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WHY ADOPT SUSTAINABLE FOREST MANAGEMENT CERTIFICATIONS? MAIN DRIVERS IN ITALY AND GERMANY

SUMMARY

In recent years, sustainable forest management has proved to be a crucial issue for forestry companies becoming more and more sensitive to environmental problems. This resulted in the inherent expansion in forest certifications formally promoting long-term environmental sustainability and a wider spectrum of forest ecosystems. In this context this study aims to assess the main motivations that encourage the adoption of sustainable forest management certification for PEFC and FSC standards and how these motivations vary depending on the characteristics of the companies. Specifically, online questionnaire surveys were submitted to a sample of Italian and German forest owners and managers considering five main motivational factors offered by the economic literature: three external mechanisms represented by the market, signalling and legal mechanism and two internal mechanisms consisting of the moral and learning mechanism. Results highlighted that the main drivers are represented for both countries by the reporting mechanism, in particular certification is seen as a tool to demonstrate externally the implementation of sustainable forest management practices. Other mechanisms that guide the intentions of forest owners and managers include the legal mechanism, in particular in the Italian case, especially for publicly owned forest areas, more driven by the interest of complying with forestry regulations and the moral mechanism, in the case of Germany. The implications of this research are seen in development of forest certification, through understanding forest owners' reasons for adopting it and providing background information to improve the design of certification programs to attract greater adoption by forest companies.

Keywords: PEFC; FSC; motivations; forest owners; reasons

INTRODUCTION

A complex interplay between economic and environmental forces is common to most European countries, especially in forest sector. In particular the forest sector is undergoing a transition towards a "circular bioeconomy", on the

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basis of regulations and strategies such as "Agenda 2030" and "Clean Planet for all", implemented by EU Member States in the context of sustainability and climate-neutral economy (Michal *et al.*, 2021). Indeed, official statistics have highlighted the growing number of forestry companies investing economic resources to improve the environmental profile of processes, products, and services (Lanfredi *et al.*, 2023). This is also highlighted by the increase in the number and complexity of forest certifications at European and in general at global level. The concept of forest certification is based on third-party auditing of compliance with established standards, principally linked to sustainability issues such as responsible or sustainable forest management, the balance between economic, social, and environmental concerns for forest management, illegal harvesting, conservation of biodiversity, timber markets (Paluš *et al.*, 2024). Regarding the latter, an important role is played by Chain of Custody (CoC) certification, which guarantees an effective system of traceability through the supply chain. There are several worldwide forest certification organizations, but Forest Stewardship Council (FSC), and Programme for the Endorsement of Forest Certification (PEFC) have become the most diffused standards at global level. These standards present some differences in relation to their origin. The FSC scheme emerged in response to the failure of national governments to address the loss of high conservation value forests, particularly in the tropics. The appearance of the FSC was followed by a concern from industry and forest owners about the cost of compliance with the different standards FSC prescriptive. So, the PEFC program was established in 1999 in response to environmental, socio-economic, political, and cultural issues of forest landowners in Europe. According to the latest statistics 390 million ha are certified worldwide (9% of the global forest surface), with FSC reporting a total certified area of 170 million ha and PEFC of 296 million ha. Both are present in the Northern hemisphere mostly, and less in tropical areas. Currently, dual certification exists in 33 countries with 86 million ha (Rocchi *et al.*, 2023). Specifically, in Europe 81 million ha of forest are certified PEFC and 56 million ha are certified FSC (FSC, 2023; PEFC, 2023). The spread of the above-mentioned certification schemes has led to an increase in scientific production in this field of research, with the aim of mainly examine attitudes and motivations of forest owners and managers to adopt forest certification. Specifically, the main categorizations of motivations are those proposed by Cashore *et al.* (2004), Overdevest and Rickenbach (2006), and Faggi *et al.* (2014). According to the non-state market-driven model (NSMD), proposed by Cashore *et al.* (2004), there are three structural factors affecting the choice to adopt forest certification: the role of the global economy in relation to the companies' dependence on foreign markets sensitive to environmental issues; the structure of the forest sector; and the public policy agenda. Overdevest and Rickenbach (2006) considered three mechanisms: market mechanism, linked to forest companies' economic and market interests; signalling mechanism, aimed to inform external stakeholders about the firm's pro-environmental behaviors, and learning

mechanism, which helps to transfer knowledge, skills, and practices to the enterprises. Instead Faggi *et al.* (2014), in their study, added two other relevant mechanisms, namely the moral mechanism linked to individual ethical values and the legal mechanism that concerns legal compliance with mandatory regulation. Given this background, the aim of this study is to understand the main motivations driving forest owners and managers towards PEFC and FSC certifications of sustainable forest management. The basic idea is at first to assess the main motivational drivers starting from a solid base offered by the economic literature on forest certifications and thus considering three external mechanisms represented by the market, signalling and legal mechanism and two internal mechanisms consisting of the moral and learning mechanism (Galati *et al.*, 2017; Zubizarreta *et al.*, 2021). Furthermore, the presence of possible differences and variations in these motivational drivers is assessed in relation to the characteristics of the certified companies and the stage of certification diffusion. Specifically, two parallel surveys were conducted, adopting the same methodological approach, but in different economic and territorial areas: Italy and Germany. The peculiar selection of the study areas can be traced back to the desire to investigate the phenomenon of the diffusion of forestry certifications which, although widely treated in the scientific literature (Lombardo *et al.*, 2021), has been little explored in relation to these two geographical areas. The number of studies concerning the assessment of the main drivers that induce Italian and German forest owners to adopt certification is rather scarce. Indeed, although Italy is one of the most important European countries and in the international context, in terms of number of environmental certifications, only a few studies have been conducted in this field research. Specifically, in their study Galati *et al.* (2017) mainly focused on the implementation of the FSC standard as a means of promoting responsible forest management and traceability of derived products, compared to the standard PEFC. This last scheme was analyzed in the work of Negro *et al.* (2021), as part of the project "PEFC Solidarity Chain" established after the Vaia storm. This also considering that the country has a large, certified forest area: out of a forest area of 10 982 013 ha, 85 838 ha are FSC certified, while 949 907 ha are PEFC certified. In the case of Germany, it can be emphasized, again, that in the literature, the analysis of the main motivational drivers towards forest certification is addressed in a very limited way, often in conjunction with other countries (Cashore *et al.*, 2005). In general, the main studies developed in this country refer to the adoption of FSC and PEFC certifications for the paper industry importers (Korhonen *et al.,* 2017; Dieckmann *et al.*, 2020), although Germany has certification levels above 65% of the national forest area (Maesano *et al.*, 2018), with respectively 1 553 728 ha of forest with FSC certification and 8 275 727 ha certified PEFC out of a total of 11.4 million ha of forest. So, this study aims to fill this research gap in the literature, analyzing for these countries, the main drivers towards the adoption of for PEFC and FSC SFM certifications and their dependence in relation to the characteristics of the companies.

MATERIAL AND METHODS
Survey design

The survey was conducted using a structured questionnaire in Google Forms. In the case of Italian sample this questionnaire was sent directly in Italian whereas in the case of Germany it was translated into German, after having pre-tested a sample of eight Italian companies through the administration of the questionnaire through telephone interviews. The questions were formulated according to a closed or hierarchical response scheme. The questionnaire was structured in three sections. In the first section, "General characteristics of the company/entity and forestry certifications adopted", aspects relating to the entities interviewed were noted, such as: name; location; legal form; the type of ownership; the total area wooded and the certified forest area in ha; the type of forest species present; the main production that constitutes the core business; the number of employees; main product destination markets; main sales channels; average company turnover in euro; the types of certification adopted and the year of adoption. The second section, "Characteristics of the forest owner/manager", provided information on the profile of the interviewees, specifically on age, educational qualification and gender, years of experience in the forestry sector. The third section "Analysis of the main motivations towards the adoption of forest certification" allowed for the detection of the motivational aspects that drive owners/managers towards the adoption of forest certification. Specifically, the statement 'I have chosen to adopt forest certification...' was followed by twenty-two items for each of which respondents were asked to indicate their degree of agreement or disagreement. For this purpose, a 5-point Likert scale (Likert, 1932) was used for the answers, where a score of 1 corresponds to 'completely disagree' and a score of 5 to 'completely agree'. The list of proposed items was developed on the basis of the main studies in this research area (Hartsfield and Ostermeier, 2003; Overdevest and Rickenbach, 2006; Jayasinghe *et al.,* 2007; Faggi *et al.,* 2014; Johansson, 2014; Mikulkova *et al.,* 2015; Galati *et al.,* 2017; Misue, 2018; Hălălişan *et al.,* 2018; Zubizarreta *et al.,* 2021; Paluš *et al.,* 2021).

Data collection

The forest owners and managers involved in the survey were identified from the international databases of FSC and PEFC including only SFM certification holders. The development of the survey was based on the methods recommended by Dillman (2007) which include an information telephone call (in the case of Italy) a pre-notification and a first and second email in order to maximize the response rate. Data were collected in September-December 2022. In the case of Italy, out of a total of 133 certified companies/bodies contacted, respectively 47 for PEFC and 86 for FSC, 83 complete questionnaires were received with a response rate of 62.4%. For Germany, there were 271 certified entities in the FSC database, but taking into account the difficulty of finding the contact details of some owners, especially in the case of private individuals, a group of 55 entities was considered (without considering all other entities within

the same group certification). In the case of PEFC certification, considering the high number of certified entities, around 12 000, following the methodology applied by Jaung *et al.* (2016) and Krause and Matzdorf (2019) a sample of 400 subjects was considered, using a simple randomization sampling method, and received 71 completed questionnaires with a response rate of 15.60%.

Data analysis

The statistical analysis was performed using the SPSS (Version 25) and Stata (Version 17) software. Specifically, a univariate descriptive analysis of the surveyed variables was carried out by calculating the centrality and variability indices for quantitative variables and the frequencies for qualitative ones. The elaboration of averages and standard deviations, for responses on a Likert scale, were conducted to analyze the main motivations for forest owners/managers to become certified. To assess how motivations could be influenced by different factors, non-parametric tests were applied. This approach has previously been used by various authors analyzing similar research topics (Hălălişan et al., 2018; Paluš *et al.*, 2018; Paluš *et al.*, 2021; Zubizarreta *et al.,* 2021). Therefore, in order to verify how the motivations for Italian and German forest owners and managers varied according to type of certification (PEFC, FSC, PEFC-FSC), total forest area (up to 100 ha, from 101 to 300, from 301 to 1000, over 1000), and the year of certification (up to 2004, from 2005 to 2012, from 2013 onwards) the Kruskal-Wallis test was applied. This test is usually used when a normal distribution of the population cannot be assumed and makes it possible to determine the presence of differences in the central value (mean or median) of more than two independent groups or samples. In the case of the factor 'type of ownership' (public or private) and legal form (sole proprietorship, other form), the Mann-Withney test or U-test was used. This test, of which the Kruskal-Wallis test is an extension, is applied in the presence of two independent groups (Hălălişan *et al.,* 2019). Specifically, for Italy, where the presence of 18 properties with poplar cultivation, this test was applied to assess possible differences in motivations according to the type of forest species present (poplar or other species). The null hypothesis underlying the methodology is that all averages identified by the variables considered are compared instead with the alternative hypothesis, namely that there exists at least one pair of averages that differ from each other. For such tests, a significance level of 5%.

RESULTS AND DISCUSSION

Description of the characteristics of the entities and certified owners/managers

The analysis of the Italian context shows a distribution of the realities surveyed mainly in the regions of northern Italy. In fact results show 34% in Friuli-Venezia Giulia, followed by 28% in Veneto, 11% in Trentino-Alto Adige, 10% in Lombardy, 6% in Tuscany, 2% in Emilia-Romagna, Piedmont and Sardinia, 1% in Calabria, Lazio, Liguria and Umbria. In Germany the largest percentage of forest owners/managers is concentrated in the federal state of

Baden-Wuerttemberg (24.3%), followed by Bavaria with 15.7%, Rhineland-Palatinate with 14.3%, North Rhine-Westphalia with 11.4%, Hessen with 8.6%, Saxony-Anhalt and Lower Saxony, each with 5.7%, Brandenburg and Thuringia, each with 4.3%, Saxony with 2.9% and, finally, by Mecklenburg-Vorpommern and Saarland, each with 1%. In the German case, the sample taken includes almost all federal states except Hamburg and Schleswig-Holstein. Regarding the legal form, in the Italian case 73.5% are represented by another form (this is a very diverse sample including, for example, 22 municipalities, 2 Regole, 4 regional authorities, 2 associations of producers, 6 consortia, 3 capital companies, 6 partnerships), and the remaining 26.5% by individual enterprises. Also, in the case of Germany, the predominant legal form is other, i.e., 78.9 % (comprising in most cases municipalities, around 35, and forestry offices), while 21.1 % are sole proprietorships. Regarding the type of forest ownership, the data show that in the Italian case there is a greater presence of privately managed forest areas (59%), compared to 28.2% in Germany where 71.8% of the surveyed areas are public property. With reference to the total forest area, the Italian realities are very diversified; in fact, forest properties of up to 100 ha are mostly consisting of poplar growers and individual enterprises (32.5%) and forest areas of over 1000 ha represented mostly by public properties (34.9%). While the percentage of German forest areas of more than 1,000 ha is 52.1 %, mostly public property. In the Italian case, the certified forest area accounts for 90% of the total forest area, whereas in Germany this incidence is 95%. About forest types, Italy has a higher percentage of broadleaf forest (43%), considering that it includes poplar forests (18 entities) while in the German case the highest percentage is found for mixed deciduous and coniferous forest (47.8%). The main production types constituting the core business in Italy are timber for industry (53.0%), followed by other functions (e.g., non-timber products and tourism-recreation), amounting to 15.66%, wood for energy (3.63%). In the remaining 27.7%, the type of product is not specified. Also, in the case of Germany, the main production is wood for industry (74.7%), followed by other functions (12.7%), and energy wood (9.85%), while 2.81% are not classified. Regarding the number of employees in the business, in the Italian case is 95.2% for entities with a number of employees < 50 and 4.8% for those with a number between 50 and 250. There are no enterprises with more than 250 employees. The percentage of the number of employees in Germany has the following values: 88.7% <50 employees; 4.2% between 50 and 250; 7.05% over 250. The main destination markets for forest products for both countries are the domestic market, namely 86.7% in the case of Italy and 95.8% in the case of Germany. The remaining part for both countries is destined for foreign markets. With reference to the main distribution channels, Italy has a higher percentage in the 'direct sale' category (61.4%) followed by 'other' with 20.5% (represented by e.g., consortium sale, standing sale to forestry companies, public auction, sale on the wownature.eu portal) and 18.1% for sale to processing industries. In the case of Germany, sales to processors (56.3%) accounted for the largest percentage, followed by direct sales (28.2%), while

15.5% fell into the 'other' category. Regarding the average company turnover, most Italian companies reported a turnover of less than two million euro (79.5%), 4.8% between 2.1 and 10 million and 15.7% did not provide an answer. In Germany, the average company turnover was 76.1% below 2 million euro, 12.7% between 2.1 and 10 million euro and 11.2% between 10.1 and 50 million euro. For both countries, it emerges that many of the realities surveyed have both FSC and PEFC certification, in particular 24.1% in Italy and 28.2% in Germany. Considering the presence of dual certification, in some cases, the survey results show that 41% of Italian companies are FSC certified and 83.1% PEFC certified; in contrast, in Germany 33.8% is certified FSC, while 94.4% PEFC.

Furthermore, it should be noted that eleven of the Italian companies, in some cases within the group certification, had already extended SFM certification to ecosystem services.

About the characteristics of the respondents, it should be noted that in the case of Italy, 62.7% were male, 9.6% female (27.7% preferred not to give any answer). Furthermore, the majority of respondents are between 41 and 60 years old (47.0%), followed by 18.1% over 60 and 13.2% between 26 and 40 years old, while 21.7% of the respondents did not state their age.

As far as the level of education is concerned, 30.1% have a high school diploma, 19.3% master's degree, 11.0% secondary school undergraduate degree, 8.4% PhD/master's degree, and 6.0% bachelor's degree, while 25.3% provided no answer. The years of experience in the forestry can be described as follows: for 23.0% the experience was between 1 to 15 years, for 27.7% from 16 to 30 years, for 14.4% over 30 years. The remaining 34.9% did not provide any answer. In the case of Germany, the majority of respondents were male (63.4%), followed by 1.4% female, while 35.2% preferred not to answer. Regarding age, the majority of respondents fall into the 41 to 60 age group (38.0%) followed by 19.7% over 60, 14.1% from 26 to 40, 2.8% from 18 to 25 (25.35% did not provide any data). In addition, 25.3% had a high school education, 18.4% a master's degree, 15.5% a bachelor's degree and 11.3% a PhD/master's degree, while 29.6% did not want to give any answer. Finally, with regard to experience in the forestry sector, it can be seen that 31.0% have more than 30 years' experience, followed by 19.7% with experience of up to 15 years, 18.3% from 16 to 30 years, while 31.0% gave no answer.

Main drivers for the adoption of forest certification in Italy and Germany

To assess the internal consistency of the items proposed to evaluate the five mechanisms, the Cronbach's α coefficient was calculated for Italy and Germany. A reliability coefficient of 0.7 was considered as an acceptable level of consistency. In fact, in the case of Italy, a value of the α coefficient of 0.90 was recorded, as in the case of Germany where the value of α was 0.91. Figure 1 shows the comparison between the two countries in relation to the main

mechanisms driving certification and Table 1 the related items attributable to each mechanism.
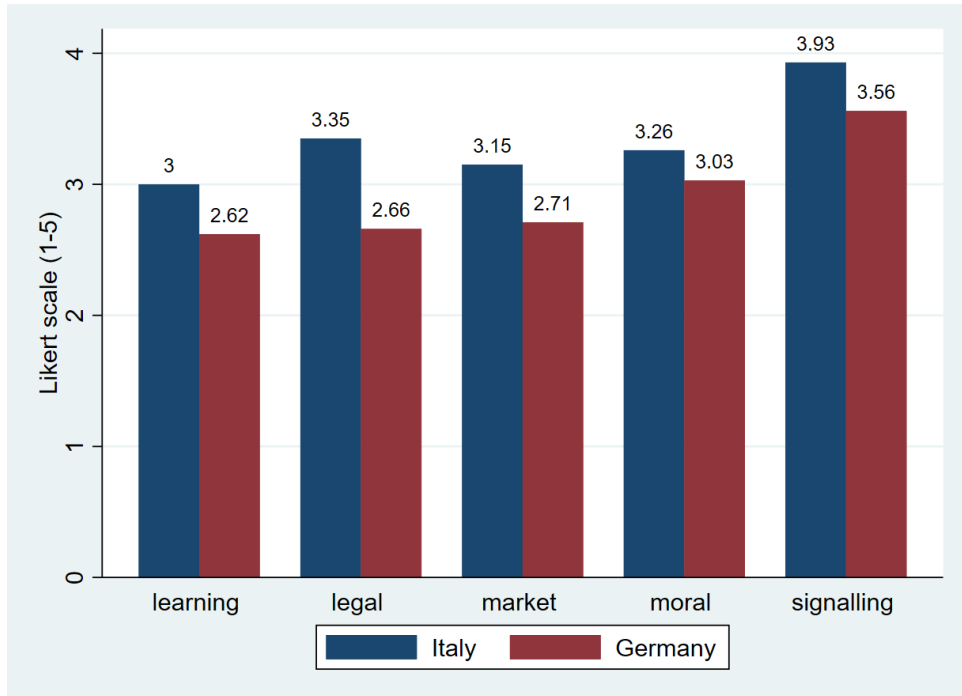

Figure 1. Mechanisms driving the adoption of forest certification.

As shown in Figure 1, the main mechanism driving both Italian and German owners towards the adoption of forest certification is represented by signalling, with an average value, respectively, of 3.93 in the Italian case and 3.56 for Germany. In particular, for Italy, as shown in Table 1, the items "To have sustainable forest management practices recognized" (4.14) and "Because certification represents a commitment to environmental responsibility" (3.94) acquire important relevance. Also, in the case of Germany, the item "To have recognition of sustainable forest management practices" has the highest average value of 3.96, followed by "To improve corporate image" with a value of 3.68. These findings are in line with those of other authors specifically focusing on SFM certification (Hartsfield and Ostermeier, 2003; Mikulková *et al.*, 2015; Lee and Chang, 2019) and highlight how forest certifications can be a useful tool to improve corporate image and to demonstrate and promote good forest management practices to external stakeholders. As for the other mechanisms, however, there are some differences between countries. In the case of Italy, in fact, the mechanism that takes, in order of importance, is represented by legal with a score of 3.35. Specifically, within this category, the item "To ensure compliance with forest policy objectives", shows the highest average value of 3.60. Although this result differs from those reported by the majority of the

empirical evidence on this research topic, where more often than not, this mechanism is little analyzed however, some authors (Paluš *et al.*, 2021) nevertheless attribute a relevant score to this mechanism especially in the case of SFM certification. In fact, this result can be explained by the fact that most of the realities under study are represented by public properties that, also in view of the new national (TUFF) or European (EUTR) forestry regulations, aim at the respect and application of sustainable forest management practices at the basis of these regulations. This is also confirmed by the new National Forestry Strategy, which plans to encourage the increase of certified areas by 30% by 2025 (Romano, 2021). In the case of Germany, however, the second most important mechanism is the moral mechanism. In fact, the item "For an interest towards environmental protection" has a mean value of 3.49. This result is in line with that of other authors (Zubizarreta *et al.*, 2021) and is of particular interest, especially in the case of SFM certification. In fact, as various authors point out, forest certification has several positive effects, especially for the conservation of biodiversity (Carlsen *et al.*, 2012; Kalonga *et al.*, 2016). Again, in the German context, the moral mechanism is followed by market aspects with an average value of 2.71. Specifically, the items of greatest importance are "To meet customers' expectations" with an average of 3.37 and "To increase competitiveness in the market" with a score of 3.35. Some studies (i.e., Galati *et al.*, 2017; Misiune, 2018) report similar results (Galati *et al.*, 2017; Misiune, 2018). Less importance in both geographical contexts is found for the learning mechanism, although for both countries the item "For improving of forest management practices" has the highest score, respectively 3.54 in the case of Italy and 3.21 in the case of Germany. This is probably because forest owners/managers in both countries already adopt sustainable forest management practices based on their forestry tradition and experience and independently of certification.

Motivational factors according to the characteristics of certified enterprises

To test the relationship and influence of the adopted certifications on the motivation of forest owners to become certified, the Kruskal Wallis test was applied. In the German case, some differences emerge in relation to the adoption of one of the two certifications (FSC or PEFC) or of dual certification (FSC, PEFC). Only for four items does the test reject the null hypothesis, there is therefore for each item at least one pair that differs significantly on average. By means of pairwise comparisons (post hoc test with Bonferroni correction) such pairs were identified. The items where it is possible to reject the null hypothesis, i.e. the absence of differences in motivation between the groups identified, fall into three specific mechanisms and in particular "To reduce environmental pollution" of the moral mechanism, "To increase internal organizational efficiency" and "To improve product quality" of the learning mechanism, "compliance with forest policy objectives" of the legal mechanism.

Table 1. Motivations for adopting FSC and PEFC SFM certifications in Italy and Germany

Mechanism	Items	Average* It	SD It	Average Germ.	SD Germ.
Signalling	**To improve corporate image**	3.81	1.84	3.68	1.25
	To ensure product traceability	3.86	1.19	3.03	1.38
	To gain recognition for sustainable forest management practices	4.14	1.14	3.96	1.31
	Because certification is a commitment to environmental responsibility	3.94	1.16	3.58	1.40
Moral	**For employee satisfaction**	2.16	1.30	2.28	1.19
	To reduce environmental pollution	3.20	1.42	2.92	1.47
	To increase customers' awareness of environmental issues	3.77	1.31	3.44	1.42
	For an interest in environmental protection	3.92	1.25	3.49	1.44
Market	**To increase the selling price of the product**	3.34	1.37	3.00	1.37
	To increase market competitiveness	3.49	1.35	3.35	1.45
	To increase national market share	3.06	1.37	2.01	1.16
	To increase foreign market share	2.48	1.36	1.92	1.20
	To meet customers' expectations	3.50	1.35	3.37	1.29
	For the diversification of sales channels	3.03	1.42	2.62	1.26
Learning	**To increase internal organisational efficiency (processes and procedures)**	2.71	1.24	2.30	1.26
	Because certification supports learning and facilitates the exchange of experiences	2.94	1.25	2.58	1.26
	For product quality improvement	2.80	1.35	2.40	1.31
	For the improvement of forest management practices	3.54	1.28	3.21	1.39
Legal	**To participate in calls for tenders**	2.84	1.55	2.28	1.33
	To ensure compliance with forest policy objectives	3.60	1.29	3.44	1.42
	To ensure compliance with current environmental legislation	3.58	1.32	2.62	1.37
	To benefit from RDP measures	3.36	1.64	2.31	1.24

* With 5-point Likert scale (1= completely disagree; 5= completely agree)

In the case of the item "To reduce environmental pollution" as can be seen both from the averages shown in Table 2, and from the values of the average ranks respectively, equal to 36.77 for PEFC-certified companies, 39.40 for those with dual certification (FSC, PEFC), and 10.00 for those with FSC, it can be seen that those with FSC certification score lower on average than those with

PEFC and dual certification. This is also confirmed by the post hoc test with the Bonferroni correction (Table 3). These results show that German forest owners and managers are more driven by moral mechanisms to adopt PEFC certification or dual certification, compared to FSC certification. Other differences emerge for the item "To increase internal organizational efficiency (processes and procedures)". For this statement, there is a statistically significant difference between the PEFC and FSC, PEFC categories.

Table 2. Analysis of differences in motivation for Germany according to the certification with the K. Wallis test

Germany	*Items*	FSC	PEFC	FSC/ PEFC	Sig K. Wallis
Moral	**To reduce environmental pollution**	1.00	2.98	3.15	0.026
Legal	**To ensure compliance with forest policy objectives**	2.25	3.30	4.00	0.030
Learning	**To increase internal organisational efficiency (processes and procedures)**	1.75	2.11	2.85	0.027
	For product quality improvement	1.25	2.26	2.95	0.021

Table 3. Post-hoc testing for the Kruskal-Wallis test according to certification type

Sample	Test statistic	Std. Error	Std. Test Statistic	Sig	Adj. Sig.
To reduce environmental pollution					
FSC-PEFC	-26.766	10.500	-2.549	.011	**.032**
FSC-FSC, PEFC	-29.400	11.042	-2.663	.008	**.023**
PEFC-FSC, PEFC	2.634	5.382	.489	.625	1.000
To increase internal organisational efficiency (processes and procedures)					
FSC-PEFC	-5.992	10.283	-.583	.560	1.000
FSC-FSC, PEFC	-19.200	10.814	-1.775	.076	.227
PEFC-FSC, PEFC	13.208	5.271	2.506	.012	**.037**
For product quality improvement					
FSC-PEFC	-15.348	10.364	-1.481	.139	.416
FSC-FSC, PEFC	-26.500	10.899	-2.431	.015	**.045**
PEFC-FSC, PEFC	11.152	5.312	2.099	.036	.107
To ensure compliance with forest policy objectives					
FSC-PEFC	-14.088	10.451	-1.348	.178	.533
FSC-FSC, PEFC	-25.025	10.991	-2.277	.023	.068
PEFC-FSC, PEFC	10.937	5.357	2.042	.041	.124

In particular, German forest owners and managers with dual certification are more driven by legal mechanisms than those with PEFC certification alone. In the case of the item "For product quality improvement", as is evident from the average ranks of 44.88 for the FSC, PEFC, 33.72 for PEFC and 18.38 for FSC, respectively, significant differences between the FSC category and the others can be seen. In other words, as confirmed by Bonferroni's correction, the motivation "product quality improvement" is not mentioned among the main reasons for adopting FSC certification.

For Italian respondents, on the other hand, the Kruskal-Wallis test accepts the null hypothesis for all items. The test for the presence of statistically significant differences in the motivational factors was also assessed for the variable "legal form" of enterprises. Two categories were identified: "individual enterprise" and "other form" and this in order to allow a better comparison between the two countries under study. Specifically, the Mann Whitney test was applied since two categories were involved. As shown in Table 4, this test in the German case allowed the rejection of the null hypothesis for the following items: "to reduce environmental pollution"; "to increase competitiveness in the market"; "to increase internal organizational efficiency (processes and procedures)"; "because certification supports learning and facilitates the exchange of experience"; "for product quality improvement"; "for the improvement of forest management practices"; "to ensure compliance with current environmental legislation"; "to benefit from RDP measures". In other words, there are significant differences on average for these items between individual enterprises and other legal forms. These differences are positive for both variables, for almost all items, i.e., as shown by the test statistic, the category "other form" almost always scores higher, only in the case of the item "increase competitiveness in the market" the category "individual enterprise" appears to have a higher motivation. This could mean that the individual enterprise is more oriented towards market mechanisms. A similar situation is found for Italy. In fact, the Mann Whitney test made it possible to reject the hypothesis of equality of the averages for the single item "to increase foreign market share", thus as also confirmed by the value of the test statistic, individual enterprises have a higher average score than "other form" (Table 4).

The analysis was also conducted with reference to the variable "type of ownership" (public or private). For the German respondents the Mann Whitney test confirmed the null hypothesis of equality, on average, between the type of ownership for all items examined. In the Italian case, however, the U-test made it possible to reject the null hypothesis for the items: "for employee satisfaction"; "because certification supports learning and facilitates the exchange of experiences"; "to ensure compliance of forest policy objectives". With respect to these items, public properties differ significantly, on average, from private ones. In particular, public properties have on average higher scores (respectively 2.56, 3.32 and 4.00) than private ones (1.88, 2.67 and 3.33), underlining that mechanisms such as moral, learning and legal are more representative for this category. Only in the Italian case was the U-test applied, in order to check for differences in motivation with regard to the type of forest species (poplar or other species). This test allowed us to reject the hypothesis of equality, on average, only for the statements "for the diversification of sales channels" and "to benefit from RDP measures". In fact, it emerges that the category "poplar" has a higher score (respectively 3.67 and 4.33) than "other forest species"(2.86 and 3.09).

Table 4. Analysis of differences in motivation for Germany and Italy according to legal form

Germany	Items	Individual enterprise	Other form	Sig. U	Test statistic
Moral	**To reduce environmental pollution**	2.13	3.13	0.020	2.322
Legal	**For compliance with environmental regulations**	1.87	2.82	0.017	2.390
	To benefit from RDP measures	1.80	2.45	0.022	2.282
Market	**To increase market competitiveness**	4.00	3.18	0.045	-2.009
Learning	**To increase internal organisational efficiency (processes and procedures)**	1.53	2.50	0.006	2.746
	Because certification supports learning and facilitates the exchange of experiences	1.93	2.75	0.025	2.237
	For product quality improvement	1.53	2.63	0.004	2.908
	For the improvement of forest management practices	2.20	3.48	0.002	3.043
Italy					
Market	**To increase foreign market share**	2.95	2.31	0.026	-2.220

In practice, it can be deduced that the poplar growers are more interested in the possibility of enjoying the benefits of the RDP and diversification of the sales channels.

Finally, the Kruskal Wallis test was applied to detect any differences in motivations in relation to the size of the wooded total area and the year of certification. In the first case, with reference to the German sample, the null hypothesis of equality on average was accepted for all variables and no significant differences emerged between the categories of the total forest area and motivations. With reference to Italy, the Kruskal Wallis test allows the rejection of the null hypothesis for the item "To have recognition in SFM practices"; For this purpose, pairwise comparisons were made, when looking at the actual p-value, three pairs are significantly different, on average, these pairs are those from: "101 to 300 ha" vs "over 1000 ha", "101 to 300 ha" vs "101 to 1000 ha" and "up to 100 ha" vs "over 1000 ha". In any case, the correction of Bonferroni does not confirm differences between the pairs. Regarding the differences in the motivational drivers in relation to the year of certification for the FSC standard (up to 2004, 2005 to 2012, from 2013 onwards), it can be seen from Table 5 that for Germany the Kruskal Wallis test rejects the null hypothesis only for the statement "to meet customers' expectations". As can be seen from the pairwise comparison, from the average ranks of 7.88 for the category "up to 2004", 19.93 for the category "2005 to 2012" and 13.17 for "2013 onwards" respectively, the category "up to 2004" differs significantly from the category "2005 to 2012". It can therefore be said that the adoption of certification has intensified over time in order to meet customer expectations. Also, for Italy, the Kruskal Wallis test

allows to reject the null hypothesis only for the item "To meet customer expectations" (Table 5). In contrast to the German case, the category "2005 to 2012" differs significantly from the others, and in particular from the category "2013 onwards" and thus shows that "Meeting the customer expectations" was a stronger motivation for those who certified in that period (2005 to 2012).

Table 5. Analysis of differences in motivation for Germany and Italy based on year of FSC certification.

	Items	Until 2004	From 2005 to 2012	From 2013 onwards	Sig K. Wallis
Market	**To meet customers' expectations (Germany)**	2.75	3.86	3.44	0.025
Market	**To meet customers' expectations (Italy)**	2.50	4.50	3.27	0.008

With regard to the year of certification for the PEFC standard, the application of the Kruskal Wallis test allows the null hypothesis to be rejected only in the case of the German sample, for the items "Because certification represents a commitment to environmental responsibility" and "For product quality improvement".

Applying the pairwise comparison shows that the pair that differs significantly is the one "from 2013 onwards - up to 2004", in particular the first one has an average rank of 26.97, the second one of 40.20. It can therefore be deduced that German owners/managers who obtained certification before 2004 compared to those who certified after 2013, considered the certification as a tool to manifest their commitment to the environment. Regarding the item "For product quality improvement" the application of the pairwise comparison shows, also in relation to the ranks average, that the pairwise comparison which presents a significant difference on average is made up of the category "from 2005 onwards" with an average rank of 28.45 and "from 2005 to 2012" with a rank of 44.59. It can therefore be stated that those who certified "from 2005 to 2012" considered as their main motivation the possibility of improving their product in terms of quality through PEFC certification, compared to those who certified recently.

CONCLUSIONS

The aim of this study was to analyze the motivations driving Italian and German forest owners and managers towards the adoption of SFM certification. The results of the work showed that the main drivers for both countries are the reporting mechanism, in particular certification is seen as a tool to demonstrate externally the implementation of SFM practices. In addition, other mechanisms that guide the intentions of forest owners and managers include the legal mechanism, in particular in the Italian case, especially for publicly owned forest areas, more driven by the interest of complying with forestry regulations and the moral mechanism, in the case of Germany. The latter result stems from the fact

that German owners show more interest in certification as an instrument for the protection of the environment, and more specifically for the conservation and protection of biodiversity. The learning mechanism, on the other hand, received less importance for both countries probably because the sustainable forestry management is now an established practice for the companies surveyed. Evaluating the motivations also on the basis of certain characteristics of the companies certified companies, it emerged that in the German case the characteristic "legal form" and specifically individual enterprises, are more motivated to certify themselves by the possibility of increasing competitiveness on the market. In the Italian case, on the other hand, some items pertaining to the moral, learning and legal mechanisms are more relevant for public properties. Finally, in the case of Italy, it emerged that poplar growers are more interested in adopting certification, compared to owners of areas characterized by other forest types, because of the possibility of benefiting from RDP measures. These results could have interesting implications for policy makers in designing policy protocols, message strategies and incentive mechanisms for encouraging more forest owners to adopt forest management certifications. In addition, these findings can provide baseline information for improving certification programs to satisfy owners 'expectations to attract more owners' participation. The main limitation of the research is the number of respondents, a total of 154 (71 for Germany and 83 for Italy), which, particularly in the case of Germany, is an unrepresentative number, considering the large number of certified companies. However, it should also be pointed out that the study is based on companies, and not individuals.

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