterizing the actors involved in the network.

In further researches, in addition to being complemented by SNA, the SA can be developed with Multi-criteria analysis in order to more accurately represent decision-making problems and help decision-makers to define priorities and best solutions. Another aspect that should be developed is the challenge related to communication, technology transfer and dissemination, providing policy-makers with effective tools that are directly applicable in defining sector policies [41]. As a general result, the hierarchy among actors has undoubtedly been identified, highlighting their so-called "social

power," namely, their respective roles and influence in decision-making processes, and clarifying the political role that each actor has in an often opaque context, where, in addition to structural positions, direct relations between individuals are also significant. Thanks to this approach, it has been possible to identify a preliminary network of actors, and the response rate has shed light on both their high level of interest in belonging to the network and their own interest in the training topics. The choice to investigate specific topics, however, represents a research limit, as these results cannot be automatically applied to other contexts.

Another interesting result, worthy of further in-depth discussion, is the lack of mutual communication between different and well-separated categories of actors. In fact, some stakeholders are excluded from the decision-making process, confirming the findings of other studies [7,42].

Currently, several "secondary" stakeholders find no place in the decision-making process at all and, even when formally included in the network, are relegated to a marginal position. This is the case, for instance, in training agencies, which, even though are fully part of the network, are evidently not able to condition it. The consequence may be the creation of a dangerous short circuit, since the failure to meet mutual expectations may lead to ineffective training courses. This study provided several initial results, which need to be examined in greater depth through subsequent investigations. The network and the position of each actor, with respect to the various indicators, are relevant only for the professional training topics. The position and importance of the actors could in fact change if analyzed with respect to other topics of investigation.

The next steps of our research could continue by analyzing stakeholders with reference to other topics, studying which factors lead to the confinement of some stakeholders to gregarious and accessory positions and the elements which cause the exclusion of some of them from the decision-making process, deepening the examination of the social and political needs defined by each actor and possibly also including in the survey those who have not provided their feedback in this first analysis. The research should also systematically investigate any conflicts or synergies and trade-offs between actors who belong to different classes or occupy different roles.

A focus on similarities and differences expressed in other fields (e.g., ecosystem services and the wood supply chain) will make it possible to identify a more stable and stronger network with an "absolute" value.

Additionally, the marginality of another actor, the associations, is to be considered a risk because the training proposals may not reflect their needs and, therefore, may be opposed by the loggers themselves, as also highlighted by Egan [43]. It is worth underlining how very few stakeholders declined to participate in the survey, justifying their decision by citing confidentiality concerns about their contacts, which confirms the importance of informal individual links.

Regarding the results obtained in the stakeholder classification, it appears evident that all groups, respectively divided by interest and by class, are represented with a strong social connection and depict a sort of general balance in the network. Within these groups, good levels of connection between stakeholders, belonging to the same class and pursuing the same purpose, have been shown by the combined use of the two techniques. On the contrary, connections among stakeholders of different groups are lower, as stated by Bruña-García and Marey-Pérez [44]. However, despite the presence of administrative and logistical barriers, a good connection was found even among stakeholders operating in different territories. In fact, the physical or administrative distance is cancelled out by the desire to establish common guidelines on a crucial and delicate issue, such as the professional training of forestry workers, beginning with the high interest shown by the political decision-makers.

As stated by other authors [18], who have investigated the training needs expressed directly by forestry loggers, we find confirmation that issues related to the supply chain aspects, work organization and investments are considered the most important ones. This is a view that is also held by other stakeholders who express different interests and occupy different roles in the forestry sector. This is in line with other researches that have shown that the main concern of forestry companies is linked to the low profitability of logging operations [24].

5. Conclusions

The availability of wood resources in the Western Italian Alps would potentially allow for the existence of a widespread network of business enterprises, guaranteeing employment and social benefits in fragile environments and, at the same time, allowing for the sustainable management of the resource itself. However, for this to happen, it is essential that businesses are efficient and have the appropriate level of professional knowledge.

The effort shown by political institutions in this area, in setting up training courses for forestry workers, has increased in recent years, thanks to continuous investment in this sector, with over € 7 million allocated in the 2014–2020 period. For several years now, political institutions and research centers have been working together to define the contents of future training courses. The associations, representing the various professional figures that work in this sector, are also particularly active, and training is considered a fundamental aspect for the professional growth of entrepreneurs.

It should be noted that training centers have a marginal role in the network, and this weakness should be considered in future investigations, bearing in mind the important contribution that trainers can make in defining the contents of such training courses and also considering that they have direct contact with workers and their needs.

Training is a topic that involves actors with different roles, with different interests, but the need expressed by the majority of actors involved in the survey is clear: To increase the offered training on managerial issues.

Interpreting the results of the survey, it is clear that all stakeholders are concerned about the economic performance of the forestry sector. As a result, being able to provide the system with the tools to implement profitability is of paramount importance, and the actors have confirmed this result, as they consider training on how to improve the yield of forest operations and how to assess investments in innovative machinery to be crucially important. In the same manner, gaining more knowledge about the wood supply chain and the enhancement of the raw material is requested.

On the other hand, stakeholders do not have confidence in the opportunities provided by information technologies, probably because they are still linked to traditional market forms, mostly local, based on direct contacts among operators of the supply chain.

In conclusion, the forestry sector stakeholders in the Western Italian Alps have highlighted the need for the training of a "modern woodsman," identifying the profile of an entrepreneur who, in addition to expressing an excellent knowledge of forestry operations and the profitable management of the site, seeks to better comprehend the timber market and the opportunities it offers.

References

1. Appelstrand, M. Participation and societal values: The challenge for lawmakers and policy practitioners. *For. Policy Econ.* **2002**, *4*, 281–290. [CrossRef]
2. Teder, M.; Kaimre, P. The participation of stakeholders in the policy processes and their satisfaction with results: A case of Estonian forestry policy. *For. Policy Econ.* **2018**, *89*, 54–62. [CrossRef]
3. Kangas, A.; Saarinen, N.; Saarikoski, H.; Leskinen, L.A.; Hujala, T.; Tikkanen, J. Stakeholder perspectives about proper participation for Regional Forest Programmes in Finland. *For. Policy Econ.* **2010**, *12*, 213–222. [CrossRef]

4.　European Commission. The New EU Forest Strategy. Available online: https://ec.europa.eu/agriculture/forest/strategy_en (accessed on 26 June 2018).

5.　Paletto, A.; Giacovelli, G.; Pastorella, F. Stakeholders' opinions and expectations for the forestbased sector: A regional case study in Italy. *Int. For. Rev.* **2017**, *19*, 68–78. [CrossRef]

6.　Kleinschmit, D.; Pülzl, H.; Secco, L.; Sergent, A.; Wallin, I. Orchestration in political processes: Involvement of experts, citizens, and participatory professionals in forest policy making. *For. Policy Econ.* **2018**, *89*, 4–15. [CrossRef]

7.　Ananda, J.; Herath, G. The use of Analytic Hierarchy Process to incorporate stakeholder preferences into regional forest planning. *For. Policy Econ.* **2003**, *5*, 13–26. [CrossRef]

8.　Reed, M.S.; Graves, A.; Dandy, N.; Posthumus, H.; Hubacek, K.; Morris, J.; Prell, C.; Quinn, C.H.; Stringer, L.C. Who's in and why? A typology of stakeholder analysis methods for natural resource management. *J. Environ. Manag.* **2009**, *90*, 1933–1949. [CrossRef] [PubMed]

9.　Peterson St-Laurent, G.; Hoberg, G.; Sheppard, S.R.J. A Participatory Approach to Evaluating Strategies for Forest Carbon Mitigation in British Columbia. *Forests* **2018**, *9*, 225. [CrossRef]

10.　Grimble, R.; Wellard, K. Stakeholder methodologies in natural resource management: A review of principles, contexts, experiences and opportunities. *Agric. Syst.* **1997**, *55*, 173–193. [CrossRef]

11.　Barnaud, C.; Corbera, E.; Muradian, R.; Salliou, N.; Sirami, C.; Vialatte, A.; Choisis, J.-P.; Dendoncker, N.; Mathevet, R.; Moreau, C.; et al. Ecosystem services, social interdependencies, and collective action: A conceptual framework. *Ecol. Soc.* **2018**, *23*, 15. [CrossRef]

12.　Krupa, M.; Cenek, M.; Powell, J.; Trammell, E.J. Mapping the stakeholders: Using social network analysis to increase the legitimacy and transparency of participatory scenario planning. *Soc. Nat. Resour.* **2018**, *31*, 136–141. [CrossRef]

13.　Raum, S. A framework for integrating systematic stakeholder analysis in ecosystem services research: Stakeholder mapping for forest ecosystem services in the UK. *Ecosyst. Serv.* **2018**, *29*, 170–184. [CrossRef]

14.　Lienert, J.; Schnetzer, F.; Ingold, K. Stakeholder analysis combined with social network analysis provides fine-grained insights into water infrastructure planning processes. *J. Environ. Manag.* **2013**, *125*, 134–148. [CrossRef] [PubMed]

15.　Robertson, P.J.; Lewis, L.B.; Sloane, D.C.; Galloway-Gilliam, L.; Nomachi, J. Developing networks for community change: Exploring the utility of network analysis. *Commun. Dev.* **2012**, *43*, 187–208. [CrossRef]

16.　Burt, R.S. The Network Structure of Social Capital. *Res. Organ. Behav.* **2000**, *22*, 345–423. [CrossRef]

17.　Powell, W.M. Neither market nor hierarchy; Network forms of organization. In *Research in Organizational Behavior*; Staw, B.M., Cummings, L.L., Eds.; JAI Press: Greenwich/London, UK, 1990; Volume 12, pp. 295–336. Available online: http://www.scirp.org/(S(czeh2tfqyw2orz553k1w0r45))/reference/ReferencesPapers.aspx?ReferenceID=1751733 (accessed on 26 June 2018).

18.　Spinelli, R.; Magagnotti, N.; Jessup, E.; Soucy, M. Perspectives and challenges of logging enterprises in the Italian Alps. *For. Policy Econ.* **2017**, *80*, 44–51. [CrossRef]

19.　Morat, J. *Skills Needed by Forest Contractors*; Report Project ConCert—Programme Leonardo 2009–2011; La Bastide des Jourdans, France, 2011.

20.　Nybakk, E.; Crespell, P.; Hansen, E.; Lunnan, A. Antecedents to forest owner innovativeness: An investigation of the non-timber forest products and services sector. *For. Ecol. Manag.* **2009**, *257*, 608–618. [CrossRef]

21.　Wiklund, J.; Shepherd, D. Entrepreneurial orientation and small business performance: A configurational approach. *J. Bus. Ventur.* **2005**, *20*, 71–91. [CrossRef]

22.　Elmi, M.; Streifeneder, T. *The Alps in 25 Maps*; Permanent Secretariat of the Alpine Convention: Bozen, Italy, 2018; ISBN 978-88-97500-43-8.

23.　Motta Fre, V.; Tondeur, V.; Marchaison, P.; Blin, L.; Dubois, C.; Haudemand, J.-C. Vocational forestry training in the transalpine area between Italy and France (in Italian). In Proceedings of the Summary of Studies and Analyses Carried Out in the Framework of the EUROPEAN Cooperation Project in Forma, Torino, Italy, 2 March 2015.

24.　Accastello, C.; Blanc, S.; Mosso, A.; Brun, F. Assessing the timber value: A case study in the Italian Alps. *For. Policy Econ.* **2018**, *93*, 36–44. [CrossRef]

25.　Magagnotti, N.; Smidt, M.; Spinelli, R. Characteristics of the students and appreciation of the courses: Each one his own? (in Italian). In Proceedings of the Seminar: Forest Training and Information: Where We Come from and Where We Are Going, Turin, Italy, 11 January 2018.

26. Harrison, S.R.; Qureshi, M.E. Choice of stakeholder groups and members in multicriteria decision models. *Nat. Resour. Forum* **2000**, *24*, 11–19. [CrossRef]

27. Noy, C. Sampling Knowledge: The Hermeneutics of Snowball Sampling in Qualitative Research. *Int. J. Soc. Res. Methodol.* **2008**, *11*, 327–344. [CrossRef]

28. Coulson, J. *The Strength of Weak Ties in Online Social Networks: How Do Users of Online Social Networks Create and Utilize Weak Ties to Amass Social Capital?* LAP LAMBERT Academic: Columbia, SC, USA, 2010; ISBN 978-3-8383-6965-5.

29. Prell, C.; Hubacek, K.; Reed, M. Stakeholder Analysis and Social Network Analysis in Natural Resource Management. *Intern. Soc.* **2009**, *22*, 501–518. [CrossRef]

30. Paletto, A.; Ferretti, F.; De Meo, I. The role of social networks in forest landscape planning. *For. Policy Econ.* **2012**, *15*, 132–139. [CrossRef]

31. Mark, S. Granovetter The Strength of Weak Ties. *Am. J. Sociol.* **1973**, *78*, 1360–1380.

32. FAO. *Guide to Good Practice in Contract Labour in Forestry*; Report of the UNECE/FAO Team of Specialists on the Best Practices in Forest Contracting; Kastenholz, E., Dyduch, C., Fitzgerald, R., Hudson, B., Jaakkola, S., Lidén, E., Monoyios, K., Morat, J., Pasek, F., Sachse, M., et al., Eds.; Food and Agriculture Organization of the United Nations: Rome, Italy, 2011; ISBN 978-92-5-106877-9.

33. Likert, R. A technique for the measurement of attitudes. *Arch. Psychol.* **1932**, *22*, 55.

34. Scott, J. Social Network Analysis. Available online: https://uk.sagepub.com/en-gb/eur/social-network-analysis/book249668 (accessed on 22 June 2018).

35. Freeman, L.C. Centrality in social networks conceptual clarification. *Soc. Netw.* **1978**, *1*, 215–239. [CrossRef]

36. Sinclair, P.A. Network centralization with the Gil Schmidt power centrality index. *Soc. Netw.* **2009**, *31*, 214–219. [CrossRef]

37. Yamaki, K. Applying social network analysis to stakeholder analysis in Japan's natural resource governance: Two endangered species conservation activity cases. *J. For. Res.* **2017**, *22*, 83–90. [CrossRef]

38. Paletto, A.; Hamunen, K.; Meo, I.D. Social Network Analysis to Support Stakeholder Analysis in Participatory Forest Planning. *Soc. Nat. Resour.* **2015**, *28*, 1108–1125. [CrossRef]

39. Bryson, J.M.; Cunningham, G.L.; Lokkesmoe, K.J. What to Do When Stakeholders Matter: The Case of Problem Formulation for the African American Men Project of Hennepin County, Minnesota. *Public Adm. Rev.* **2002**, *62*, 568–584. [CrossRef]

40. Dos Muchangos, L.S.; Tokai, A.; Hanashima, A. Stakeholder analysis and social network analysis to evaluate the stakeholders of a MSWM system—A pilot study of Maputo City. *Environ. Dev.* **2017**, *24*, 124–135. [CrossRef]

41. Blanc, S.; Accastello, C.; Bianchi, E.; Lingua, F.; Vacchiano, G.; Mosso, A.; Brun, F. An integrated approach to assess carbon credit from improved forest management. *J. Sustain. For.* **2018**, *1–15*, 1–15. [CrossRef]

42. Ananda, J. Implementing participatory decision making in forest planning. *Environ. Manag.* **2007**, *39*, 534–544. [CrossRef] [PubMed]

43. Egan, A.F. Training preferences and attitudes among loggers in northern New England. *For. Prod. J.* **2005**, *55*, 19–26.

44. Bruña-García, X.; Marey-Pérez, M.F. The challenge of diffusion in forest plans: A methodological proposal and case study. *Forests* **2018**, *9*, 240. [CrossRef]