



## Forest certification in Spain: Analysis of certification drivers

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### ABSTRACT

Despite being the European Union country with the second largest wooded area and the fourth in terms of forest occupation with respect to its territory, only 9.47% of the forest area in Spain is certified by one of the two most important forest certification systems (PEFC and FSC). The literature review has shown that forest certification drivers may be divided into five main mechanisms. The first three are external: Market, Signalling and Legal mechanisms, and the last two internal: Moral and Learning mechanisms. 124 completed questionnaires out of 1194 certified companies in Spain were received to carry out a descriptive and a cluster analysis of the main motivations that encourage the adoption and certification of the PEFC standard and how these motivations vary depending on the characteristics of the companies. Findings reveal that the most valued motivations by this order are related to attracting customer attention, the improvement of companies' corporate image, the sensitivity to environmental problems and the increase of the competitiveness of the company. Some of the motivations are significantly influenced by the characteristics of the companies, but only the export level has a significant influence (negative) on all the characteristics of the moral mechanism. The implications of the findings can help to identify and characterize the different clusters that exist among certified companies in the Spanish forestry sector. This information can be useful for managers and policy makers to better understand the specific reasons for each conglomerate of companies when opting for certification.

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## 1. Introduction

Forest certification can be defined as “a method by which an independent, third party performs a valuation to determine whether forest management satisfies pre-established ecological, economic, and social standards and verifies it through a written document” (Paluš, H. and Kaputa, 2009; Paluš, Hubert et al., 2019). This form of environmental certifications are supposed to assure consumers that the forest products they intend to buy come from properly managed forests and, at the same time, drives forest management systems to be more environmentally and socially responsible (Lewis and Davis, 2015). These certifications assist forest managers on how to manage forests responsibly, through the provision of standards and guidance documents (Ponte et al., 2011) and are aligned within the phenomenon of ecolabels, which are symbols or stamps that are designed to assist consumers in identifying environmentally superior products and services, increasing

their confidence in making environmentally friendly purchases (Darnall et al., 2018).

The most important forest certification schemes worldwide are FSC and PEFC. FSC scheme was the one that emerged first, specifically in 1993. It emerged mainly because national governments were unable to address critical environmental issues in forestry (Castka and Corbett, 2016a; Castka and Corbett, 2016b) and because the frustration that exists among environmental NGOs, certain wood producers and among high-end furniture retailers because of the impossibility of signing a global forestry convention at the 1992 Rio Earth Summit (Bernstein and Cashore, 2004). The appearance of the FSC scheme was followed by a concern from industry and forest owners, who were concerned about the cost of compliance with the different standards FSC prescriptive (Cashore, Benjamin William et al., 2004). As a result, the forest industry evolved a competitor scheme, establishing the umbrella Programme for the Endorsement of Forest Certification (PEFC) in 1999, with the aim of uniting the large number of national forest certification schemes that were created (Gale et al., 2017). The FSC system focuses on adopting common principles globally for the promotion of sustainable forest management. By contrast, the PEFC system, which was established

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in 1998, recognizes individual programmes in different countries and provides a common eco-label (Galati et al., 2017).

There is currently an academic debate that focuses on analysing and comparing the two standards (Karlsson-Vinkhuyzen et al., 2017). Over time, the PEFC system has been criticized for not being so strict in the recognition of civil rights (Feilberg et al., 2012), because it is limited to local legal requirements which may not be sufficiently strong in all countries (Feilberg et al., 2012). Furthermore, several of the current national standards do not cover the ILO conventions, indigenous peoples' rights and/or dispute resolution. Therefore, the strength of this part of the PEFC Forest Management certification system depends on the strength of the local law. A quarter of a century since its founding, FSC standard is also receiving some criticism mostly from frustrated supporters of FSC, who say it hasn't worked out as planned (Conniff, 2018). Furthermore, a number of recent logging industry scandals suggest that the FSC label has sometimes been used to "greenwash" illegal timber trafficking (Conniff, 2018). The author claims that the industry has also been able to gain influence over FSC due to competition from rival forest-certifying organizations, notably the Programme for the Endorsement of Forest Certification (PEFC).

Furthermore, in the field of private certification standards there is a need for acceptance by the different related stakeholders, with the aim of laying the foundation for a high performance (Tröster and Hiete, 2019). This fact is particularly important, as this kind of certification schemes are voluntary and thus need confirmation by external parties and stakeholders. If demands by different stakeholder groups are met by the certification schemes, the acceptance increases which is a highly important precondition for these schemes, which are private and have no binding character such as state regulations (Overdevest, 2010). A high acceptance by stakeholders finally results in benefits for the certification schemes such as higher adoption rates (Tröster and Hiete, 2019).

Anyway and despite all these criticism, the importance of certification as a forest governance mechanism has increased, as well as interest in the potential of forest certification to promote conservation and protect biodiversity around the world. (Galati et al., 2017). However, it might be suggested that there have been several attempts to carefully document the motivations of companies and forest owners to adopt forest certifications (Faggi et al., 2014; Galati et al., 2017; Lewis and Davis, 2015; Nussbaum and Simula, 2004; van der Ven and Cashore, 2018; Vidal et al., 2005). More specifically and in the case of the Spanish forest industry, this analysis has been approached in a limited way (Díaz-Balteiro and Jalón, 2017; Gómez-Zamalloa et al., 2011; Riera et al., 2007). This fact is particularly relevant, because with 27.6 million ha that occupy 54.5% of its territory, Spain is the second European Union (EU) country with the largest wooded area and the fourth in terms of forest occupation with respect to its territory (Eurostat, 2019). In addition, only 9.47% of the forest area in Spain is certified by one of the two most important forest certification systems (Maesano et al., 2018). This data is far from those countries such as Finland, Austria or Germany, with certification levels above 65% of their forest area (Maesano et al., 2018).

In the case of Spain, it is important to mention that due to the phenomenon of *dehesas* (forest area composed mainly of holm oaks and cork oaks, which allows the development of an essentially herbaceous layer (pasture) for the use of livestock) (BOE, 2010) the wooded area is quite lower (18.4 million ha) than the forest area (27.6 million ha). This difference between forest area and wooded area is not so pronounced in northern European countries and in more humid areas (Eurostat, 2019), so it is possible that this factor may affect the fact that in Spain the forest area is less productive than in these countries.

Riera et al. (2007) analysed the efficiency and equity

implications of three types of forest policies, including forest certification, in the case of the Spanish forest industry. Gómez-Zamalloa et al. (2011) conducted an investigation that analysed the impacts of forest certification on the forest industry at the European level, including Spain. Díaz-Balteiro and García de Jalón (2017) implemented a survey in the eucalyptus plantations of northwestern Spain with the aim of analysing if there is a direct relationship between forest certification and sustainability in the eyes of key stakeholders. Alves (2019) studied the perception of experts in Brazil, Spain and Portugal regarding the level of difficulty to implement forest certification. It may be then concluded that the analysis of the motivations of Spanish companies and forest owners to adopt forest certifications has attracted little attention from the scientific community.

In an attempt to shed light on this research gap, a survey-based study of the Spanish forest industry's views on forest certification was conducted. Specifically, PEFC standard has been chosen, because it is the most widespread standard in the Spanish forestry sector (PEFC Spain, 2020). The objective of this study is to analyse the main factors that encourage the adoption of the PEFC standard in the companies in the Spanish forestry sector and to analyse if there are variations in these motivations, depending on the characteristics of the certified companies and the dissemination stage.

The remainder of this paper is divided into 5 sections. Section 2 presents the research context and literature review on the diffusion of forest certifications worldwide and the motivations that drive the implementation of forest certifications. Section 3 presents the methods on which the study was based. The results obtained are analysed in Section 4, to finally present the discussions in section 5 and the conclusions, in section 6.

## 2. Research context and literature review

### 2.1. Forestry sector and certified forest area in Spain

In Spain, hardwoods represent 55% of the wooded area, conifers 37% and mixed ones the remaining 8% (Ministry of Agriculture, Food and the Environment, 2014). According to the National Forest Inventory, just over 80% of forests are made up of two or more species of trees. The most extensive formation is the holm oak with 15.3% of the wooded area, about 2.8 M ha, followed by the *dehesas* (mostly holm oak), with 2.4 M ha, and Aleppo pine with 2 M ha (Ministry of Agriculture, Food and the Environment, 2014).

Coniferous represented, in 2016, 51% of the total harvested volume, while non-coniferous reached 49%. Of the total coniferous cuttings, half corresponded to the *Pinus Pinaster* species, while in the hardwood cuttings, where non-native species predominate, 86% corresponded to *Eucalyptus* spp. The production of roundwood in Spain in recent years has remained close to 18 Mm<sup>3</sup> (Spanish Government, 2017). In 2016, 69% of the total felling ended up in pulpwood, while 29% was used for sawmilling and plywood/veneer industries. Regarding the production of roundwood, firewood and basic products, Spain provides 3.6% of the production of the EU-27 (Spanish Government, 2017).

The percentage of productive forest area dedicated to forestry in Spain is 20.4% (FAO, 2010), being this percentage significantly lower than the world average (30%) and than the European average (52%) (Montero and Serrada, 2013). In this sense, Spain registers a level of use of forest biomass much lower than the potential offered by its forest and although the forest mass grows at an annual rate of 2.19% (European average of 0.51%), it is the eighth country at a European level in wood use (COSE, 2019).

One of the reasons for underusing a part of the forest area is related to the smallholder structure of the property: 67% of the Spanish forest area is privately owned and in many cases they are

owners of small portions who, individually, they have little value and their exploitation is not profitable (COSE, 2019). Another reason may be that only 13% of the Spanish forest area has a management plan (WWF, 2010). Furthermore, private ownership of forests, which represents two-thirds of the Spanish forest area, is the one with the smaller proportion of management plans: only 5% compared to 30% in public areas (WWF, 2010). This fact may hamper a correct management of forest production at the national level. Finally, the stony nature and the complicated orography of part of the territory at the national level also make its forest exploitation and the production of derived products difficult (TEFTOR, 2012).

In relation to forest certification worldwide at present, 11% of the world's forest area (405 million ha) is certified with the two most widespread certification schemes worldwide, PEFC and FSC (U.S. Endowment for Forest and Communities, 2018). The United States accounts for 8% of the world's certified forest, after Canada (40%). Europe covers 37% of the world's certified area (U.S. Endowment for Forest and Communities, 2018), with different percentages according to the country and with an irregular distribution and are characterized by having different forest management practices for different types of forests and property types (Maesano et al., 2018).

Regarding the diffusion of forest certifications, the PEFC system is currently the most implemented in the world. As of December 31, 2019 there was a PEFC certified area of more than 325 million ha worldwide, and there were 22,000 PEFC Chain of Custody certified companies in 70 countries (PEFC Spain, 2020). Of the total forests with forest certification worldwide, 65% are certified according to PEFC. In the specific case of this study and in the case of Spain, the PEFC certification is also the most implemented; covering 88% of the total certified forest area (2.311.218 ha certified with PEFC versus 301,000 ha certified by FSC) (FSC Spain, 2019, PEFC Spain, 2020).

## 2.2. Motivations and factors that drive forest certification

There are several works in the academic literature that have analysed the drivers or motivations that impel the adoption and certification of environmental management systems in different sectors (Bansal and Roth, 2000; González-Benito and González-Benito, 2005; Heras-Saizarbitoria and Boiral, 2013; Martínez-Costa et al., 2008; Prajogo, 2011). However and in the particular case of the forestry industry, the study of the main motivations affecting the adoption of voluntary certifications has been limited (Fiore et al., 2016; Fiore et al., 2020). This section presents the results of the literature review on the motivations that drive the owners and companies of the forestry sector to implement sustainable forest management and chain of custody certifications, which are presented in the summary of Table 1.

The methodology followed for this literature review was the "Standard, non-systematic review" type, which is the traditional and most accessible approach to literature evaluation with the aim of identifying and highlighting current state-of-the-art of a scientific area and explain recent research findings (Aretoulaki et al., 2020). This type of analysis is considered useful to identify topics, theoretical perspectives or common themes within a specific discipline or research methodology or to identify components of a theoretical concept (Ward et al., 2009). A number of databases – Web of Science, Scencedirect, Scopus and Google Scholar – were searched using the following combination of keywords: "forest certification", "motivation", "driver", "pefc" and "fsc". The references of the primary papers were also analysed and some were added to the study sample.

Table 1 summarizes the main empirical studies (i.e. survey based research carried out by scholars) and has collected

information on the country where each study has been conducted, the forest certification/s that has/have been analysed, the sample of companies that have participated, the methodology used in the study and the main motivations identified in each of the works.

Once the main identified motivations have been analysed, it can be concluded that these can be ascribed to 5 motivations groups, which are aligned with the motivational models defined by Faggi et al. (2014), Takahashi (2001), Overdevest and Rickenbach (2006) and Galati et al. (2017). According to these models, companies in the forest sector participate in forest certification due to the economic benefits achievable in the markets, due to the possibility of improving production efficiency, to the expected social returns and also due to the sense of morality or ethics in business decisions (Galati et al., 2017).

### 2.2.1. External motivations

2.2.1.1. *Market motivation.* The market mechanism has been one of the main mechanisms or motivations identified in the literature review when adopting forest certification (Attah et al., 2011; Auld et al., 2008; Carlsen et al., 2012; Faggi et al., 2014), mainly because the certification is considered an indispensable tool for the expansion of the company to other markets, and can become a competitive advantage. From this perspective and according to Overdevest and Rickenbach (2006), which conducted an empirical study of FSC certificate holders in the United States, forest owners join certification schemes to gain price premiums or other market benefits.

Ulybina and Fennell (2013a) conducted an investigation in Russia that analysed the implementation of voluntary forest certification, through more than one hundred interviews with the different actors in the Russian forest industry. According to this study, many foreign markets require forest certification for imported wood products, this requirement being one of the main drivers of forest certification. Chen et al. (2011), who made a research project, based on interviews with Chinese manufacturers of forest products, identified the access to particular markets and the increase in sales and/or prices as the main motivations for certification adoption. Ratnasingam et al. (2008) identified the following motivations in the Malaysian timber industry: (1) increase market share, (2) the possibility of obtaining a price premium and (3) greater strategic flexibility. Norris et al. (Norris et al., 2010) synthesized and analysed the state of knowledge on the value of human-modified habitats for forest biodiversity in the West African rainforests, concluding that forest certification benefits land owners/managers through premium price payments or access to environmental sensitive markets, which demand a relatively low environmental impact products.

Hoang, H. T. N. et al. (2015) analysed the benefits and challenges of forest certification from the perspective of small household groups in Quang Tri Province, Central Vietnam. The authors identified the increased selling price and extended trade networks as potential benefits, but they also identified several barriers, such as high initial and annual audit costs and difficult paperwork, as well as complicated sales procedures for certified timber. Maraseni et al. (2017) conducted a similar study in the same province of Vietnam, also including a furniture processing business in the study. They concluded that even though net returns are higher from certified timber production than non-certified timber production, for the economic profitability of the certification to be achieved, it is necessary to certify a plantation with a minimum area of 3000 ha. On the other hand, in the case of the sawmill, the fact of producing its products with certified wood gives it a significantly higher profitability. More recently, Hoang, H. T. N. et al. (2019) analysed the costs associated with forest certification for a group of small-holders, also in Quang Tri province in Vietnam. The results of the

**Table 1**  
Summary of the review of the literature on motivations that drive forest certification.

Year	Reference	Country	Analysed Certification	N	Type of study - Methodology	Market	Signalling	Legal	Moral	Learning
2001	Takahashi (2001)	Japan and Canada	ISO 14001, FSC, CSA	193 firms	Survey to firms + Probit regression	X	X		X	X
2003	Hartsfield and Ostermeier (2003)	Mexico, CA and USA	FSC	69 survey responses	Survey to firms + Content analysis	X	X			X
2004	Nussbaum and Simula (2004)	Worldwide	FSC, SFI, PEFC	General, n/a.	Literature review + case studies				X	X
2005	Cashore, Benjamin et al. (2005)	Canada, USA, Germany	ISO 14001, FSC	143 Canadian, 283 US and 134 German firms	Survey to firms + Regression analysis	X			X	
2005	Overdevest (2005)	USA	FSC, SFI, PEFC	40 interviews	Interviews with land owners, third-party certifiers, end-of-chain retailers and NGOs		X			X
2005	Vidal et al. (2005)	North America	FSC, CSA, SFI, PEFC	158 firms	Survey to firms + cluster analysis + determinant function analysis	X	X			X
2006	Overdevest and Rickenbach (2006)	USA	FSC	67 survey responses	Survey to firms + exploratory factor anal. + IPA anal. + cumulative logit model regression	X	X			X
2006	Owari et al. (2006a)	Finland	FSC	50 firms	Personal interviews	X	X			
2007	Riera et al. (2007)	Spain	PEFC, FSC	n/a	Efficiency analysis + distributional equity analysis	X				
2008	Auld et al. (2008)	Worldwide	SFI, FSC, PEFC, CSA	n/a	Literature review	X		X	X	
2008	Leahy et al. (2008)	Minnesota (USA)	FSC, SFI	37 forest landowners	Data generated through three focus groups	X				X
2008	Ratnasingam et al. (2008)	Malaysia	MTCC	215 firms	Survey to firms + Statistical analysis with SPSS	X				X
2008	Tikina et al. (2008)	OR and WA (USA)	ATFS, SFI, FSC	353 survey responses	Survey to forest managing entities + standard logistic regression analysis	X				
2009	Araujo et al. (2009)	Brazil	Cerflor, FSC	48 survey responses	Survey + exploratory factor an.+ IPA an.		X			X
2009	Cubbage et al. (2009)	Argentina, Brazil, Chile, USA and Canada	SFI, FSC, CSA, CERFLOR, CERTFOR	81 firms in the USA and Canada, 48 in Brazil, 7 in Argentina, 3 in Chile	Mixed methods of personal interviews and email surveys + calculation of simple summary statistics	X	X		X	
2009	Ebeling and Yasué (2009)	Ecuador and Bolivia	FSC	78 semi-structured interviews	Interviews with government, timber ind., NGOs, forest communities and landholders	X	X	X		
2009	Paluš, H. and Kaputa (2009)	Slovakia	PEFC, FSC	33 forest owners+ 20 wood processors	Survey + frequency analysis	X	X			X
2010	Bouslah et al. (2010)	Canada and USA	FSC, SFI, CSA, ISO14001	160 third-party certification events	Event-study methodology				X	
2010	Cubbage et al. (2010)	Argentina, Chile	FSC, CERTFOR	10 firms in Argentina and Chile	Managers' opinions + secondary data from audit reports	X				X
2010	Marx and Cuypers (2010)	221 countries	FSC	Data from FAO, UNDP index, FSC and WB	Data analysis	X	X			
2010	Schepers (2010)	Worldwide	FSC	n/a	Literature review	X			X	
2011	Chen et al. (2011)	China	PEFC, FSC	20 Chinese wood products companies	Interviews + data analysis (manual techniques + qualitative data analysis)	X	X		X	
2011	Gómez-Zamalloa et al. (2011)	EU countries	PEFC, FSC	32 survey responses	Delphi method + contingent valuation method (CVM)	X				X
<b>Year</b>	<b>Reference</b>	<b>Country</b>	<b>Analysed Certification</b>	<b>N</b>	<b>Type of study - Methodology</b>	<b>Market</b>	<b>Signalling</b>	<b>Legal</b>	<b>Moral</b>	<b>Learning</b>
2011	Suryani et al. (2011)	Malaysia	MTCC	23 firms	Mixed-mode technique of personal and telephone interviews	X	X			X
2012	Carlsen et al. (2012)	Ghana	FSC	35 firms	Semi-structured interviews	X		X	X	
2012	Espinoza et al. (2012)	USA	SFI, FSC, ATFS, PEFC	137 U.S. hardwood lumber producers	Survey of U.S. hardwood lumber manufacturers + statistical analysis	X	X			
2013	Ulybina and Fennell (2013b)	Russia	FSC, PEFC	107 interviews	Qualitative methods: interviews, and participatory observation	X	X	X		X
2014	Faggi et al. (2014)	Argentina	FSC	12 open-ended qualitative interviews	Interviews + comparison of data (Wilcoxon Matched-Pairs Signed-Ranks Test)	X	X	X	X	X
2015	Lewis and Davis (2015)	Malaysia	MTCS	8 timber-producing FMUs	Combination of archival research with data collected during a fieldwork in Malaysia	X	X			X
2015	Narasimhan et al. (2015)	USA	FSC, ISO 14001	59 firms	Statistical analysis of FSC Certificate + Compustat data + Event Study Method		X			X



Table 1 (continued)

Year	Reference	Country	Analysed Certification	N	Type of study - Methodology	Market	Signalling	Legal	Moral	Learning
2016	Tuppura et al. (2016)	Worldwide	FSC, PEFC, ISO 14001	60 leading forestry companies	Quantitative survey data + Kruskal–Wallis test	X	X	X	X	X
2017	Bowler et al. (2017)	New Zealand	FSC	8 case studies + 13 interviews to experts	Comparative case study approach + data triangulation from multiple sources	X				X
2017	Galati et al. (2017)	Italy	FSC	86 survey responses	Survey to FSC certified companies managers + descriptive statistics analysis	X	X	X	X	X
2017	Paluš, Hubert et al. (2017)	Czech and Slovak Republics	PEFC, FSC	131 survey responses	Survey to CoC certified firms + The Mann–Whitney <i>U</i> test + ANOVA Test	X	X	X	X	
2017	Karlsson-Vinkhuyzen et al. (2017)	Bolivia and Chile	PEFC, FSC	n/a	Literature review	X	X			
2017	Paletto et al. (2017)	Calabria (Italy)	PEFC, FSC	40 enterprises of forest-wood chain	Survey to firms + descriptive statistical analysis + Tobit regression analysis	X	X			
2018	Maesano et al. (2018)	43 EU- states	PEFC, FSC	499 FSC and 284 PEFC reports	Quantitative	X	X			
2018	Paluš, Hubert, Parobek, Vlosky et al. (2018)	Eastern Europe	PEFC, FSC	744 survey responses	Survey to firms + multivariate analysis of variance	X	X			
2018	Paluš, Hubert, Parobek, Šulek et al. (2018)	Slovakia	PEFC, FSC	273 survey responses	Survey to land owners + Mann–Whitney <i>U</i> test + chi-square test	X	X		X	X
2018	Sugiura and Oki (2018)	Japan	FSC, SGEC	63 survey responses	Descriptive and comparative analysis, with two-sided Fisher's exact test	X	X			X
2018	Tian et al. (2018)	China	PEFC, FSC, CFCC	507 survey responses from landowners	A landowners survey-based study + Econometric modelling	X				X
2018	van der Ven and Cashore (2018)	Worldwide	FSC, SFI, PEFC	n/a	Literature review	X	X			
2019	Halalisan et al. (2019)	Romania	FSC	116 survey responses	Survey to firms + non-parametric Kruskal Wallis ANOVA test and Mann–Whitney <i>U</i> test	X	X			

study concluded that although the total estimated cost is quite high, forest certification produces higher income for forest owners and therefore allows them to cover the associated cost. In any case, it is important to mention that this group of forest owners received financial support from external sources such as NGO, FSC funds and governmental programs, to cover this cost. This study (Hoang, H. T. N. et al., 2019) also revealed that high economic performance is a very important driver associated with forest certification, also due to the fact that the number of companies that buy certified wood locally and nationally is increasing considerably. Accordingly and due to the growing awareness of sustainable forest management and forest certification at the international level, customers of Vietnam furniture producers have become more sensitive to certification issues (Hoang, N. et al., 2015) and have started paying particular attention to legal issues related to forest management, including licenses and certified wood products.

In the case of Lao PDR's private smallholder plantations, legality becomes a principle for access to some markets (Flanagan and Laity, 2015), for example, timber or logs entering Vietnam from Lao PDR are required to meet the Vietnam-EU 'proof of legality' requirements. This requirement is emerging as the primary requirement to this country's producers, to access markets where such laws apply. In different studies (Flanagan and Laity, 2015, Hoang, H. T. N. et al., 2015, Hoang, N. et al., 2015) is highlighted the need to simplify the complex administrative procedures and to reduce the costs of certification, in order to attract enough smallholders and required forest area for certification.

Several authors have confirmed that this economic aspect is an important reason when deciding to opt for forest certification (Chen et al., 2011; Chen and Innes, 2013; Leahy et al., 2008; Zhao et al., 2011). In this sense, the belief that consumers will be willing to pay a price premium for environmentally certified

products is therefore a key factor (Espinoza et al., 2012; Ratnasingam et al., 2008; Tian et al., 2018; Tuppura et al., 2016). Kilgore (2007), who analysed the perspectives of Minnesota family forest owners on forest certification, pointed in this direction, stating that if price premiums were paid for certified wood, this would increase the diffusion of forest certification.

**2.2.1.2. Signalling motivation.** Another important mechanism that has been identified as a driver of forest certification by different authors is the signalling mechanism (Chen et al., 2011; Faggi et al., 2014; Hartsfield and Ostermeier, 2003; Marx and Cuyper, 2010), which relates to the objective of gain trust and legitimacy from direct external customers and from environmental advocates that monitor sustainable forestry. According to Espinoza et al. (2012), who realised a survey of U.S. hardwood lumber manufacturers, analysing the industry's awareness and perceptions about forest certification, the companies participating in forest certification recognized their interest in being perceived as an environmentally and socially responsible company by customers. In this sense, certification provides an organizational cue to external parties such as buyers, environmental groups, or states that indicate how a firm will meet high ecological standards (Overdevest and Rickenbach, 2006). Halalisan et al. (2019), which analysed the adoption of FSC Chain of Custody certification in the Romanian forest industry, pointed in that direction, concluding that one of the main motivations of the adoption of forest certification is to improve the reputation of the companies. Chen et al. (2011), in their interviews-based study of Chinese manufacturers of forest products, identified the improvement of corporate reputation and social responsibility, and better recognition from the client, as key motivations.

Dare et al. (2011a) examined the influence of forest certification on community engagement practices within Australian plantation

management, concluding that this influence is limited by regulatory, corporate and social constraints preventing it from having greater impact on these practices. The authors stated that forest certification is positively affecting engagement processes conducted within operational plantation management, but certification has a longer term, cumulative impact on engagement, with one important outcome being capacity building amongst plantation managers themselves, resulting in improved social awareness, and ongoing critical reflection and discussion between plantation managers. Gordon et al. (2012) analysed the relation between corporate social responsibility (CSR) and forest management through in-depth interviews with key stakeholders across three plantation management regions in Australia. The study concluded that although there was wide support for these CSR initiatives by key stakeholders, some of them were not satisfied that forest companies were actively implementing them, this fact having implications for forest companies including negative impacts on their reputation and loss of business opportunities.

**2.2.1.3. Legal motivation.** Some studies have emphasized the role of regulation as drivers of forest certification (Auld et al., 2008; Cashore, Benjamin et al., 2006; Doonan et al., 2005; Ebeling and Yasué, 2009; Galati et al., 2017); which concerns legal compliance with mandatory regulation.

In this sense, countries have been passing laws helping to combat illegal logging by imposing stricter trade and labelling regulations and excluding illegally sourced timber and wood products from their markets, e.g. Japan's Green Purchasing Policy, 2007 and European law (EU Regulation N° 995/2010) banning the import of products containing illegally procured timber (Ulybina and Fennell, 2013b). This means that timber exporters are required to demonstrate the legality of their products, through an existing forest certification scheme. Forest certification meets fundamental timber legality requirements, providing meaningful indication of legality, for example in relation to the EU Timber Regulation (EUTR) (NEPCON, 2019). The right policy signals can lead firms to seek out green markets. Therefore, forest certification is an example of how private environmental rule-making play an important role in global environmental governance.

Technological innovations are improving the potential of these certification systems to trace the product along complex global supply chains (Auld et al., 2010; Castka, Searcy and Fischer, 2020; Castka, Searcy and Mohr, 2020). In this sense, if the products are tracked along the supply chain and consequently producers require such tracking on the products purchased, this fact may drive the diffusion of those standards, because, instead of punishing, participants are rewarded. And it's at this point that technology can help, providing the means and reducing the cost of tracking, with guarantees. The adoption of technologies for remote auditing and technology-enhanced auditing (TEA) also enhance the importance of legal motivation when companies take the step towards certification. According to the authors, under the right conditions, increased adoption of TEA will ensure more efficient and effective processes of certification services (Castka, Searcy and Fischer, 2020). Technological innovations can play an important role when certifying the veracity and timeliness of the audit process and the application of technologies (Castka, Searcy and Mohr, 2020).

## 2.2.2. Internal motivations

**2.2.2.1. Moral motivation.** The moral mechanism is a personal driver, which represents the choice of decision makers according to their individual ethical values (Galati et al., 2017; Van De Ven and Graaf, 2006). Williams et al. (2013) developed a qualitative study into the pro-environmental engagement of small businesses with respect to climate change in the east of England, and identified the

managers' values and engagement as two of the most mentioned motivations. Carlsen et al. (2012), who assessed the factors affecting decisions on forest certification uptake among Ghanaian timber firms, pointed in this direction, stating that personal norms, attitudes and practises of company leaders are important, especially for company-level decisions related to environmental or social responsibility. Also in Africa and in one of the first studies carried out on the impacts of forest certification in the tropical zone, Kalonga et al. (2016) concluded that forest certification is directly related to conservation and environmental performance, concluding in their study that biodiversity indicators (species richness, density and diversity) are higher in certified forests than non-certified forests.

Takahashi (2001) identified the moral mechanism as one of the 4 main drivers of forest certification in Japan and Canada. Faggi et al. (2014) analysed the factors inspiring forest managers from large landholding companies in the Northeast of Argentina to implement voluntary actions and the perceptions of these motivations outside the companies. In their study also found that during the decision process to adopt a forest certification, the personal value of decision makers is a more important mechanism than the economic mechanism. Nevertheless, there are also authors (Poulsen and Clark, 2010) who affirm that although the greatest challenge for certification is defining standards for wildlife management and biodiversity conservation; these remain at an early stage of development.

**2.2.2.2. Learning motivation.** The learning mechanism express the will of companies to transfer knowledge and skills through the adoption of certifications (Overdevest and Rickenbach, 2006). Araujo et al. (2009) studied forest certification adoption by Brazilian companies, focusing on familiarity with certification systems, external influences on pursuing forest certification, and companies' intention to recertify their forests. They concluded that forest certification can be seen as a learning and technology transfer mechanism because attempts to fill the gap through the integration of scientific experts (e.g., biologists, forest engineers, economists, and sociologists) and forest managers in a way to achieve high standards in production, maintenance and monitoring of forest values.

According to Overdevest and Rickenbach (2006), which conducted an empirical study of FSC certificate holders in the United States, certification is a technology transfer model in which ecologically-based knowledge, skills, and practices, i.e. "new forestry", is transferred from ecologists to practicing foresters. Forest planning requirements make certain that firms set explicit goals in accordance to external standards during formal planning. Certificate holders are therefore required to pursue these goals. Independent auditors monitor implementation and require firms to adopt changes based on the outcomes of these processes in order to maintain their certified status. The resulting feedback about environmental impacts of production presumably creates enabling conditions under which learning could occur.

Taking into account the literature review, the first objective of this article is to analyse the motivations that lead Spanish forest industry companies to adopt and certify the PEFC standard. More specifically, we will analyse the relevance of external motivations (market, signalling and legal) and internal motivations (moral and learning). The second is to analyse how these motivations vary according to the characteristics of the firms, namely, the size, the activity sector, the age of the certification, the export level and the FSC certification. Finally, the third is to find out how the motivations vary between the different clusters of certified companies classified according to their characteristics. These targets lead us to announce the following research questions (RQs):

RQ1: How do external and internal motivations influence the

adoption and certification of the PEFC standard?

RQ2: How do external and internal motivations vary in the adoption and certification of the PEFC standard depending on the characteristics of the companies?

RQ3: How do the external and internal motivations vary between the different clusters of certified companies formed in accordance with their characteristics?

### 3. Methods

#### 3.1. Survey design

The questionnaire was structured in two sections. In the first section the questions were aimed at obtaining general information about the company (number of workers, subsector in which it develops its activity, export level, year of certification, information about the manager and whether they are also certified according to the FSC standard). In the second section, it focuses specifically on the drivers to adopt and certificate forest management standards. With this objective, this part consists of 16 items, grouped into 5 dimensions (market, signalling, legal, moral and learning). The five main dimensions have been defined based on the conclusions of the literature review, and are aligned with the motivational models of Faggi et al. (2014) and Galati et al. (2017). The selected items for each dimension are described in Table 2 and were valued using a 5 point Likert scale type.

#### 3.2. Data collection procedure

For the development of the quantitative study, the survey was uploaded onto the Google Drive platform, guaranteeing respondent anonymity and ethical commitment. PEFC Spain provided us a database with information of the 1194 certified companies certified in September 2019. This database included contact information, activity information and information on the scope of the certification. An email was sent to each company, in which the link of the survey was included, explaining the objectives of the project and inviting them to participate in the study. The 1194 companies were

contacted via email and 124 completed questionnaires were received between October and December 2019, which represents a return rate of 10.3% of the population and the error was 8.33% for a 95% confidence level.

Furthermore, in order to avoid distortions caused by the existence of different types of characteristics in the sample and the population, two tests of difference in proportions were developed. Specifically, the chi-square bilateral independence test was carried out by transforming the binomial function of the proportions and number of enterprises in the sample and comparing with the expected range of enterprises in each sector and size group. Data from PEFC Spain and SABI databases were also cross-checked. This crossing allowed us to disregard possible distortions caused by differences between the proportion of each activity and size group in the sample and the population.

In addition, in order to test for internal consistency of the motivations, a reliability test was performed using the Cronbach's  $\alpha$  test (Robinson et al., 1991). In the present study, the construct of external sources of motivation had an indicator value of 0.828, while in the case of internal sources the value was 0.873, meaning that the questionnaire has suitable internal consistency.

The common method bias was analysed, given that the motivations were grouped together in the same measuring instrument. Such possible distortion was tested using Harman's post-hoc single factor test. This showed that the factor with the greatest weight accounted for 40.88% of total variance is lower than the 50% recommended value referred to in the literature (Podsakoff and Organ, 1986).

#### 3.3. Statistical analysis

The statistical analysis was performed using the SPSS software, version 26. In a first phase, the descriptive study was carried out with the objective of analysing the motivations that lead companies to adopt and certify the PEFC standard. More specifically, the analysis was focused on the relevance of external motivations (market, signalling and legal) and internal motivations (moral and learning).

**Table 2**  
Classification of research items.

DIMENSION 1: MARKET	
Full item	Abbreviated item
Increase the competitiveness of the company in the market	Company competit.
Increasing foreign markets participation share	Export
Increasing national market share	Market share
Differentiate the product from the competition	Differentiation
Diversify sales channels	Diversify sales
Increase the selling price of products	Increase price
DIMENSION 2: SIGNALLING	
Full item	Abbreviated item
Attracting customers attention	Customer
Improve the company's corporate image	Image
Certify the traceability of the product	Certify wood origin
DIMENSION 3: LEGAL	
Full item	Abbreviated item
To be able to participate in a competition or public tender	Participate in tenders
Ensure compliance with current legislation	Law compliance
DIMENSION 4: MORAL	
Full item	Abbreviated item
Be more sensitive to environmental issues	Environ. sensitivity
Internal commitment to reduce environmental impact	Red. Environ. impact
Improving environmental engagement in stakeholder relations.	Interest groups
DIMENSION 5: LEARNING	
Full item	Abbreviated item
Improve product quality	Imp. product quality
Improve the efficiency of processes and internal procedure	Imp. process efficiency

In the second phase, the objective was to analyse if there were significant differences between the motivations identified by the companies, depending on the following variables: company size, activity sector, years of certification, export level and whether they had FSC certification. This approach has been previously used by various authors who have investigated similar issues (Faggi et al., 2014; Galati et al., 2017; Paluš, H. and Kaputa, 2009).

In the third phase, a cluster analysis based on a vector quantification with SPSS 26 was carried out. In a first step, the objective of this phase was to study the association among the characteristics of the certified companies to create clusters, and in the second one, analyse if there were differences between the motivations of each group of companies. This technique has been used in similar studies about environmental management (Gavronski et al., 2013; Heras-Saizarbitoria et al., 2016) and forest certification (Basso et al., 2020).

### 3.4. Characteristics of the sample

Firstly, the characteristics of the companies that had responded to the survey were analysed, as shown in Table 3. A total of 124 have responded, of which more 90 were micro-small enterprises (which corresponds to the demographics of companies in this sector in Spain) (INE - Spanish National Statistics Institute, 2017), 31 carry out their activity in forestry work and 33 in first transformation, 86 has more than 3 years' experience working with the PEFC certificate, 65 export more than the 10% and 62 have certified their system also with FSC.

## 4. Results

### 4.1. Motivations for PEFC certification

An analysis of the main motivations that companies have for certification has been made, see Fig. 1. The two most valued motivations are related to Signalling Mechanisms and are, in this order, "Customers" (4.161) and "Image" (3.895), followed by motivations related to Moral Mechanism, like "Environmental sensibility" (3.862) and "Reduce environmental impact" (3.742) and other related to Market Mechanisms, like "Company competitiveness" (3.814) and "Differentiation" (3.766). Motivations related to Learning Mechanism and Legal Mechanism have obtained lower values.

### 4.2. Motivations for PEFC certification, according to the characteristics of the firms

As it can be seen in Table 4, according to the size, within the motivations related to Market Mechanism, the item "Export" is the only one that has a positive and significant correlation index (0.19), i.e. medium sized companies mainly give greater value to this motivation (3.28), but despite this it is not considered a very relevant motivation within this group of companies.

Among the motivations related to the Signalling Mechanism, the item "Certify wood origin" is considered a more relevant motivation among the smaller enterprises with negative correlation index (-0.29).

Micro-enterprises give significantly higher value to Moral

Mechanism motivations. Specifically, "Environmental sensitivity" (4.05) was the best rated and "Reduce environmental impact" (3.95) the third between micro-enterprises. These motivations among medium and large companies are not as relevant.

Finally, motivations related to the Learning Mechanism do not acquire the same relevance as motivations related to the Moral Mechanism. The negative correlation indexes of the dimension with the items "Improve product quality" (-0.26) and "Improve process efficiency" (-0.25) confirm that the bigger companies provides less relevance to these items.

There are no major differences between the motivations that companies have depending on their activity.

The Forest Work companies give greater importance to the item "Increase price motivations", even though they give it a low value (2.81), and to the "Certify wood origin" item (3.84).

The companies belonging to the First transformation group in general give low values to the motivations. They give the highest value to "Customer" item (4.09) in spite of obtaining an average value below the average given by other groups of activity.

On the other hand, companies belonging to the second transformation group give the lowest value to "Increase price" item (1.77), and to those related to Signalling Mechanism, like "Image" (3.60) and "Certify wood in origin" (3.10). However, among this type of motivations and despite the fact that there is no significance in the differences, the value given by this type of company to "Customer" should be highlighted (4.33).

As seen in Table 5, the motivations do not seem to be much affected by the date of certification. The only factors in which variation are detected "Customer" (Correlation index -0.21) and "Diversify sales" (Correlation index -0.19), so the companies with less experience considered these external motivations more important. Specifically, it seems that companies that have been certified at later dates seem to be more influenced by customers; 4.44 is the rating given by companies certified after 2015 compared to 3.45 which is the rating of companies certified before 2006. This may be because over the years, the chain effect of requiring suppliers to be certified begins to take effect.

As seemed predictable, the higher the export level, the more important the export factor is with a correlation index of 0.464. In addition, exporting companies also value the customer factor as the most important motivation. It is noteworthy that the companies with an export level higher than 50% value the customer motivation with 4.93.

On the other hand, the value of the motivations belonging to the Moral Mechanism drop significantly when the export level increases with negative correlation coefficients "Environmental sensitivity" (-0.27), "Reduce environmental impact" (-0.22) and "Interest groups" (-0.21). Likewise, among companies with a low level of exports, greater importance is also given to the motivations related to Law compliance with a correlation coefficient of -0.25.

There are small differences between the motivations of FSC-certified and non-certified companies. Specifically, the motivations related to the Market Mechanism have a higher average rating among companies with FSC certification, with significant differences ( $\alpha = 0.05$ ) in the items "Company competitiveness" and "Exports".

**Table 3**  
Characteristics of the companies of the sample.

Size	N° Employees	Activity	Years of certif.	Export level	FSC				
Micro	40 (0–10)	Forestry Work	31	Before 2006	11	Do not export	45	Certified	62
Small	51 (11–50)	1st transformation	33	2006–2010	34	Less than 10%	14		
Medium	29 (51–250)	2nd transformation	30	2011–2015	43	10%–50%	50	No certified	62
Large	4 (+251)	Others	30	2016–2019	36	More than 50%	15		



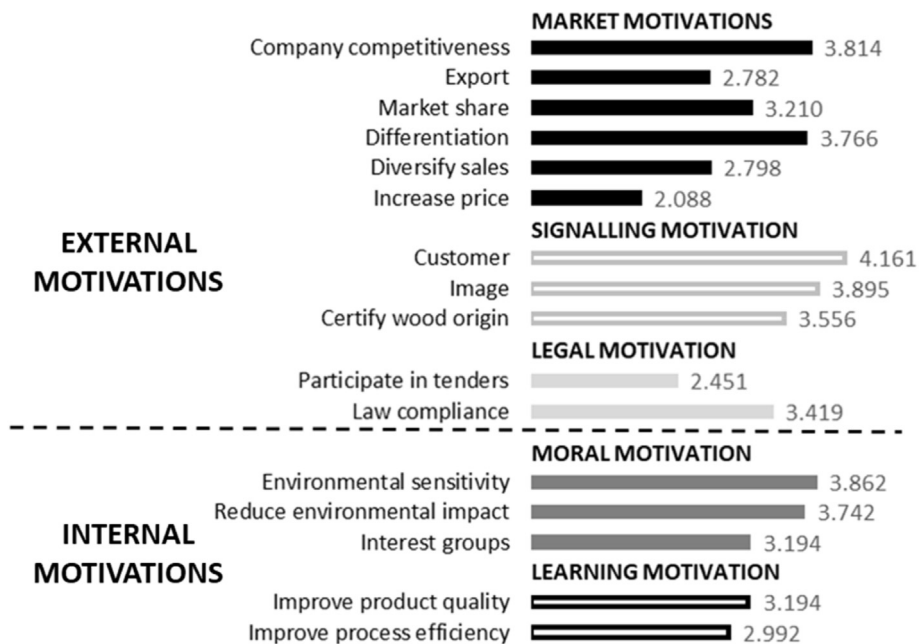


Fig. 1. Main motivations of the companies to adopt PEFC.

Table 4  
Descriptive statistics for motivations according to size and activity.

	Size					Correlation (Bilat. Sig.)	Activity				
	Micro	Small	Medium	Large	Sig. K. Wallis		Forest work	First transf.	Second transf.	Others	Sig. K. Wallis
1-Market mechanism											
Company competit.	3.58	4.08	3.69	3.75	0.16	0.04(0.70)	3.87	3.73	3.67	4.00	0.65
Export	2.08	3.10	3.28	2.25	0.00	0.19(0.04)	2.52	2.58	3.17	2.90	0.31
Market share	3.03	3.31	3.28	3.25	0.73	0.06(0.49)	3.16	3.24	3.33	3.10	0.98
Differentiation	3.58	3.98	3.79	2.75	0.08	-0.06(0.54)	3.68	3.73	3.73	3.93	0.63
Diversify sales	2.85	2.90	2.69	1.75	0.37	-0.13(0.15)	3.03	2.88	2.70	2.57	0.52
Increase price	2.30	2.22	1.66	1.50	0.17	-0.18(0.05)	2.81	1.94	1.77	1.83	0.00
2-Signalling mechanism											
Customer	4.03	4.10	4.38	4.75	0.47	0.14(0.13)	4.03	4.09	4.33	4.20	0.69
Image	3.85	4.00	3.83	3.50	0.68	-0.05(0.56)	3.94	3.82	3.60	4.23	0.04
Certify wood origin	3.75	3.73	3.21	2.00	0.01	-0.29(0.00)	3.84	3.70	3.10	3.57	0.03
3-Legal mechanism											
Participate in tenders	2.18	2.65	2.38	3.25	0.37	0.11(0.23)	2.16	2.21	2.80	2.67	0.27
Law compliance	3.70	3.35	3.24	2.75	0.32	-0.16(0.07)	3.74	3.48	3.23	3.20	0.33
4-Moral mechanism											
Environ. sensitivity	4.05	3.98	3.62	2.25	0.01	-0.28(0.00)	4.03	3.79	3.57	4.07	0.38
Red. Environ. impact	3.95	3.82	3.52	2.25	0.04	-0.25(0.01)	3.90	3.67	3.40	4.00	0.26
Interest groups	3.25	3.27	3.14	2.00	0.20	-0.16(0.09)	3.19	3.18	3.23	3.17	1.00
5-Learning mechanism											
Imp. product quality	3.60	3.24	2.69	2.25	0.03	-0.26(0.00)	3.52	3.33	2.83	3.07	0.28
Imp. process efficiency	3.30	3.08	2.52	2.25	0.07	-0.22(0.02)	3.42	3.09	2.87	2.57	0.06

4.3. Motivations for PEFC certification, according to clusters of certified companies

4.3.1. Cluster definition

The classification technique of K averages considered the solution of three clusters as the optimal solution. The three constructs discriminate the clusters with a statistically significant Wilks' Lambda test ( $p < 0.000$ ). Box's M test ( $SIG = 0.322$ ) showed that there were no significant covariance within groups. Subsequently, a canonical analysis was conducted and as a result, 98.4% of the original cases and 95.2% of the cross validations were correctly distributed (Hair et al., 2006).

Initially, the variables related to the characteristics of the companies were adapted to a scale of variation 0 to 1 in order to

facilitate the comparison and exposure of the data. Later, the significances of the differences between the groups were calculated in order to define the characteristics of the groups. In general, as it can be seen in Table 6, in the first group the main characteristics of the companies are larger dimension, more experience working with PEFC certification, very high export rate, and higher proportion of companies working on first transformation and second transformation activities. In the second group, all the companies belong to the sector activity "Others" and there is a higher proportion of FSC certified companies. In the third, the main characteristics are smaller dimension, less experience working with PEFC certification, very low export rate and high proportion of companies working on forestry work activities.

**Table 5**  
Descriptive statistics for motivations according to years of certification, export level and FSC certification.

	Years of certification						Export level						PEFC + FSC certification			
	More than 13	9-13	4-8	1-3	Sig. K.Wallis	Correlation (Bilat. Sig.)	No export	Less than 10%	10% -50%	More than 50%	Sig. K.Wallis	Correlation (Bilat. Sig.)	No FSC	With FSC	Sig. Mann-U	Correlation (Bilat. Sig.)
<b>1-Market mechanism</b>																
Company competit.	3.45	3.85	3.67	4.06	0.28	-0.17(0.06)	3.71	3.64	3.94	3.87	0.71	0.06(0.48)	3.60	4.03	0.03	0.20(0.03)
Export	2.55	3.18	2.70	2.58	0.18	-0.09(0.28)	1.80	2.93	3.30	3.87	0.00	0.46(0.00)	2.50	3.06	0.03	0.20(0.03)
Market share	2.55	3.41	3.16	3.28	0.17	-0.17(0.06)	3.02	3.14	3.46	3.00	0.32	0.06(0.49)	3.05	3.37	0.11	0.13(0.15)
Differentiation	3.45	3.82	3.79	3.78	0.70	-0.07(0.44)	3.84	3.50	3.96	3.13	0.04	-0.16(0.08)	3.73	3.81	0.64	0.04(0.69)
Diversify sales	2.09	2.88	2.72	3.03	0.10	-0.19(0.04)	2.71	3.00	2.90	2.53	0.69	-0.05(0.59)	2.63	2.97	0.17	0.14(0.15)
Increase price	1.55	2.12	1.98	2.36	0.40	-0.15(0.09)	2.36	2.14	1.98	1.60	0.26	-0.17(0.06)	1.89	2.29	0.13	0.15(0.10)
<b>2-Signalling mechanism</b>																
Customer	3.45	4.24	4.05	4.44*	0.04	-0.21(0.02)	3.89	4.21	4.16	4.93	0.03	0.24(0.01)	4.08	4.24	0.56	0.07(0.46)
Image	3.91	3.79	3.95	3.92	0.78	0.03(0.78)	3.98	3.79	3.96	3.53	0.41	-0.08(0.38)	3.90	3.89	0.85	-0.01(0.93)
Certify wood origin	4.00	3.74	3.23	3.64	0.13	-0.05(0.58)	3.67	3.21	3.68	3.13	0.24	-0.11(0.23)	3.55	3.56	0.95	0.01(0.94)
<b>3-Legal mechanism</b>																
Participate in tenders	1.91	2.53	2.60	2.36	0.36	-0.05(0.62)	2.67	2.71	2.34	1.93	0.37	-0.14(0.12)	2.40	2.50	0.84	0.03(0.73)
Law compliance	3.55	3.26	3.35	3.61	0.55	-0.03(0.76)	3.64	3.93	3.34	2.53	0.01	-0.25(0.00)	3.42	3.42	0.80	0.00(1.00)
<b>4-Moral mechanism</b>																
Environ. sensitivity	3.82	3.91	3.81	3.89	0.87	-0.05(0.58)	3.87	4.43	4.02	2.80	0.00	-0.27(0.00)	4.03	3.68	0.08	-0.19(0.09)
Red. Environ. impact	3.64	3.79	3.67	3.81	0.82	-0.07(0.45)	3.73	4.14	3.96	2.67	0.01	-0.22(0.01)	3.90	3.58	0.12	-0.13(0.15)
Interest groups	3.18	3.38	3.07	3.17	0.73	-0.08(0.39)	3.27	3.43	3.32	2.33	0.02	-0.21(0.02)	3.31	3.08	0.35	-0.10(0.28)
<b>5-Learning mechanism</b>																
Imp. product quality	2.91	3.26	3.14	3.28	0.84	-0.06(0.50)	3.18	3.14	3.36	2.73	0.50	-0.03(0.75)	3.19	3.19	0.92	0.00(1.00)
Imp. process efficiency	2.73	2.97	3.00	3.08	0.89	-0.05(0.55)	2.96	3.14	3.14	2.47	0.38	-0.04(0.66)	2.85	3.13	0.22	0.10(0.26)

**Table 6**  
Characteristics of the firms of each cluster.

Cluster	N	Size	Years of certification	Export rate	FSC	Forestry work	First transf	Second transf	Others
1	33	0.60	0.48	0.80	0.39	0.03	0.45	0.52	0.00
2	35	0.47	0.39	0.48	0.66	0.00	0.00	0.00	1.00
3	56	0.13	0.32	0.18	0.46	0.54	0.32	0.14	0.00
Total	124	0.35	0.38	0.43	0.50	0.25	0.27	0.20	0.28
Sig. K. Wallis	-	0.00	0.45	0.00	0.08	0.00	0.00	0.00	0.00

4.4. Variation of motivations by clusters

In a second step, it was analysed whether there were significant differences between the clusters related to the motivations for adoption and PEFC certification. These motivations are shown in Table 7. In the statistics analysis, it was detected that the motivations of the first group are more related with the exportations and less with improving image, law compliance, environmental sensitivity, reducing environmental impact and improving process quality. The companies of the second group are more motivated by the improvement of the image, the environmental sensitivity and the reduction of the environmental impact and less by improving the efficiency of the process. Finally, in the third group are more relevant the motivations of increase the price, law compliance, reduce environmental impact, improve product quality and improve process efficiency. However, the exportation rate is less relevant.

5. Discussion

The results of our study suggest that the main mechanisms that promote forest certification in companies of the Spanish forest industry are aligned with the 5 main mechanisms identified in the literature, as stated by Faggi et al. (Faggi et al., 2014), Takahashi (2001) (Takahashi, 2001), Overdeest and Rickenbach (Overdeest and Rickenbach, 2006) and Galati et al. (Galati et al., 2017). The first three blocks are external: Market, Signalling and Legal mechanisms, and the last two internal: Learning and Moral mechanisms.

Market and Signalling mechanisms obtain in general greater valuations within the external motivations, similar to what happens in other studies (Galati et al., 2017; Overdeest and Rickenbach, 2006). According to the findings of our study, forest certification in companies of the Spanish forest industry is mainly driven by factors and motivations related to maintaining their external market and to improve their reputation.

**Table 7**  
Characteristics of the motivations of each cluster.

	1	2	3	Total	Sig. K. Wallis
<b>1-Market mechanism</b>					
Company competit.	3.76	3.97	3.75	3.81	(0.52)
Export	3.33	3.00	2.32	2.78	(0.00)
Market share	3.24	3.17	3.21	3.21	(0.97)
Differentiation	3.55	3.97	3.77	3.77	(0.32)
Diversify sales	2.85	2.57	2.91	2.80	(0.46)
Increase price	1.73	1.80	2.48	2.09	(0.09)
<b>2-Signalling mechanism</b>					
Customer	4.45	4.17	3.98	4.16	(0.22)
Image	3.61	4.14	3.91	3.90	(0.03)
Certify wood origin	3.30	3.46	3.77	3.56	(0.11)
<b>3-Legal mechanism</b>					
Participate in tenders	2.27	2.69	2.41	2.45	(0.50)
Law compliance	3.00	3.23	3.79	3.42	(0.00)
<b>4-Moral mechanism</b>					
Environ. sensitivity	3.33	4.00	4.09	3.86	(0.00)
Red. Environ. impact	3.24	3.94	3.91	3.74	(0.00)
Interest groups	2.94	3.20	3.34	3.19	(0.36)
<b>5-Learning mechanism</b>					
Imp. product quality	2.97	2.94	3.48	3.19	(0.10)
Imp. process efficiency	2.82	2.54	3.38	2.99	(0.01)

Within the internal motivations, moral motivations are the most valued. Our results are consistent with the empirical evidence that ethical or moral aspects have also an important influence on the decision of companies in the forest industry when adopting forest certifications, which highlights the importance of adopting these management schemes to ensure responsible management of forest resources (Carlsen et al., 2012; Tuppura et al., 2016; Van De Ven and Graafl, 2006; Williams and Schaefer, 2013).

According to the characteristics of the companies, some of the motivations are significantly influenced, as occurs in different studies that have analysed this field of study (Faggi et al., 2014; Halalisan et al., 2019; Overdevest and Rickenbach, 2006).

In relation to external motivations, the two most valued items within the Market mechanism are "Increase the competitiveness of the company in the market" (even more so among FSC certified companies) and "Differentiate the product from the competition". Previous empirical research highlights the importance of these business performance factors (Overdevest and Rickenbach, 2006) and market motivations (Chen et al., 2011; Galati et al., 2017; Halalisan et al., 2019; Hoang, H. T. N. et al., 2019; Ulybina and Fennell, 2013a), related to the objective of accessing environmentally sensitive niche markets.

Although the benefits of forest certification in terms of the market may be positive, factors such as the costs associated with the initial and annual audits and the difficult paperwork, can act as a barrier to the diffusion of this type of standards in the forestry sector of some countries (Hoang, H. T. N. et al., 2019; Maraseni et al., 2017). Ehrenberg-Azcárate and Peña-Claros (2020), conducted an analysis of evaluation reports belonging to 543 forest management units (FMUs) located in the tropics and covering 20 years of certification. The study concluded that during the last decade most developing tropical countries have had a hard time overcoming some of the limitations obstructing the adoption of certification, such as the high costs of certification. In the case of the Spanish forestry sector, the cost of certification involves, on the one hand, indirect costs, such as those produced by the change in management to meet the standards of sustainable forest management; and the direct costs that are related to the audit process (PEFC Spain, 2020). The final cost of the process will largely depend on the management carried out to date and the area that is certified. In the case of the present study, the Spanish companies and forest owners who have participated in the questionnaire have not explicitly

mentioned these barriers to certification in the form of costs. One of the reasons for this fact may be that the owners, which in the case of Spain also has a smallholder property structure (67% of the Spanish forest area is privately owned and in many cases they are owners of small portions) (COSE, 2019) use the joint certification modality. This fact allows optimizing expenses without losing guarantees in the fulfillment of the requirements (PEFC Spain, 2020). In this way, small owners are associated and considerably reduce the costs of certification per owner, which makes it more affordable and may encourage the dissemination of these standards. This type of joint certification between owners could be a driver or could promote forest certification in the case of other countries with similar property structures, as pointed out by Maraseni et al. (2017), who state that the group certification could reduce costs also in the case of the Central Vietnamese forestry sector. Specifically, they conclude in their study that the aggregation of 3000 ha of smallholder farmers might receive sufficient overall return from selling certified wood to cover the costs of certification.

This block of external motivations does not vary excessively according to the characteristics of the companies, although among medium-sized companies the motivations related to increasing exports are more important. This fact seems reasonable, since it may be related to the fact that medium-sized companies are the largest exporters in the case of the Spanish forest industry (Díaz Balteiro, 2008; Gobierno de España, 2020). In the case of small and micro enterprises, the diversification of sales reaches a certain relevance. In the literature, it is highlighted that one of the main motivations is related to the bargaining power of prices (Espinoza et al., 2012; Hoang, H. T. N. et al., 2019; Maraseni et al., 2017; Ratnasingam et al., 2008; Tian et al., 2018). However, in this study it has been the least valued motivation, although small companies and those that carry out activities related to forestry work value it a little better.

The importance of the Signalling mechanism has been highlighted in our study, with two of its items (out of a total of three) being the most valued by the surveyed companies and are, in that order, "Attract customer's attention" and "Improve company's corporate image". The importance of this mechanism when it comes to promoting forest certification has also been highlighted by various studies (Dare et al., 2011b; Faggi et al., 2014; Gordon et al., 2012; Halalisan et al., 2019), underlining the importance of the improvement of corporate social responsibility, community engagement, accountability towards stakeholders, and contribution to community development and well-being. A high acceptance by stakeholders finally results in benefits for the certification schemes such as higher adoption rates. Anyway, due to the fact that in the field of private certification standards there are different related stakeholders (both internal and external), these companies are likely to be always operating with opposition from some of them (Conniff, 2018; Tröster and Hiete, 2019). Therefore, there may be criticisms from these about whether forest companies are actively implementing CSR initiatives in practice or not (Gordon et al., 2012).

In relation to Customer item, the importance of this motivation is greater among recently certified companies. The explanation for this fact may be related to the knock-on effect that leads to demanding the certification of management standards from suppliers, as for the case of Quality and Environment Management Standards (Heras-Saizarbitoria et al., 2016). In addition, as companies become more export oriented, customer motivation is more valued, which may be logical and is in line with the results of different authors in other regions of the world (Nathan et al., 2018; Owari et al., 2006b). Improving the company's corporate image is also influenced by the characteristics of the companies. In this case, companies whose activity is related to forestry work value this

motivation more than those belonging to the first transformation and in turn, these more than those working in the second transformation.

At a global level and in our study, legal motivations are less valued, in contrast to other works in this field (Ebeling and Yasué, 2009; Faggi et al., 2014; Galati et al., 2017). Although the public administrations in Spain could exclude from public purchase those forest products which could not credit the fulfillment in origin, in our study the legal motivations of Spanish companies when opting for forest certification have not been highly valued. One of the possible reasons for this fact may be that the law or regulation that defines this requirement is recent (Forest Law 21/2015) and that it began to be applied between 2016 and 2017 (Spanish Government, 2017). In the case of “Law compliance” item, this is better valued among companies that do not export much.

The most highly valued items within the Moral group are “Environmental sensitivity” and “Internal commitment to reduce environmental impact” items. These moral motivations are the ones that obtain the best valuation specially among small and low exporting companies, confirming the point made by Williams et al. (Williams and Schaefer, 2013), which demonstrated in their study a clear pro-environmental engagement of small businesses in the east of England, with respect to climate change in particular, being the personal values and beliefs the most notable motivation for managers in this study. The positive effects of forest certification in conserving biodiversity have been highlighted in different studies (Carlsen et al., 2012; Ehrenberg-Azcárate and Peña-Claros, 2020; Kalonga et al., 2016; Takahashi, 2001), despite the fact that there are also criticisms on this point by other authors (Conniff, 2018; Poulsen and Clark, 2010). However, in our study two of the three most highly valued items within the Moral group have also been highly valued by the surveyed companies globally (third and fifth respectively), confirming the importance of this motivational mechanism in companies in the forestry sector in Spain.

In addition, the export level has a negative influence on all the characteristics of the moral motivations group. However, the motivations belonging to the Learning mechanism do not obtain such a high valuation level, although it is observed that among small-sized companies the “Improve product quality” item obtains a more relevant valuation.

The cluster analysis allowed us to identify and define three company groups, with clear common characteristics. There were significant differences between the clusters related to the motivations for PEFC certification. In the first cluster group (larger companies, high export rate and more experienced working with PEFC certification), the main motivations for certification are clearly external, such as increasing exports. This result may be logical, since companies with these characteristics in Spain obtain greatest presence in international markets and have a greater dimension and resources to be able to compete in them (Díaz Balteiro, 2008; Gobierno de España, 2020).

The main drivers of the second group are external, such as improvement of the image, and internal as the environmental sensitivity and the reduction of the environmental impact. They consider the learning mechanism motivations less relevant, specially, improving the efficiency of the process.

The third group is characterized by smaller companies, low export rate and less experience working with PEFC certification. The motivations are mainly internal, such as reducing environmental impact, improving product quality and process efficiency. As stated previously, this tendency of small companies due to internal motivations and in particular, due to ethical or moral motivations like the sense of personal responsibility has been mentioned in previous works (Battisti and Perry, 2011; Iraldo et al., 2010; Williams and Schaefer, 2013).

## 6. Conclusions

According to our study, the main external reasons that drive Spanish forest companies for certification are related to accessing new markets (Market mechanism) and improving corporate image (Signalling Mechanism). In this sense, the value that the customer attributes to forest certification is considered a critical motivation. Its relevance is increasing among large, exporting and recently certified companies. For these reasons, it is necessary to know, what kinds of pressure are customers exerting? To what extent is this factor causing a chain reaction? Is this motivation going to be transferred from the companies that act in second transformation to the companies that develop forestry work activities? This chain effect has already occurred with other management standards in many sectors and the results obtained in this study lead us to believe that it is becoming increasingly relevant in the forestry sector. In relation to internal motivations, ethical or moral aspects have been identified as the most important influence on the decision of these companies when adopting forest certification.

From a managerial perspective and taking into account the great path that the Spanish forest industry still has in terms of forest certification, this study could provide interesting insights to companies in the sector that are considering entering or expanding their presence in international markets.

For policymakers, the results of this study suggest the need to develop policies, with the aim of promoting forest certification, taking into account the low level of certification that exists in the Spanish forest industry and also taking into account the great potential that this industry has in Spain, being one of the countries in Europe with the largest forest area. In the Spanish forest industry different groups of companies can be identified according to their characteristics. Accordingly, the needs and resources available to undertake these processes are very different in these companies and therefore public administration should work on programmes adapted to facilitate these processes and allow companies to improve their results.

The main limitations of the research are related to the generalization of the data. The research has been developed in Spain, which is a territory with certain characteristics. However, this fact allows us to open a first line of research that would focus on analysing how the motivations that lead companies to become certified in different countries vary and how the characteristics of the companies interfere with them, in addition to the possibility of expanding the study of the certification to other raw materials as well. Likewise, we consider necessary to analyse the influence of the motivations on the results obtained by companies, an aspect of great relevance not only for the academic field, but also for companies and public decision-makers.

## CRedit authorship contribution statement

**Mikel Zubizarreta:** Conceptualization, Investigation, Project administration, Supervision, Writing - original draft, Writing - review & editing. **Germán Arana-Landín:** Data curation, Methodology, Software, Validation, Formal analysis, Writing - review & editing. **Jesús Cuadrado:** Validation, Formal analysis, Writing - review & editing, Visualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.



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## References

- Alves, et al., 2019. Implementation of Forest Certification in Brazil, Spain And Portugal: An Analytic Hierarchy Process (AHP) Application. *International Forestry Review* 21(1), 11–22.
- Araujo, M., Kant, S., Couto, L., 2009. Why Brazilian companies are certifying their forests? *For. Pol. Econ.* 8, 579–585.
- Aretoulaki, E., Ponis, S., Plakas, G., Agalinos, K., 2020. A systematic meta-review analysis of review papers in the marine plastic pollution literature. *Mar. Pollut. Bull.* 111690.
- Attah, A., Ioras, F., Ratnasingham, J., Abrudan, I.V., 2011. Chain of custody certification: an assessment of Ghanaian timber sector. *European journal of wood and wood products* 1, 113–119.
- Auld, G., Gulbrandsen, L.H., McDermott, C.L., 2008. Certification schemes and the impacts on forests and forestry. *Annu. Rev. Environ. Resour.* 187–211.
- Auld, G., Cashore, B., Balboa, C., Bozzi, L., Renckens, S., 2010. Can technological innovations improve private regulation in the global economy? *Bus. Polit.* 3, 1–39.
- Bansal, P., Roth, K., 2000. Why companies go green: a model of ecological responsiveness. *Acad. Manag. J.* 4, 717–736.
- Basso, V., Andrade, B., Jacovine, L., Silva, E., Alves, R., Nardelli, A., 2020. Forest management certification in the Americas: difficulties in complying with the requirements of the FSC system. *Int. For. Rev.* 2, 169–188.
- Battisti, M., Perry, M., 2011. Walking the talk? Environmental responsibility from the perspective of small-business owners. *Corp. Soc. Responsib. Environ. Manag.* 3, 172–185.
- Bernstein, S., Cashore, B., 2004. Non-state global governance: is forest certification a legitimate alternative to a global forest convention? *Hard Choices, Soft Law: Voluntary Standards in Global Trade, Environment and Social Governance*, pp. 33–63.
- BOE, 2010. Ley 7/2010, de 14 de julio, para la dehesa. *Disposiciones Generales*.
- Bouslah, K., M'Zali, B., Turcotte, M., Kooli, M., 2010. The impact of forest certification on firm financial performance in Canada and the US. *J. Bus. Ethics* 4, 551–572.
- Bowler, K., Castka, P., Balzarova, M., 2017. Understanding firms' approaches to voluntary certification: evidence from multiple case studies in FSC certification. *J. Bus. Ethics* 2, 441–456.
- Carlsen, K., Hansen, C.P., Lund, J.F., 2012. Factors affecting certification uptake—perspectives from the timber industry in Ghana. *For. Pol. Econ.* 83–92.
- Cashore, B.W., Auld, G., Newsom, D., 2004. *Governing through Markets: Forest Certification and the Emergence of Non-state Authority*. Yale University Press.
- Cashore, B., van Kooten, G.C., Vertinsky, I., Auld, G., Affolderbach, J., 2005. Private or self-regulation? A comparative study of forest certification choices in Canada, the United States and Germany. *For. Pol. Econ.* 1, 53–69.
- Cashore, B., Gale, F., Meidinger, E., Newsom, D., 2006. *Confronting Sustainability: Forest Certification in Developing and Transitioning Countries*. Yale University Faculty of Environmental Studies Publication Series.
- Castka, P., Corbett, C., 2016a. Adoption and diffusion of environmental and social standards. *Int. J. Oper. Prod. Manag.*
- Castka, P., Corbett, C.J., 2016b. Governance of eco-labels: expert opinion and media coverage. *J. Bus. Ethics* 2, 309–326.
- Castka, P., Searcy, C., Fischer, S., 2020. Technology-enhanced auditing in voluntary sustainability standards: the impact of COVID-19. *Sustainability* 11, 4740.
- Castka, P., Searcy, C., Mohr, J., 2020a. Technology-enhanced auditing: improving veracity and timeliness in social and environmental audits of supply chains. *J. Clean. Prod.* 120773.
- Chen, J., Innes, J.L., 2013. The implications of new forest tenure reforms and forestry property markets for sustainable forest management and forest certification in China. *J. Environ. Manag.* 206–215.
- Chen, J., Innes, J.L., Kozak, R.A., 2011. An exploratory assessment of the attitudes of Chinese wood products manufacturers towards forest certification. *J. Environ. Manag.* 11, 2984–2992.
- Conniff, R., 2018. *Greenwashed Timber: How Sustainable Forest Certification Has Failed*. Yale Environment.
- COSE, 2019. *La biomasa forestal en el contexto de la transición ecológica*.
- Cubbage, F., Moore, S., Henderson, T., Araujo, M., 2009. Costs and Benefits of Forest Certification in the Americas. *Natural resources: Management, economic development and protection*, pp. 155–183.
- Cubbage, F., Diaz, D., Yapura, P., Dube, F., 2010. Impacts of forest management certification in Argentina and Chile. *For. Pol. Econ.* 7, 497–504.
- Dare, M.L., Schirmer, J., Vanclay, F., 2011a. Does forest certification enhance community engagement in Australian plantation management? *For. Pol. Econ.* 5, 328–337.
- Dare, M.L., Schirmer, J., Vanclay, F., 2011b. Does forest certification enhance community engagement in Australian plantation management? *For. Pol. Econ.* 5, 328–337.
- Darnall, N., Ji, H., Vázquez-Brust, D.A., 2018. Third-party certification, sponsorship, and consumers' ecolabel use. *J. Bus. Ethics* 4, 953–969.
- de España, Gobierno, 2020. *Anuario de Estadística Forestal 2018*.
- Díaz Balteiro, L., 2008. *Caracterización de la industria forestal en España: aspectos económicos y ambientales*. Fundación BBVA/BBVA Foundation.
- Díaz-Balteiro, L., Jalón, S.G.d., 2017. Certifying forests to achieve sustainability in industrial plantations: opinions of stakeholders in Spain. *Forests* 12, 502.
- Doonan, J., Lanoie, P., Laplante, B., 2005. Determinants of environmental performance in the Canadian pulp and paper industry: an assessment from inside the industry. *Ecol. Econ.* 1, 73–84.
- Ebeling, J., Yasué, M., 2009. The effectiveness of market-based conservation in the tropics: forest certification in Ecuador and Bolivia. *J. Environ. Manag.* 2, 1145–1153.
- Ehrenberg-Azcárate, F., Peña-Claros, M., 2020. Twenty years of forest management certification in the tropics: major trends through time and among continents. *For. Pol. Econ.* 102050.
- Espinoza, O., Buehlmann, U., Smith, B., 2012. Forest certification and green building standards: overview and use in the U.S. hardwood industry. *J. Clean. Prod.* 30–41.
- Eurostat, 2019. *Forests, Forestry and Logging - Statistics Explained*.
- Faggi, A.M., Zuleta, G.A., Homberg, M., 2014. Motivations for implementing voluntary environmental actions in Argentine forest companies. *Land Use Pol.* 541–549.
- FAO, 2010. *Evaluación de los recursos forestales mundiales 2010: informe principal*.
- Feilberg, P., Hain, H., Sloth, C., van Boven-Flier, D., 2012. *Comparative Analysis of the PEFC System with FSC Controlled Wood Requirements*. NEPCON: Aarhus, Denmark, pp. 1–76.
- Fiore, M., Galati, A., Crescimanno, M., Contò, F., Giacomarra, M., Tinervia, S., 2016. Managerial suggestions to sustainable market choices: a business profitability assessment on the adoption of voluntary certification in the wine industry of the Italian "mezzogiorno" regions. *Calitatea* 154, 71.
- Fiore, M., Giacomarra, M., Crescimanno, M., Galati, A., 2020. Quality certifications' impact on wine industry assets performance. *Bulgarian Journal of Agricultural Science* 2, 257–267.
- Flanagan, A., Laity, R., 2015. Over-regulated and under marketed: challenges in supporting feasible verification processes in Lao PDR. A contribution to Project FST/2012/012: enhancing key elements of the value chain for plantation-grown wood in Lao PDR.
- Galati, A., Gianguzzi, G., Tinervia, S., Crescimanno, M., La Mela Veca, D.S., 2017. Motivations, adoption and impact of voluntary environmental certification in the Italian Forest based industry: the case of the FSC standard. *For. Pol. Econ.* 169–176.
- Gale, F., Asci, F., Lovell, H., 2017. Sensing reality? New monitoring technologies for global sustainability standards. *Global Environ. Polit.* 2, 65–83.
- Gavronski, I., Paiva, E.L., Teixeira, R., de Andrade, Ferreira, Marta Cleia, 2013. ISO 14001 certified plants in Brazil—taxonomy and practices. *J. Clean. Prod.* 32–41.
- Gómez-Zamalloa, M.G., Caparrós, A., Ayanz, A.S., 2011. 15 years of Forest Certification in the European Union. Are we doing things right? *Forest Systems* 1, 81–94.
- González-Benito, J., González-Benito, O., 2005. An analysis of the relationship between environmental motivations and ISO14001 certification. *Br. J. Manag.* 2, 133–148.
- Gordon, M., Lockwood, M., Vanclay, F., Hanson, D., Schirmer, J., 2012. Divergent stakeholder views of corporate social responsibility in the Australian forest plantation sector. *J. Environ. Manag.* 390–398.
- Government, Spanish, 2017. *SPAIN MARKET REPORT ON TIMBER AND WOOD PRODUCTS*.
- Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R.L., 2006. *Multivariate data analysis 6th Edition*. Pearson Prentice Hall. New Jersey. humans: critique and reformulation. *J. Abnorm. Psychol.* 49–74.
- Halalisan, A.F., Popa, B., Heras-Saizarbitoria, I., Ioras, F., Abrudan, I., 2019. Drivers, perceived benefits and impacts of FSC Chain of Custody Certification in a challenging sectoral context: the case of Romania. *Int. For. Rev.* 2, 195–211.
- Hartsfield, A., Ostermeier, D., 2003. Certification: the view from FSC-certified land managers. *J. For.* 8, 32–36.
- Heras-Saizarbitoria, I., Boiral, O., 2013. ISO 9001 and ISO 14001: towards a research agenda on management system standards. *Int. J. Manag. Rev.* 1, 47–65.
- Heras-Saizarbitoria, I., Arana, G., Boiral, O., 2016. Outcomes of environmental management systems: the role of motivations and firms' characteristics. *Bus. Strat. Environ.* 8, 545–559.
- Hoang, H.T.N., Hoshino, S., Hashimoto, S., 2015. Forest stewardship council certificate for a group of planters in Vietnam: SWOT analysis and implications. *J. For. Res.* 1, 35–42.
- Hoang, N., Toppinen, A., Lähinen, K., 2015. Foreign subsidiary development in the context of a global recession: a case of the furniture industry in Vietnam. *Int. For. Rev.* 4, 427–437.
- Hoang, H.T.N., Hoshino, S., Onitsuka, K., Maraseni, T., 2019. Cost analysis of FSC forest certification and opportunities to cover the costs a case study of Quang

- Tri FSC group in Central Vietnam, 3, 137–142.
- INE - Spanish National Statistics Institute, 2017. Demografía armonizada de empresas.
- Iraldo, F., Testa, F., Frey, M., 2010. Environmental management system and SMEs: EU experience, barriers and perspectives. *Environ. Man* 258.
- Kalonga, S.K., Midtgaard, F., Klanderud, K., 2016. Forest certification as a policy option in conserving biodiversity: an empirical study of forest management in Tanzania. *For. Ecol. Manage.* 1–12.
- Karlsson-Vinkhuyzen, S., Kok, M.T.J., Visseren-Hamakers, I.J., Termeer, C.J.A.M., 2017. Mainstreaming biodiversity in economic sectors: an analytical framework. *Biol. Conserv.* 145–156.
- Kilgore, et al., 2007. Assessing family forestland certification opportunities: a Minnesota case study. *Journal of Forestry* 105(1), 27–33.
- Leahy, J.E., Kilgore, M.A., Hibbard, C.M., Donnay, J.S., 2008. Family forest landowners' interest in and perceptions of forest certification: focus group findings from Minnesota. *N. J. Appl. For.* 2, 73–81.
- Lewis, R.A., Davis, S.R., 2015. Forest certification, institutional capacity, and learning: an analysis of the impacts of the Malaysian Timber Certification Scheme. *For. Pol. Econ.* 18–26.
- Maesano, M., Ottaviano, M., Lidestav, G., Lasserre, B., Matteucci, G., Scarascia Mugnozza, G., Marchetti, M., 2018. Forest certification map of Europe. *iFor. Biogeosci. For.* 4, 526.
- Maraseni, T.N., Son, H.L., Cockfield, G., Duy, H.V., Nghia, T.D., 2017. The financial benefits of forest certification: case studies of acacia growers and a furniture company in Central Vietnam. *Land Use Pol.* 56–63.
- Martínez-Costa, M., Martínez-Lorente, A.R., Choi, T.Y., 2008. Simultaneous consideration of TQM and ISO 9000 on performance and motivation: an empirical study of Spanish companies. *Int. J. Prod. Econ.* 1, 23–39.
- Marx, A., Cuyper, D., 2010. Forest certification as a global environmental governance tool: what is the macro-effectiveness of the Forest Stewardship Council? *Regulation & Governance* 4, 408–434.
- Ministry of Agriculture, Food and the Environment, 2014. Diagnóstico del Sector Forestal Español. Análisis y Prospectiva - Serie Agrinfo/Medioambiente nº 8.
- Montero, G., Serrada, R., 2013. La situación de los bosques y el sector forestal en España. ISFE: Pontevedra, Spain.
- Narasimhan, R., Schoenherr, T., Jacobs, B.W., Kim, M.K., 2015. The financial impact of FSC certification in the United States: a contingency perspective. *Decis. Sci. J.* 3, 527–563.
- Nathan, I., Chen, J., Hansen, C.P., Xu, B., Li, Y., 2018. Facing the complexities of the global timber trade regime: how do Chinese wood enterprises respond to international legality verification requirements, and what are the implications for regime effectiveness? *For. Pol. Econ.* 169–180.
- NEPCON, 2019. How forest certification systems meet the EUTR requirements.
- Norris, K., Asase, A., Collen, B., Gockowski, J., Mason, J., Phalan, B., Wade, A., 2010. Biodiversity in a forest-agriculture mosaic – the changing face of West African rainforests. *Biol. Conserv.* 10, 2341–2350.
- Nussbaum, R., Simula, M., 2004. Forest Certification: A Review of Impacts and Assess Ment Frameworks. The Forests Dialogue. Yale University, School of Forestry and Environmental Studies, New Haven.
- Overdevest, C., 2005. Treadmill politics, information politics, and public policy: toward a political economy of information. *Organ. Environ.* 1, 72–90.
- Overdevest, C., 2010. Comparing forest certification schemes: the case of ratcheting standards in the forest sector. *Soc. Econ. Rev.* 1, 47–76.
- Overdevest, C., Rickenbach, M.G., 2006. Forest certification and institutional governance: an empirical study of forest stewardship council certificate holders in the United States. *For. Pol. Econ.* 1, 93–102.
- Owari, T., Juslin, H., Rummukainen, A., Yoshimura, T., 2006a. Strategies, functions and benefits of forest certification in wood products marketing: perspectives of Finnish suppliers. *For. Pol. Econ.* 4, 380–391.
- Owari, T., Juslin, H., Rummukainen, A., Yoshimura, T., 2006b. Strategies, functions and benefits of forest certification in wood products marketing: perspectives of Finnish suppliers. *For. Pol. Econ.* 4, 380–391.
- Paletto, A., Notaro, S., Pastorella, F., Giacobelli, G., Giovannelli, S., Turco, R., 2017. Forest certification in Calabria (Italy): attitudes, preferences and willingness to pay of manufactures and enterprises of forest-wood chain. *Forest@* 1, 107–123.
- Paluš, H., Kaputa, V., 2009. Survey of Attitudes towards Forest and Chain of Custody Certification in the Slovak Republic. *Drewno*, pp. 65–81.
- Paluš, H., Parobek, J., Dudík, R., Šupín, M., 2017. Assessment of chain-of-custody certification in the Czech and Slovak Republic. *Sustainability* 10, 1898.
- Paluš, H., Parobek, J., Šulek, R., Lichý, J., Šálka, J., 2018. Understanding sustainable forest management certification in Slovakia: forest owners' perception of expectations, benefits and problems. *Sustainability* 7, 2470.
- Paluš, H., Parobek, J., Vlosky, R.P., Motik, D., Oblak, L., Jošt, M., Glavonjić, B., Dudík, R., Wanat, L., 2018. The status of chain-of-custody certification in the countries of Central and South Europe. *European journal of wood and wood products* 2, 699–710.
- Paluš, H., Parobek, J., Dzian, M., Šimo-Svrček, S., Krahulcová, M., 2019. How companies in the wood supply chain perceive the forest certification. *Acta Facultatis Xylogiae Zvolen res Publica Slovaca* 1, 155–165.
- Podsakoff, P.M., Organ, D.W., 1986. Self-reports in organizational research: problems and prospects. *J. Manag.* 4, 531–544.
- Ponte, S., Gibbon, P., Vestergaard, J., 2011. Governing through Standards: Origins, Drivers and Limitations. Palgrave Macmillan.
- Poulsen, J.R., Clark, C.J., 2010. Congo Basin Timber Certification and Biodiversity Conservation. Biodiversity Conservation in Certified Forests.
- Prajogo, D.I., 2011. The roles of firms' motives in affecting the outcomes of ISO 9000 adoption. *Int. J. Oper. Prod. Manag.*
- Ratnasingam, J., Macpherson, T., Ioras, F., 2008. An assessment of Malaysian wooden furniture manufacturers' readiness to embrace chain of custody (COC) certification. *Holz als Roh-und Werkstoff.* 5, 339–343.
- Riera, P., Aranda, L., Mavsar, R., 2007. Efficiency and equity of forest policies: a graphic analysis using the partial equilibrium framework. *For. Pol. Econ.* 7, 852–861.
- Robinson, J.P., Shaver, P.R., Wrightsman, L.S., 1991. Criteria for scale selection and evaluation. Measures of personality and social psychological attitudes 3, 1–16.
- Schepers, D.H., 2010. Challenges to legitimacy at the forest stewardship council. *J. Bus. Ethics* 2, 279–290.
- FSC Spain, 2019.**
- Spain, P.E.F.C., 2020. Certificación Forestal PEFC: Gestión Forestal Sostenible & Cadena de Custodia.
- Sugiura, K., Oki, Y., 2018. Reasons for choosing forest stewardship council (FSC) and sustainable green ecosystem council (SGEC) schemes and the effects of certification acquisition by forestry enterprises in Japan. *Forests* 4, 173.
- Suryani, A.N., Shahwahid, H.M., Fauzi, P.A., Alias, R., Vlosky, R., 2011. Assessment of chain-of-custody certification costs for sawnwood manufacturers in Peninsular Malaysia. *J. Trop. For. Sci.* 159–165.
- Takahashi, T., 2001. Why Firms Participate in Environmental Voluntary Initiatives: Case Studies in Japan and Canada.
- TEFTOR, 2012. Caracterización del espacio forestal en España.
- Tian, N., Poudyal, N.C., Lu, F., 2018. Understanding landowners' interest and willingness to participate in forest certification program in China. *Land Use Pol.* 271–280.
- Tikina, A., Kozak, R., Larson, B., 2008. What factors influence obtaining forest certification in the U.S. Pacific Northwest? *For. Pol. Econ.* 4, 240–247.
- Tröster, R., Hiete, M., 2019. Do voluntary sustainability certification schemes in the sector of mineral resources meet stakeholder demands? A multi-criteria decision analysis. *Res. Pol.* 101432.
- Tuppura, A., Toppinen, A., Puumalainen, K., 2016. Forest certification and ISO 14001: current state and motivation in forest companies. *Bus. Strat. Environ.* 5, 355–368.
- Ulybina, O., Fennell, S., 2013a. Forest certification in Russia: challenges of institutional development. *Ecol. Econ.* 178–187.
- Ulybina, O., Fennell, S., 2013b. Forest certification in Russia: challenges of institutional development. *Ecol. Econ.* 178–187.
- U.S. Endowment for Forest and Communities, 2018. The State of America's Forests: an Interactive Guide.
- Van De Ven, B., Graafl, J., 2006. Strategic and Moral Motivation for Corporate Social Responsibility.
- van der Ven, H., Cashore, B., 2018. Forest certification: the challenge of measuring impacts. *Current Opinion in Environmental Sustainability* 104–111.
- Vidal, N., Kozak, R., Cohen, D., 2005. Chain of custody certification: an assessment of the North American solid wood sector. *For. Pol. Econ.* 3, 345–355.
- Ward, V., House, A., Hamer, S., 2009. Developing a framework for transferring knowledge into action: a thematic analysis of the literature. *J. Health Serv. Res. Pol.* 3, 156–164.
- Williams, S., Schaefer, A., 2013. Small and medium-sized enterprises and sustainability: managers' values and engagement with environmental and climate change issues. *Bus. Strat. Environ.* 3, 173–186.
- WWF, 2010. ¿Recuperando Bosques O Plantando Incendios?.
- Zhao, J., Xie, D., Wang, D., Deng, H., 2011. Current status and problems in certification of sustainable forest management in China. *Environ. Man* 6, 1086–1094.