



# Forest certification and its impact on business management and market performance: The key role of motivations

Mikel Zubizarreta<sup>a</sup>, Germán Arana-Landín<sup>a,\*</sup>, Waleska Siguenza<sup>b</sup>, Jesús Cuadrado<sup>c</sup>

<sup>a</sup> Business Management Department, University of the Basque Country (UPV/EHU), 20018 Donostia-San Sebastián, Spain

<sup>b</sup> Department of Public Policy and Economics History, University of the Basque Country (UPV/EHU), Bilbao, Spain

<sup>c</sup> Department of Mechanical Engineering, University of the Basque Country (UPV/EHU), 48940 Leioa, Vizcaya, Spain.

## ARTICLE INFO

### Keywords:

Forest management certification  
PEFC  
Dissemination  
Drivers  
Forest management results

## ABSTRACT

The impact of forest certification standards on firm management and market performance is analysed in this paper, so as to isolate the influence of internal (moral and learning) and external (market and signalling) sources of motivation. To do so, three propositions are formulated and then empirically tested on a sample of Spanish companies certified by the Programme for the Endorsement of Forest Certification (PEFC). In the structural model, the association of the external motivations with management performance was not confirmed, although the one of internal motivations was significant and companies certified due to internal reasons yielded greater benefits. Our results suggested that the implementation of forest certification per se will not improve overall performance. Moreover, when the standard is internally driven, it is reasonable to expect the implementation of the necessary measures to improve management performance, using the guidelines prescribed by such standard. The findings may be used to characterize certified firms and to anticipate the benefits of both the implementation and the certification of the standard, shedding light on the associations between the motivational factors and the benefits of forest certification standards, a field which has yet to be addressed.

## 1. Introduction

The Programme for the Endorsement of Forest Certification (PEFC) is the most widely implemented standard globally, covering 70% of the certified forest area worldwide (PEFC Spain, 2023). As of February 2023, there were 286 million ha of PEFC certified forest in 55 countries. In addition, 20,000 companies were PEFC Chain of Custody certified (PEFC Spain, 2023). The large market share of the PEFC in comparison with Forest Stewardship Council (FSC) certification is particularly pronounced in Spain, where 80% of the certified forest area is PEFC certified (PEFC and FSC certifications relating to 2,600,000 ha and 612,110 ha, respectively) (FSC Spain, 2023; PEFC Spain, 2023). The most representative associations within the Spanish forestry sector agreed to join the PEFC initiative, in representation of Spain, in November 1998, and in May 1999 they formed the “Association for Spanish Forest Certification” (CEF, later to be named PEFC - Spain). The Spanish Forest Certification System was first endorsed in 2002 and has been re-endorsed a further two times (PEFC Spain, 2024). PEFC certified companies within Spain have also significantly increased by 91% over the past five years.

However, the question of forest certification in Spain has been the focus of few studies (Díaz-Balteiro and García de Jalon, 2017; Gómez-Zamalloa et al., 2011; Riera et al., 2007; Zubizarreta et al., 2021; Zubizarreta et al., 2023). Their focus has been on the main factors that encourage the adoption of the PEFC standard among companies within the Spanish forestry sector and their varied motivations, depending on the characteristics of the certified companies. Zubizarreta et al. (2023) assessed whether the specific economic motivations of Spanish PEFC certified companies materialized in practice, focusing on two variables: “economic profitability” and “variation in turnover”. Even so, in no study has the association been addressed between the motivations for adopting forest certification and their associated impacts.

In the case of ISO 14001, some authors (Boiral, 2007; Heras et al., 2008; Gavronski et al., 2008; Heras-Saizarbitoria et al., 2011) have stated that the higher the degree of motivation, the greater the perceived benefits among certified companies. This result is associated with both internal, among which those related to moral and learning motivations stand out, and external motivations, including market, signalling, and legal reasoning. Moreover, another interesting area of study is to analyse which sources of motivation - internal or external - have the most

\* Corresponding author.

E-mail address: [g.arana@ehu.es](mailto:g.arana@ehu.es) (G. Arana-Landín).

<https://doi.org/10.1016/j.forpol.2024.103266>

Received 1 December 2023; Received in revised form 29 May 2024; Accepted 29 May 2024

Available online 14 June 2024

1389-9341/© 2024 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

influence on obtaining the greatest perceived benefits among certified companies. Studies of that relation in the context of the ISO 9001 and the ISO 14001 standards, (Nair and Prajogo, 2009; Heras-Saizarbitoria et al., 2011; Liu et al., 2020; Agus et al., 2020) concluded that companies that implemented and certified those standards mainly for internal reasons obtained better results than those that implemented it solely for external reasons.

Although the literature on the motivations that drive forest sector companies around the world to seek certification and on its impacts is abundant, to the best of our knowledge, the relation between motivations to seek forest certification and the impacts of certification throughout the world have not been analysed elsewhere.

Considering the above line of reasoning, the aim of this study is to analyse the relation between the motivations that drive companies to seek certification and the perceived impacts or benefits that certification may entail for companies. In addition, both the internal and the external sources of motivation to achieve certification were isolated, so as to study their influence on perceived impacts, in order to determine which sort of motivation has the greatest influence.

The remainder of this paper is organized as follows. After this introduction, an exhaustive literature review is presented on the motivations that drive companies to achieve certification and the results linked to certification. The working propositions are defined on the basis of that review, after which the research methods are described. Those methods lead on to Section 4, which is focused on the questionnaires administered to Spanish companies within the forestry sector and the analysis of their results. Finally, the conclusions and the contributions of the study are presented.

## 2. Literature review and development of propositions

### 2.1. Business case for corporate sustainability

The Business Case for Social Responsibility is among the most widely studied topics in business and society literature. It is a ubiquitous term that is collectively used to denote a variety of benefits that companies could derive from their social engagement (Panwar et al., 2017) and that can lead to better financial performance. The business case for corporate sustainability discourse emphasizes how sustainable practices can improve the financial performance of a business (Rode et al., 2021). Under this framework, the forest products industry, which previously showed some apathy towards environmental responsibility, is now recasting itself as an environmental asset, seeking to present itself as an ally in the search for innovative solutions to address climate change.

However, the existence of a business case to justify corporate sustainability initiatives has also been criticized. According to several authors (Alexander and Rutherford, 2019; Arshi et al., 2018), even though the business case approach has sparked widespread corporate interest in sustainability, it has neither led to a radical review of unsustainable business practices for most companies, nor has it resolved the main environmental challenges that threaten the planet. Corporate efforts to further sustainability that have the objective of profit generation, often promote, rather than suppress, unbridled consumerism, which is according to Fuchs et al. (2021), the fundamental cause of environmental unsustainability. As stated by Busch et al. (2023), the idea that companies voluntarily resolve environmental crises appears risky. The vision of a single business case for sustainability that is limited to short-term financial gains is too limited in scope and its impact is too weak to address the enormous environmental challenges that are looming on the horizon.

Even so, there are authors who are less pessimistic. According to several authors (Scherer et al., 2013; Haigh and Hoffman, 2014; Busch et al., 2023; Arana-Landin et al., 2024), companies are drivers of innovation, but governments, regulators and non-governmental organizations also play an important role in this context. Stakeholder-oriented business development is an effective means of addressing sustainability

issues, by involving stakeholders on the path towards the creation of solutions to current sustainability problems. However, there is a critical need to expand the concept to differentiated types of business cases for sustainability, and there are reasons to remain optimistic about the role of business when addressing sustainability challenges.

### 2.2. Forest sector

Growing public interest and global awareness of environmental and social issues have also intensified pressures on companies within the forestry industry in their efforts to balance potentially conflicting stakeholder demands effectively. Market-based solutions, such as forest certification programs, are commonly used to encourage companies to take action, to avoid environmental problems such as biodiversity loss and deforestation. However, companies often have no clear strategy for the creation of short-term financial benefits that are sufficient to offset the economic costs of either conserving biodiversity or alleviating deforestation. Instead, the financial benefits of certification programs are often indirect and, whether or not linked to substantial investments, exercise influence on consumer perceptions, in an area where the symbolism of approved trademarks may be sufficient (Wolff and Schweinle, 2022; Zubizarreta et al., 2023). Some authors (Buxton, 2021; Barnett et al., 2021) concluded that market-based mechanisms were ineffective at inciting companies to act voluntarily in ways that might reverse the challenges of large-scale forest degradation, even if they provide financial benefits to the companies. Barnett et al. (2021) noted faltering investments in sustainability, beyond those environmental problems for which interventions were direct and relatively quick in financial terms.

Pirard et al. (2023) analysed the potential of mixing public and private policies with the concept of hybrid governance in the case of the forestry sector. Their conclusions were that hybrid governance, which should not translate into a mere accumulation of public and private components, provides flexibility to adapt to changing sustainability concerns and can mean that public and private entities mutually compensate their respective weaknesses. According to Dobrynin et al. (2020), multi-stakeholder forest governance requires state, company and NGO action, as well as the involvement of local communities, to participate in hybrid modes of governance. It requires the configuration of environmentally responsible subjects and the creation of mutual consent regarding forestry problems and objectives. However, the authors recognize that there is still a lack of clear legislative, technical, and administrative support in situations where “responsibilization” in forest governance requires citizens and communities to assume responsible for resource sustainability.

The following sections present the results of the literature review on the motivations that drive owners and companies in the forestry sector to implement sustainable forest management and chain of custody certifications, and the perceived impacts.

### 2.3. Motivations that drive forest certification

The main empirical studies on the motivations that drive forest certification are summarized in Table 1. Information was collected on the country of each study, the forest certifications that were analysed, the sample of companies, the methodology used in each study, and the main motivations identified in each of the works.

Having identified and analysed the main motivations, the conclusion was that they can be ascribed to 3 external and 2 internal groups related to motivation, 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 those models, the companies that participate in forest certification do so due to the economic benefits that may be achieved within the market, the possibility of improving production efficiency, the expected social returns, and a sense of morality or ethics when taking business decisions (Galati et al., 2017).

**Table 1**  
Main drivers for forest certification.

Year	Reference	Country	Certification	N	Type of study - Methodology	Market	Signalling	Legal	Moral	Learning
2001	(Takahashi, 2001)	Japan and Canada	ISO 14001, FSC, CSA	193 firms	Survey-based study of firms + Probit regression	X	X		X	X
2003	(Hartsfield and Ostermeier, 2003)	Mexico, CA and USA	FSC	69 survey responses	Survey-based study of 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 et al., 2005)	Canada, USA, Germany	ISO 14001, FSC	143 Canadian, 283 US, and 134 German firms	Survey-based study of 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 & NGOs		X			X
2005	(Vidal et al., 2005)	North America	FSC, CSA, SFI, PEFC	158 firms	Survey-based study of firms + cluster analysis + functional determinant analysis	X	X			X
2006	(Overdevest and Rickenbach, 2006)	USA	FSC	67 survey responses	Survey-based study of firms + EFA + IPA cumulative logit regression	X	X			X
2006	(Owari et al., 2006)	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-based study of firms + SPSS statistical software analysis	X				X
2008	(Tikina et al., 2008)	OR and WA (USA)	ATFS, SFI, FSC	353 survey responses	Survey-based study of forest management agencies + standard logistic regression analysis	X				
2009	(Araujo et al., 2009)	Brazil	Cerflor, FSC	48 survey responses	Survey + EFA+ IPA		X			X
2009	(Cubbage et al., 2009)	Argentina, Brazil, Chile, the USA, and Canada	SFI, FSC, CSA, CERFLOR, CERTFOR	81 firms based in the USA and Canada, 48 in Brazil, 7 in Argentina, and 3 in Chile	Mixed methods of personal interviews & email surveys + simple summary statistics	X	X		X	
2009	(Ebeling and Yasué, 2009)	Ecuador and Bolivia	FSC	78 semi-structured interviews	Interviews with government, timber industry, NGOs, forest communities, and landholders	X	X	X		
2009	(Paluš 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	
<b>Year</b>	<b>Reference</b>	<b>Country</b>	<b>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>
2010	(Cubbage et al., 2010)	Argentina, Chile	FSC, CERTFOR	10 firms based 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	(Scheppers, 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 + CVM	X				X

(continued on next page)

Table 1 (continued)

Year	Reference	Country	Certification	N	Type of study - Methodology	Market	Signalling	Legal	Moral	Learning
2011	(Suryani et al., 2011)	Malaysia	MTCC	23 firms	Mixed-mode technique of personal & 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-based study of U. S. hardwood lumber manufacturers + statistical analysis	X	X			
2013	(Ulybina and Fennell, 2013)	Russia	FSC, PEFC	107 interviews	Qualitative methods: interviews & 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-Rank Test)	X	X	X	X	X
2015	(Lewis and Davis, 2015)	Malaysia	MTCS	8 timber-producing Forest Management Units	Archival research combined with data collected during 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
2016	(Tuppura et al., 2016a, 2016b)	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 with experts	Comparative case-study approach + data triangulation from multiple sources	X				X
2017	(Galati et al., 2017)	Italy	FSC	86 survey responses	FSC certified company manager surveys + descriptive statistics analysis	X	X	X	X	X
2017	(Paluš et al., 2017)	Czech and Slovak Republics	PEFC, FSC	131 survey responses	CoC certified firm surveys + Mann-Whitney U 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-based study of 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			
<b>Year</b>	<b>Reference</b>	<b>Country</b>	<b>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>
2018	(Paluš et al., 2018b)	Eastern Europe	PEFC, FSC	744 survey responses	Survey-based study of firms + multivariate analysis of variance	X	X			
2018	(Paluš et al., 2018a)	Slovakia	PEFC, FSC	273 survey responses	Survey-based study of land owner + Mann–Whitney U 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	Survey-based study of landowners + 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 of firms + non-parametric Kruskal Wallis ANOVA test & Mann-Whitney U test	X	X			
2021	Zubizarreta et al., 2021	Spain	PEFC	124 survey responses	Descriptive and cluster analysis	X	X		X	
2022	Malek, 2022	Worldwide	PEFC, FSC	n/a	Literature review	X	X	X	X	X
2022	George et al., 2022	Northeast U.S.	FSC, SFI, ATFS, PEFC	157 survey responses	Survey + descriptive statistics	X	X		X	

Note: ATFS = American Tree Farm System; CERFLOR = Brazilian forest certification programme; CVM = Contingent Valuation Method; EFA = Exploratory Factor Analysis; FSC=Forest Stewardship Council; IPA = Interpretative Phenomenological Analysis; ISO=International Standards Organization; PEFC=Programme for the Endorsement of Forest Certification; SFI=Sustainable Forestry Initiative. Source: Authors' own work.

### 3. External motivations

#### 3.1. Market motivation

The market mechanism is one of the main motivations for adopting forest certification (Ulybina and Fennell, 2013; Halalisan et al., 2019; Zubizarreta et al., 2021; Malek, 2022; George et al., 2022), because it can drive company expansion into other markets and can represent a competitive advantage. Furthermore, certification, especially when a requirement, is often an important driver for entry into foreign markets.

#### 3.2. Signalling motivation

Another important driver described in the literature is the signalling mechanism, the intention of which is to gain legitimacy with direct external customers, and environmental stakeholders (Hartsfield and Ostermeier, 2003; Marx and Cuypers, 2010; Chen et al., 2011; Faggi et al., 2014; George et al., 2022; Malek, 2022). Forest certification may indeed signal a degree of confidence, so that external parties, such as buyers and environmental groups, trust in the high ecological standards of a company and their fulfilment over time, (Overdevest and Rickenbach, 2006; Zubizarreta et al., 2021).

#### 3.3. Legal motivation

Regulation has been identified by various authors (Doonan et al., 2005; Cashore et al., 2006; Auld et al., 2008; Ebeling and Yasué, 2009; Galati et al., 2017; Malek, 2022) as a driver of forest certification. The concept here refers to legal compliance with mandatory regulations. Currently timber exporters are required to demonstrate the legality of their products. In that regard, forest certification meets fundamental timber legality requirements and provides a meaningful indication of legality.

### 4. Internal motivations

#### 4.1. Moral motivation

The moral mechanism reflects the choice of decision makers according to their individual ethical values (Galati et al., 2017; Zubizarreta et al., 2021; George et al., 2022). Williams and Schaefer (2013) identified the values and commitment of managers of small and medium-sized enterprises within England as two of the most cited motivations. Takahashi (2001) and Zubizarreta et al. (2021) also highlighted moral mechanisms among the main drivers of certification that they identified, in the specific cases of the forestry industry in Japan, Canada, and Spain.

#### 4.2. Learning motivation

Learning mechanisms integrate motivations to transfer knowledge and skills within companies through both the adoption and the certification of forest management systems.(Overdevest and Rickenbach, 2006; Malek, 2022). Overdevest and Rickenbach (2006) and Hälälışan et al. (2021) identified certification as a technology transfer model in which ecologically based knowledge and practices are transferred from ecologists to foresters and forest industry agents. In that way, companies are encouraged to establish explicit objectives that are in harmony with ecological standards throughout their day-to-day operations. Independent auditors monitor the implementation of those practices and require companies to implement changes that are based on the results of those processes. The feedback resulting from that dynamic created conditions that were conducive to learning processes within companies (Halalisan

et al., 2023).

#### 4.3. Economic and operational performance improvement related to forest certification

Table 2 summarizes the main empirical studies on the economic and the management-related impacts of forest certification. It includes references to both the primary papers under analysis and some studies added to the study sample, in which the influence on market access and process management improvement is analysed.

#### 4.4. Operational performance improvement related to forest certification

Cashore et al. (2006) identified improved production efficiency as one of the benefits of forest certification. Auld et al. (2008) also identified improved management as a key benefit in their literature review. Moore and Cabbage (2012) obtained similar results in their study focused on the United States and Canada. In two studies with different authors, Paluř et al. (2018a), (Paluř et al., 2018b) studied, respectively, forest management certification in Slovakia, and in Croatia, Czech Republic, Poland, Serbia, Slovakia, and Slovenia. They identified the following positive impacts: penetration of new markets, increased sales volumes, and increased profit margins. With a focus on Chile, Tricallotis et al. (2018) concluded that forest certification had improved the associations between forestry companies and their stakeholders, moving to more multicentric governance, shared between various interested parties. In the study of George et al. (2022) the following were identified: better internal documentation, record keeping, and consistency of implementation. Malek (2022) identified improvements to business management and increased exports, in addition to economic and social impacts, which generated increased income.

#### 4.5. Economic impacts of forest certification

Burivalova et al. (2017) concluded that although most studies cited market access and price premium as impacts, they rarely met the expectations of forest managers (Burivalova et al., 2017). Access to new markets and the price premium were also identified as key impacts within different regions, such as China (e.g., Wang et al., 2005; Yuan and Eastin, 2007; Zhao et al., 2011; He et al., 2015), Europe (Oy, 2005; Lidestav and Lejon, 2011; Paluř et al., 2018a), and North America (Hayward and Vertinsky, 1999; Espinoza et al., 2012; Moore et al., 2012).

In most studies, access to new markets has been identified as a key impact of certification, which is related to a better corporate image and credibility in international markets (Oy, 2005; Butterfield et al., 2005; Cabbage et al., 2010; Moore et al., 2012; Paluř et al., 2018a; Paluř et al., 2018b). Non-economic benefits have also been identified in various studies as key impacts, such as market recognition and external credibility (Cabbage et al., 2010; Paluř et al., 2018a), signalling and learning (Araujo et al., 2009), and better stakeholder relations (Halalisan et al., 2019), which can also contribute to the economic viability of a company.

Even so, price premiums are not often achieved for certified forest products (Tricallotis et al., 2018). Bouslah et al. (2010) highlighted that forest certification had no positive short-term impact on the financial performance of companies in Canada and the US, regardless of the certification system adopted. It was suggested in other studies that certified companies benefitted from market access, but obtained no greater economic return in terms of pricing premiums. Evidence of that situation can be found in Europe (e.g., Dias et al., 2013; Halalisan et al., 2013; Hirschberger, 2005; Gulbrandsen, 2005), South America (e.g.,



**Table 2**  
Economic and Operational performance improvement related to forest certification.

Year	Reference	Country	Analysed Certification	N	Type of study – Methodology	Economic – Market access	Economic – Price premium	Process management improvement
1999	(Thornber et al., 1999)	Worldwide	FSC	Discussion paper	Literature Review	–	–	
1999	(Hayward and Vertinsky, 1999)	USA	FSC	20 certified forest owners	Qualitative methods: structured interviews	X	X	X
2001	(Wilson et al., 2001)	Canada	ISO 14,001, CSA, FSC, FORESTCARE	117 companies	Survey + descriptive statistics	X		X
2001	(Bass, 2001)	Worldwide	FSC	156 FSC certificates + Field case studies + interviews	Qualitative methods	–	–	X
2003	(Rametsteiner and Simula, 2003)	Europe	FSC, PEFC	130 CARs	Literature Review	X		X
2005	(Vidal et al., 2005)	North America	FSC, CSA, SFI, PEFC	158 firms	Survey-based study of firms + cluster analysis + determinant function analysis	–	–	–
2005	(Butterfield et al., 2005)	North America and Europe	FSC, SFI, PEFC	6 company case studies	Qualitative methods: interviews	X		X
2005	(Oy, 2005)	Finland, Sweden, Norway	FSC, PEFC	3 selected pilot regions	Questionnaires + Interviews with forestry authorities	X	X	X
2005	(Newsom et al., 2005)	21 countries	FSC	129 certified operations	Descriptive statistics			X
2005	(Nebel et al., 2005)	Bolivia	FSC	FSC, SRA, Bolivian chamber of commerce (foreign industry) data	Descriptive statistics	X	X	
2005	(Gulbrandsen, 2005)	Norway, Sweden	FSC, PEFC	2 forest markets	Comparison analysis	X		X
2005	(Hirschberger, 2005)	6 EU countries	FSC	2817 CARS	Document analysis	X		X
2005	(Wang et al., 2005)		FSC, Smartwood				X	
2006	(Cashore et al., 2006)	Worldwide	SFI, FSC, PEFC, CSA	16 case studies	Case studies + Qualitative research	X	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>Economic – Market access</b>	<b>Economic – Price premium</b>	<b>Process management improvement</b>
2007	(Yuan and Eastin, 2007)	China	FSC	41 companies	Case Study	X	X	
2008	(Auld et al., 2008)	Worldwide	SFI, FSC, PEFC, CSA	n/a	Literature review	X		X
2009	(Araujo et al., 2009)	Brazil	Cerflor, FSC	48 survey respondents	Survey + EFA + IPA	X		X
2009	(Barbosa de Lima et al., 2009)	Brazil	FSC	7 FSC certified & 7 non-certified firms	Field observations and interviews using structured questionnaires	X		X
2009	(Peña-Claros et al., 2009)	Tropical Regions	FSC	138 CAR reports from 213 certified FMU-s	Statistical analysis (Chi square, multiple regression analyses...)	X		X
2009	(Ebeling and Yasué, 2009)	Ecuador and Bolivia	FSC	78 semi-structured interviews	Interviews with government, timber industry, NGOs... Event-study methodology	X		
2010	(Bouslah et al., 2010)	Canada and the USA	FSC, SFI, CSA, ISO14001	160 third-party certification events				
2010	(Cubbage et al., 2010)	Argentina, Chile	FSC, CERTFOR	10 firms	Managers' opinions + secondary data from audit reports	X		X
2011	(Lidestav and Lejon, 2011)	Sweden	FSC, PEFC	449 forest owners	Analysis of 2 datasets + survey + binary logistic regression	X		X
2011	(Zhao et al., 2011)	China	FSC	1 Case study	Document analysis + case study	X	X	
2012	(Espinoza et al., 2012)	USA	SFI, FSC, ATFS, PEFC	137 U.S. hardwood lumber producers	Survey + statistical analysis	X	X	
2012	(Moore et al., 2012)	USA and Canada	FSC, SFI	92 SFI and 98 FSC certified firms	Survey + statistical analysis	X	X	X
2013	(Ulybina and Fennell, 2013)	Russia	FSC, PEFC	107 interviews	Qualitative methods: interviews, and participatory observation	X		

(continued on next page)

Table 2 (continued)

Year	Reference	Country	Analysed Certification	N	Type of study – Methodology	Economic – Market access	Economic – Price premium	Process management improvement
2013	(Dias et al., 2013)	Portugal	FSC	209 species and 86,582 ha of savannah	National Forest Inventory data + FSC certified area analysis	X		
2013	(Halalisan, AF et al., 2013)	Romania	FSC	70 CoC certified firms	K-means cluster analysis	X		
Year	Reference	Country	Analysed Certification	N	Type of study – Methodology	Economic – Market access	Economic – Price premium	Process management improvement
2015	(Narasimhan et al., 2015)	USA	FSC, ISO 14001	59 firms	FSC Certificate + Compustat data analysis + Event Study Method	X		X
2015	(He et al., 2015)	China	FSC	20 forest stakeholders	Case study	X	X	
2016	(Nordén et al., 2016)	Sweden	FSC, PEFC	1240 plots +327 survey respondents	Descriptive statistics	X		
2017	(Burivalova et al., 2017)	Africa, Asia, and America	FSC	50 studies	Literature Review	X	X	
2018	(Paluš et al., 2018a)	Slovakia	PEFC, FSC	273 survey respondents	Survey-based study of land owners + Mann–Whitney U test + Chi-square test	X	X	X
2018	(Tricallotis et al., 2018)	Chile	FSC, PEFC	72 Chilean forestry sector actors	Qualitative research: in-depth interviews	X		X
2022	Malek et al., 2022	Worldwide	PEFC, FSC	n/a	Literature review	X	X	X
2022	George et al., 2022	North-east USA	FSC, SFI, ATFS, PEFC	157 survey responses	Survey + descriptive statistics	X		
2023	Zubizarreta et al., 2023	Spain	PEFC	988 companies	Longitudinal study using information on databases.			

Note: ATFS = American Tree Farm System; EFA = Exploratory Factor Analysis; FSC=Forest Stewardship Council; IPA = Interpretative Phenomenological Analysis; ISO=International Standards Organization; PEFC=Programme for the Endorsement of Forest Certification; SFI=Sustainable Forestry Initiative. Source: Authors' own work.

Ebeling and Yasué, 2009; Tricallotis et al., 2018; Barbosa de Lima et al., 2009; Araujo et al., 2009), and North America (e.g., Butterfield et al., 2005b; Narasimhan et al., 2015; Wilson et al., 2001).

There are only a few studies on forest certification and its impact on the economic profitability or turnover of certified companies. A highly relevant aspect of most of the studies was their assessment of the economic impact of forest certification using qualitative methods, such as in-depth questionnaires and interviews, often in combination with statistical analysis.

Frey et al. (2018) concluded that forest certification was profitable in Vietnam yielding sale prices of more than 20% for certified wood. Tham et al. (2021) found that the certified wood value chain was financially profitable in the case of Vietnam. In Sweden, around 37% of the forest owners who were surveyed considered that forest certification had a positive effect on profitability (Lidestav and Lejon, 2011).

Zubizarreta et al. (2023) could not confirm a treatment effect between forest certification and better financial performance. Instead, a positive selection effect was found: companies with better financial performance had a higher propensity to certify.

#### 4.6. Associations between the motivations to apply for forest certification and its benefits

As can be concluded from the literature review, the motivations that drive forest certification, whether internal or external, are varied, and there is no clear predominance of one over the others. The objective of this study is to analyse the relation between those motivations and the impacts attributable to forest certification. To do so, it is necessary to study the relation between complex and interrelated aspects, such as perceived motivational factors and perceived results and impacts.

In the analysis of that relation in the case of the ISO 14001 standard, most authors (Tibor and Feldman, 1996; Woodside et al., 2004; Boiral,

2007; Heras-Saizarbitoria et al., 2011) claimed that more motivated companies obtained greater benefits as a consequence of adopting the standard. Other empirical studies, found that the higher the degree of motivation - whether internal (e.g., improvements to company internal efficiency) or external (e.g., customer demand) - the higher the number of perceived benefits that the certified companies acknowledged (Hillary, 2000; Darnall et al., 2000; Kitazawa and Sarkis, 2000; Boiral, 2007; Heras et al., 2008; Heras-Saizarbitoria et al., 2011).

In the literature, the effects of motivations on management results and by extension on market results when implementing standardized management systems have also been studied in numerous articles. The extensive literature on those associations and on the adoption of management systems based on the main standards within companies is noteworthy. Among them, the following are worth highlighting:

- ISO 9001 (Tarí et al., 2012; Valmohammadi and Kalantari, 2015; Del Castillo-Peces et al., 2018).
- OSHAS 18001 (Abad et al., 2013; Lo et al., 2014).
- ISO 14001 (Terziowski et al., 2003; Boiral, 2007; Heras et al., 2008; Gavronski et al., 2008; Heras-Saizarbitoria et al., 2011).
- ISO 14006 (Landeta-Manzano et al., 2015, 2017).
- ISO 26000 (Castka and Balzarova, 2008; Castka and Balzarova, 2010; Moratis and Cochiuș, 2017).
- Integración ISO 9001 e ISO 14001 (Nair and Prajogo, 2009; Heras-Saizarbitoria et al., 2011; Liu et al., 2020; Agus et al., 2020)

In addition, the associations between forest management standards and the previously mentioned management standards in the context of both the motivations and the effects of their adoption is notable at a general level. Closer links were found with environmental management standards. Specifically, both the motivations and the impacts were separately analysed at the forestry level in numerous studies. In the case

of PEFC, there are 5 groups of motivations highlighted in the literature: market, signalling, legal, moral, and learning (Zubizarreta et al., 2021). Those five groups of motivations are also highlighted in the case of ISO 14001 and other environmental standards, such as EMAS (Eco-Management and Audit Scheme) (Heras-Saizarbitoria et al., 2011; Heras-Saizarbitoria et al., 2016a, 2016b). The motivations for adopting and certifying forest management systems and environmental management systems based on ISO 14001 have also been compared in previous studies, in which most followed the same pattern, although a few differences were detected (Tuppura et al., 2016a, 2016b).

With regard to the effects of adopting and certifying forest management systems, in addition to the specific environmental management results, two main groups stood out among the results of companies when adopting environmental management systems: management results associated with the internalization of the standard and market results. Specifically, since the first studies on the effects of adopting the ISO 14001 standard, Renzi and Capelli (2000) and later Gu et al. (2008), have pointed to the way that its adoption has improved the business management system, favouring the data control and handling that in turn favours management and helps to improve business competitiveness and market positioning. Subsequently, Heras-Saizarbitoria et al. (2016a, 2016b) highlighted that the motivations for adopting EMAS, especially internal motivations, influenced the extent to which management improvements were achieved and internalized, pointing out that those factors affected market performance.

In contrast, Heras-Saizarbitoria et al. (2011) offered somewhat differing results. Specifically, they found that only the internal motivations affected management performance. However, external motivations also affected market outcomes related to competitiveness and were positively correlated with improved management performance measured in terms of a reduction of environmental problems.

Considering those patterns, the theoretical arguments have led to the following propositions, in order to find out whether the previous associations can be replicated and confirmed in the case of forest certification:

**Proposition 1.** External sources of motivation will be positively associated with management performance of forest certification.

**Proposition 2.** Internal sources of motivation will be positively associated with management performance of forest certification.

Moreover, another interesting area of study could be to analyse whether the management performance of forest certification is positively related to the market performance. That is, to analyse the mediating effect of management results between motivations and market results. In that context, some authors (Prajogo, 2009) affirmed that the improvement of business performance requires that the basic principles of forest management systems be oriented towards the improvement of product quality, cost reduction, delivery improvement, and innovation performance. Therefore, the improvement in commercial performance could be the result of the improvement of operations and business management. Furthermore, some other authors (Heras-Saizarbitoria et al., 2011; Díaz de Junguitu and Allur, 2019; Tayo Tene et al., 2021) confirmed that internal drivers led to better management results that contributed to better market performance in the case of the ISO 14001 standard. Thus, the aim of that proposition is to analyse the association between management and market performance, leaving the direct influence of motivations on market performance out of the analysis.

**Proposition 3.** The management performance of forest certification will be positively associated with market performance.

## 5. Methods

### 5.1. Survey design

The questionnaire design included four fundamental parts. The first

part collected general information, maintaining the anonymity of the respondent companies, and to avoid bias that might arise from greater or lesser response rate frequencies, depending on company characteristics. General information was collected, in which the size of the company, its activity, and date of certification were analysed. In the second, the main motivations, according to the PEFC standard, that have led companies down the path towards forest certification were included. Based on a previous analysis of the literature (Zubizarreta et al., 2021), the motivations were divided into two main groups depending on whether they arose from either external or internal factors. Specifically, within the external factors, reputation and corporate image, customer demands, and legal aspects were analysed, and among the internal factors, those related to moral awareness of the environment and learning and continuous improvement were analysed. In the third, the focus was on the management performance. In that case, the benefits that influenced the improvement of processes and product management were analysed. Finally, the benefits related to the market were studied, drawing a distinction between the benefits that influenced product prices and market share. In all cases, respondents were expected to select between 1-to-5 points on a Likert-type scale. Measurement scales of this type that measure perceptions are often used in the empirical literature on management and are considered to meet the criteria of reliability and validity (Ketokivi and Schroeder, 2004). The survey itself set out in Spanish the meaning of each of the 5 points on the rating scale, as an aid to its understanding, following the guidelines indicated by Corvelec (Corvelec, 2018). In addition, in order to obtain more information on the main internal and external sources of motivation and the main impacts on management and market results, the survey included open-ended questions, in order to gain a more precise understanding. Those open-ended questions were asked beforehand, so that the subsequent content of the survey could not influence their perceptions. Subsequently, in a second phase, it was found that the open questions yielded heterogeneous results, but in 96.77% of cases corresponded to the survey items. It was then confirmed that those survey items were the most highly rated in all cases, which upheld the internal consistency of the data, although it was true that, in some cases, they shared the highest value with another items (Taylor et al., 2007; Chakraborty and Biswas, 2019).

### 5.2. Data collection

The questionnaire was sent to the 1194 companies that had gained certification in 2019. The respondents were informed of the research protocol. The aim was to collect information from companies with some experience working with a certified forest management system, in order to measure the results. In addition, the protocol guaranteed the anonymity of the companies that responded to the questionnaire at all times. Specifically, 124 companies responded to the questionnaire, i.e., a response rate of 10.38%, which yielded an error of less than 8.4% at a confidence level of 95%.

The bilateral Chi-square independence test was performed to avoid any possible bias. With this objective in mind, the proportional differences between the universe (1194) and the sample (124) were analysed, transforming the variables with a binomial function according to whether or not they belonged to each specific group. Specifically, both size and activity were analysed, by classifying the companies into micro (10 or less), small (11-to-50), medium (51-to-250), and large (251 or more employees) companies, and taking into account whether their activities were forest work, first transformation, or second transformation groups. In the first step of the test, the data files containing the data of the certified companies, sourced from PEFC Spain, were previously cross-checked with the SABI database (an economic-financial information database of the Van Dijk Bureau). In the second, the results of the universe from the cross-checked files were compared with the results of the sample calculated on an Excel file generated with the answers to the questionnaire. Through those tests, any bias linked to the different group compositions and in relation to size and activity was



ruled out.

In addition, a reliability analysis to measure the internal consistency of each of the factors supported by the observable variables is presented in Table 3. In the analysis, the external motivations factor values never reached the necessary minimum values to uphold the internal consistency of the data. The legal motivations variable was therefore excluded from the construct, because its rating was significantly lower in relation to the other items, it had a different pattern of variation, in relation to both the other motivations and the open-ended questions, and in no case had it been chosen as the main motivation. Having withdrawn the legal variable as an external motivation, Cronbach's Alpha yielded a value higher than 0.7 in all cases, which is defined in the literature as an adequate value. (Robinson, 1991).

Finally, common method bias was tested using Harman's post hoc test of individual factors. In that test, the factor with the highest value explained 38.18% of the variance, i.e., it explained less than 50%, fulfilling the requirements specified in the work of Podsakoff and Organ (1986).

### 5.3. Statistical analysis

The statistical study was divided into two main parts. In the first part, the descriptive analysis was performed using version 28 of the SPSS Software. It included a study of motivations and results sorted in accordance with company characteristics and two studies of the results in terms of company motivations. The first one followed the classification used in previous studies on ISO 9001 (Boiral and Roy, 2007) and ISO 14001 (Boiral, 2007; Heras-Saizarbitoria et al., 2011), in which adoption processes were classified as mobilizing, proactive, ritual, and reactive, depending on the importance of the external and internal motivations.

In the second part, despite not being able to affirm the causality of the relationships, as it was not possible to certify the non-existence of other determining factors, a Structural Equation Model (SEM) was implemented, in order to contrast the propositions based on the theoretical arguments, with the aim of confirming the associations. To that end, the guidelines set out by Byrne (2013) were followed using the EQS software to confirm the associations obtained at the theoretical level based on the motivations and the effects of adopting management standard certifications. SEM is a multivariate statistical analysis technique with various statistical tests that can be used to determine the adequacy of the model that is fitted to the data (Bollen, 1989). This technique, incorporating observable and latent variables, serves to represent (Shahangian et al., 2021), to estimate (Hurlimann et al., 2008), and to test (Doria et al., 2009) the structural associations of a model. Its two fundamental parts are for measurement and for structural purposes (Shahangian et al., 2021). As Mueller (2012) pointed out, this type of model has a great advantage, in so far as it can be used to

**Table 3**  
Latent and observed variables.

Factors	α Cronbach	Included observable variables	Excluded observable variable
External motivations	0.750	Reputation and corporate image Customer demands Moral awareness of the environment	Legal
Internal motivations	0.722	Learning and continuous improvement Process management improvement	
Management Performance	0.979	Product management improvement	
Market Performance	0.775	Increase in sales Increase in price	

evaluate and to confirm the type and the direction of the associations expected to be found between the variables of the model, in order subsequently to estimate the parameters of the proposed associations on the basis of theoretical studies. Hence, they are usually referred to as confirmatory models, since the fundamental interest is through the analysis of the sample to “confirm” the associations proposed based on the explanatory theory that was chosen as a reference (Byrne, 2013; Mueller, 2012).

In the SEM models, it is commonly accepted that the minimum sample size depends on the characteristics of the model (Kline, 2011). There are several methods to indicate the minimum value of N. Among those methods, the ratio obtained from the ratio between N and the number of estimated parameters (in our study 124/21 = 5.9) has to be larger than 5 (Worthington and Whittaker, 2006), the ratio between N and the number of measured indicators (124/8 = 15.5) has to be greater than 15 (Hair et al., 2014), or the ratio obtained from the ratio between N and the observed variables plus the number of latent constructs (124/12 = 10.33) has to be larger than 8 (Catena et al., 2003). In addition, the approach of MacCallum et al. (1996), based on the overall fit of the model measured by the RMSEA index, an indicator that is affected by the sample size, is worth mentioning. Specifically, an optimal fit of the RMSEA yielded a value of below 0.05 in the literature, as was the case in this study where the value was 0.034 (Lee and Cai, 2012; Steiger, 2007).

In our study, the measurement part was used to apply a confirmatory factor analysis to examine the associations between the latent and the observed variables (Ross et al., 2014). The following equations were formulated:

$$(M_1) \text{ Reputation and corporate image} = \tau_1 * \text{External motivations} + \iota_1 * \text{Error}_1.$$

$$(M_2) \text{ Customer demands} = \tau_2 * \text{External motivations} + \iota_2 * \text{Error}_2.$$

$$(M_3) \text{ Moral awareness of the environment} = \tau_3 * \text{Internal motivations} + \iota_3 * \text{Error}_3.$$

$$(M_4) \text{ Learning and continuous improvement} = \tau_4 * \text{Internal motivations} + \iota_4 * \text{Error}_4.$$

$$(M_5) \text{ Process management improvement} = \tau_5 * \text{Management Performance} + \iota_5 * \text{Error}_5.$$

$$(M_6) \text{ Product management improvement} = \tau_6 * \text{Management Performance} + \iota_6 * \text{Error}_6.$$

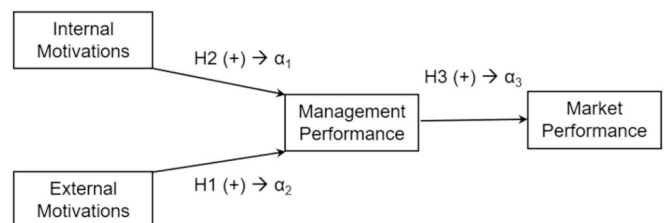
$$(M_7) \text{ Increase in sales} = \tau_7 * \text{Market Performance} + \iota_7 * \text{Error}_7.$$

$$(M_8) \text{ Increase in Price} = \tau_8 * \text{Market Performance} + \iota_8 * \text{Error}_8.$$

$\tau_1, \tau_2, \tau_3, \tau_4, \tau_5, \tau_6, \tau_7$  and  $\tau_8$ , and  $\iota_1, \iota_2, \iota_3, \iota_4, \iota_5, \iota_6, \iota_7$  and  $\iota_8$  are the coefficients used to measure the degree to which the latent variables can be related with the observable variables and the errors, respectively.

The structural part, represented in Fig. 1, was intended to analyse the 3 stated propositions. For that reason, the first structural equation captures the associations of internal and external motivations with management performance. The second structural equation includes the association between management performance and market performance. The association of motivations with market performance is only analysed indirectly, as authors such as Prajogo (2009) and Tayo Tene et al. (2021) pointed out that the influence of motivations on management performance affected market performance.

$$(S_1) \text{ Management Performance} = \alpha_1 * \text{External motivations} + \alpha_2 *$$



**Fig. 1.** Structural equation model showing the propositions. (Source: Authors' own work. Note: Solid lines show propositions P1, P2 and P3. The + sign represents a positive association between two variables.)

Internal motivations +  $\beta_1$  \* Distortion<sub>1</sub>.

$$(S_2) \text{ Market Performance} = \alpha_3 * \text{Management Performance} + \beta_2 * \text{Distortion}_2.$$

$\alpha_1, \alpha_2$  and  $\alpha_3$  are the coefficients used to measure the degree to which the latent variables can be used to test the propositions, and  $\beta_1$  and  $\beta_2$  are indicators of the relation between the dependent factors and the distortions.

## 6. Results

### 6.1. Descriptive analysis

Table 4 shows the mean and standard deviations of the observable variables, depending on the characteristics of the firms. It can be seen that the companies rated the motivations section higher than the results section. Specifically, the means obtained for the evaluation of motivations were between 3 (medium) and 4 (high), while the benefits were between 2 (low) and 3 (medium). Among the motivations, the ratings of the variables “reputation and corporate image”, and “moral awareness of the environment” stand out with values of 3.8 and 3.6, respectively. Among the results, the value of the “increase in price” (2.2) variable was notably negative.

In relation to the influence of company characteristics on the results, it was observed that the smaller companies valued two internal motivations –“moral awareness of the environment” and “learning and continuous improvement”-, significantly more than the larger companies. In addition, they also valued the management result –“process management improvement” and “product management improvement”-, more positively. In relation to activity, significant differences were detected in relation to the results. Specifically, the companies engaged in Forest Work, despite being a small sample of only 17 companies, yielded significantly higher scores across the board in the results that were analysed. Average scores of 3.5 or higher were given to the four variables under analysis and a significant difference of 0.8 or higher with respect to the mean scores of the other companies.

The structural part is used to analyse the influence of motivations on the results. Specifically, the sample was divided into four groups, each one representing the various motivations of the companies when adopting and certifying their forest management systems, following the classification of Boiral and Roy (2007). Applying the Kruskal-Wallis H-test, it was observed that the results were not homogeneously distributed in the four motivation groups under analysis. Specifically, the best

results for “product management improvement” and “increase in price” variables were linked to the mobilizing integration group (high level of external and internal motivations), which also achieved the best results for “process management improvement” together with the companies forming the proactive integration group (low level of external motivations and high level of internal motivations) (see Table 5). However, the best results for the “increase in sales” variable corresponded to the ritual integration group (high level of external and low level of internal motivations), closely followed by the mobilizing integration group. Finally, it was noteworthy that the lowest scores for all four variables corresponded to the reactive integration group (low level of internal and external motivations).

### 6.2. Structural equation modelling

SEM was conducted adopting the Maximum Likelihood Solution (MLS). The research model included four factors to test the propositions. In addition, 8 observed variables were included. The fitness analysis of the model started with the calculation of the Chi-square. The value was 17.254 for 14 degrees of freedom, which implied a *p*-value of 0.243 that was higher than 0.05. The goodness of fit is depicted in Table 7. Joreskog- Sorbom's Goodness of Fit Index (GFI), Joreskog- Sorbom's Adjusted Goodness-of-Fit Index (AGFI), the Comparative Fit Index (CFI), the Bentler-Bonett Normed Fit Index (NFI), and the Bentler-Bonett Non-Normed Fit Index (NNFI), all yielded optimal values that were higher than 0.9 (Müller et al., 1999). In addition, the standardized root mean residual (SRMR) and the root-mean-square error approximation (RMSEA) had low levels of 0.043 and 0.034, respectively (Müller et al., 1999). Measurement of the reliability of the model yielded an optimum Cronbach's Alpha (0.886) and RHO coefficient (0.932) (Fornell and Larcker, 1981).

The measurement component was explained by the standardized equations (from M1 to M8). As may be seen, the *R*<sup>2</sup> varied between 0.392 and 0.950, so the percentage of variance explained varied between adequate values higher than 30% (M<sub>2</sub>, M<sub>3</sub>, M<sub>5</sub> and M<sub>6</sub>) and optimal values higher than 55% (M<sub>1</sub>, M<sub>4</sub>, M<sub>7</sub>, M<sub>8</sub>) (Tenenhaus, 2008).

(M<sub>1</sub>) Reputation and corporate image

$$= 0.831^* \text{ External motivations} + 0.557^* \text{ Error}_1 \rightarrow R^2 = 0.690$$

$$(M_2) \text{ Customer demands} = 0.729^* \text{ External motivations} + 0.684^* \text{ Error}_2 \rightarrow R^2 = 0.532$$

**Table 4**

Descriptive analysis of the results according to the size and activity of the firms.

	Mean	Micro	Small	Medium	Large	Forest work	First transf.	Second transf.	Other
Reputation and corporate image	3.8(0.8)	3.9(0.9)	3.9(0.8)	3.8(0.6)	3.4(0.7)	4.1(0.8)	3.9(0.8)	3.7(0.6)	3.8(0.8)
Customer demands	3.1(0.9)	2.9(0.9)	3.3(0.9)	3.1(0.8)	2.5(0.9)	3.5(0.8)	3.1(0.9)	3.0(0.9)	3.0(0.9)
Moral awareness of the environment	3.6(1.1)*	3.8(1.1)	3.7(1.0)	3.4(0.9)	2.2(0.9)	3.6(1.1)	3.7(1.0)	3.4(1.1)	3.7(1.1)
Learning and continuous improvement	3.1(1.3)*	3.5(1.2)	3.2(1.3)	2.6(1.2)	2.3(1.3)	3.5(1.1)	3.3(1.2)	3(1.2)	2.9(1.4)
Process management improvement	2.8(1.4)*+	3.2(1.4)	2.9(1.5)	2.4(1.0)	1.5(1.0)	3.6(1.3)	3.1(1.3)	2.5(1.3)	2.6(1.5)
Product management improvement	2.7(1.3)*+	3.0(1.3)	2.8(1.5)	2.3(1.0)	1.5(1.0)	3.5(1.1)	2.9(1.2)	2.4(1.2)	2.5(1.5)
Increase in sales	2.9(1.3)++	3.0(1.4)	3.0(1.4)	2.7(1.1)	2.5(0.6)	3.7(1.3)	2.7(1.2)	2.6(1.1)	2.9(1.4)
Increase in price	2.2(1.3)++	2.4(1.5)	2.2(1.3)	1.8(0.9)	1.8(1.0)	3.5(1.5)	2.2(1.3)	1.8(0.9)	1.8(1.2)
N	124	40	51	29	4	17	31	25	51

Source: Authors' own work. Note: The standard deviation of the sample is shown between parentheses. \* Significant differences detected at a significance level of  $\alpha = 0.05$  (Kruskal-Wallis H-test) between the groups formed according to the number of employees. + Significant differences detected at a significance level of  $\alpha = 0.05$  (Kruskal-Wallis H-test) for companies according to their activity. ++ Significant differences detected at a significance level of  $\alpha = 0.01$  (Kruskal-Wallis H-test) for companies according to their activity.

**Table 5**  
Influence of the motivations on results.

External motivations	High	Ritual integration	(12.1%)	Mobilizing integration	(39.5%)
		Process management improvement	2.8(1.5)**	Process management improvement	3.5(1.3)**
		Product management improvement	2.6(1.3)**	Product management improvement	3.5(1.2)**
		Increase in sales	3.4(1.4)*	Increase in sales	3.3(1.2)*
		Increase in price	1.9(1.2)**	Increase in price	2.9(1.4)**
	Low	Reactive integration	(37.1%)	Proactive integration	(11.3%)
		Process management improvement	2.0(1.1)**	Process management improvement	3.5(1.3)**
		Product management improvement	1.9(1.0)**	Product management improvement	3.2(1.1)**
		Increase in sales	2.5(1.3)*	Increase in sales	2.9(1.2)*
		Increase in price	1.6(1.0)**	Increase in price	2.0(1.2)**
Internal Motivations				High	

Source: Authors' own work. Note: The standard deviation of the sample appears between parentheses. \*\* Significant differences detected at a significance level of  $\alpha = 0.01$  (Kruskal-Wallis H-test). \* Significant differences detected at a significance level of  $\alpha = 0.05$  (Kruskal-Wallis H-test).

**Table 7**  
Goodness of fit summary, fit measures and reliability indexes.

Goodness of fit summary	
Chi-square	17.254
Degrees of freedom	14
Probability value	0.243
Fit Measures	
GFI	0.968
AGFI	0.916
CFI	0.995
NFI	0.973
NNFI	0.990
SRMR	0.034
RMSEA	0.043
RELIABILITY	
Cronbach's Alpha	0.886
Coefficient RHO	0.932

Source: Authors' own work.

- (M<sub>3</sub>) Moral awareness of the environment  
= 0.626\* Internal motivations + 0.780\* Error<sub>3</sub> → R<sup>2</sup> = 0.392
- (M<sub>4</sub>) Learning and continuous improvement  
= 0.917\* Internal motivations + 0.399\* Error<sub>4</sub> → R<sup>2</sup> = 0.840
- (M<sub>5</sub>) Process management improvement  
= 0.698\* Management Performance + 0.716\* Error<sub>5</sub> → R<sup>2</sup> = 0.487
- (M<sub>6</sub>) Product management improvement  
= 0.733\* Management Performance + 0.681\* Error<sub>6</sub> → R<sup>2</sup> = 0.537
- (M<sub>7</sub>) Increase in sales = 0.942\* Market Performance + 0.335\* Error<sub>7</sub> → R<sup>2</sup> = 0.888

$$(M_8) \text{ Increase in Price} = 0.975^* \text{ Market Performance} + 0.223^* \text{ Error}_8 \rightarrow R^2 = 0.950$$

The structural model is shown in Fig. 2 and in Equations E<sub>1</sub> and E<sub>2</sub>. Used to test the stated propositions, it was based on the following two standardized equations that presented optimum R<sup>2</sup> values (0.591 and 0.636).

$$(E_1) \text{ Management Performance} = 0.174 * \text{ External motivations} + 0.613 * \text{ Internal motivations} + 0.639 * \text{ Distortion}_1 \rightarrow R^2 = 0.591.$$

$$(E_2) \text{ Market Performance} = 0.819 * \text{ Management Performance} + 0.604 * \text{ Distortion}_2 \rightarrow R^2 = 0.636.$$

6.3. Propositions

P<sub>1</sub>: External sources of motivation for PEFC implementation will be positively associated with management performance.

Proposition 1 was rejected. The relation between the factors at the structural level was not significant.

P<sub>2</sub>: Internal sources of motivation of PEFC implementation will be positively associated with management performance.

Proposition 2 was accepted. The structural model lent support to the proposition. In addition, the indices of the structural model and its associations were quite strong.

P<sub>3</sub>: Management performance of PEFC implementation will be positively associated with Market Performance.

Proposition 3 was accepted. It was also confirmed at a confidence level of  $\alpha = 0.01$  and with a very high resulting index in the structural model of 0.819. A figure that, in addition to confirming the proposition, also indicated a very strong degree of influence.

7. Discussion

In our study, the best results were in relation to the “product management improvement” and the “increase in price” variables that were in the mobilizing integration group (high level of external and internal motivations). That same group also achieved the best results for “process management improvement”, together with the companies forming the proactive integration group (low level of external motivations and high level of internal motivations). However, the best results for the “increase in sales” variable were linked to the ritual integration group (high level of external and low level of internal motivations), closely followed by the mobilizing integration group. The lowest scores for the four variables under analysis were linked to the reactive integration group (low level of internal and external motivations). It can therefore be affirmed that the conditions and the context within which the standard was adopted, rather than the standard per se, had the highest impact on organizational performance.

In the structural model, the influence of the external motivations was not confirmed, although the influence of internal motivations on management performance was significant. The greater significance of the

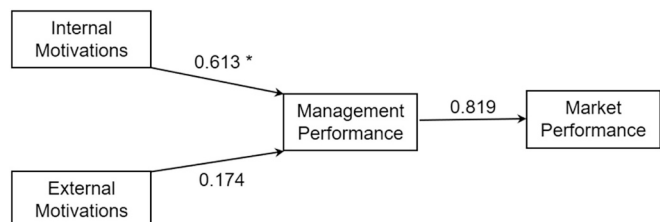


Fig. 2. Summary of the Structural equation results.

internal motivations was aligned with the results of other academic studies on the ISO 14001 standard. The association between motivations for integrating the ISO 14001 standard and the effects of integration were analysed in those studies, to conclude that companies certified for internal reasons obtained greater benefits (Singels et al., 2001; Boiral and Roy, 2007; Heras-Saizarbitoria et al., 2011; Díaz de Junguitu and Allur, 2019). Specifically, the ritual and reactive integrations were linked with symbolic adoption of standards (Díaz de Junguitu and Allur, 2019; Tayo Tene et al., 2021). The impact of the standard on management performance, without being truly integrated into daily activities, may be uncertain. If the standard is internally driven (proactive and mobilizing integrations), it is reasonable to expect the implementation of the necessary measures to improve management performance.

Based on the results, it may be suggested that better management performance leads to better market performance. The comments of managers lent support to the findings, reinforcing the argument that the implementation of forest certification per se will not improve market performance. However, improving operational and management processes will improve customer perceptions of quality and, in consequence, market performance.

In addition, the mediating effect of management results between internal motivations and market results should be measured. The opinions of managers and technicians supported the results that confirmed the conclusions reached in the case of ISO 14001 (Heras-Saizarbitoria et al., 2011; Díaz de Junguitu and Allur, 2019; Tayo Tene et al., 2021). Internal drivers are linked to more substantive adoptions. They lead to better management results that contribute to better market performance. Therefore, although external drivers, such as institutional pressures to obtain certification, are in many cases important, the focus should be on what each company or forest owner can do internally to improve management performance using the guidelines prescribed by forest certification standards and thus, improve market performance. Those results also imply that the importance of the manager or forest owner perspective should also be highlighted, as managers can achieve effective and successful implementation of these standards when their commitment is clear and explicitly stated.

## 8. Conclusions

The associations between the motivations that drive forest certification and the perceived impacts have been analysed in this study. On the basis of the results, it may be emphasized that outcomes related to forest certification can vary significantly from one organization to another, depending on the driving force behind the measures taken to achieve certification. In line with the conclusions obtained in the work of Nair and Prajogo (2009), it has been affirmed that the improvement of business performance requires the basic principles of forest management systems to be oriented towards the improvement of product quality, cost reduction, delivery improvement, and innovation performance. Therefore, the result of improvements to operations and business management will result in the improvement of commercial performance. This conclusion can help forest managers and owners to develop realistic expectations towards the results of forest certification standards and their implementation, and can set the path that companies must follow, if they are to see the real benefits and impacts of such standards.

Managers therefore need to raise awareness of the importance of forest certification and, so that their message is communicated to employees, they must evaluate the standards, and internalize them on a day-to-day basis, rather than only preparing for external audits. Once the external motivations are transformed into internal ones, the workforce will voluntarily implement the standards.

In our study a general framework has been proposed, which contributes to improving our understanding of the key issues underlying forest certification and that can be used to explain the associations between the motivations and the impacts associated with forest certification, from a critical point of view, which is yet an unaddressed area of

study. The implications of these findings may be of interest to the main stakeholders that concern themselves with certification and its implementation, especially managers, consultants, certified bodies, and the public administration. In addition, the results have managerial implications and should encourage firms considering forest certification to undertake an in-depth examination of their motives and to evaluate whether they should go ahead with the certification process. Managers considering the adoption of the forest certification standard when commercial pressures are low and when they have not yet clearly identified internal motives should take time to reflect on its potential benefits and impacts, in order to maximize the internal benefits.

### 8.1. Limitations and future lines of research

There are several limitations in relation to the survey that was administered in this study, which may serve to define future lines of work. Based on the results, causality cannot be asserted, as there may be other important factors that are not considered in this study. Another limitation is related to the fact that the information was based on the perceptions of forest managers and owners. Therefore, the analysis of forest certification and its impacts, carried out in this way, may present certain methodological weaknesses and distortions. Thus, an interesting avenue of research might be to examine the existence of different perceptions of forest certification within the same organizations, interviewing employees, managers, and quality specialists. Performing case studies, interviews and qualitative analyses could be the most appropriate approach to this type of research. Moreover, future surveys might collect, analyse and triangulate information from various stakeholders, including middle managers, employees, suppliers, customers, and auditors, as suggested by Heras-Saizarbitoria et al. (2011). Furthermore, although the sample size is sufficient, it has not been possible to affirm the causality of the relationships. That is one reason why those associations should be investigated in greater detail. It would therefore be advisable to carry out further research with larger sample sizes, comparing them with samples of non-certified companies, aligning replications of the study in different regions and cultures, and incorporating quality data that could condition these associations, such as the characteristics of the companies.

In addition, it has been suggested in several studies that organizations certified for longer periods tend to obtain greater benefits than more recently certified organizations, because of the extra time they have had to integrate the improvements that accompany certification (Siougle et al., 2019; Hernandez-Vivanco et al., 2019). Therefore, surveys designed to collect information at various moments would provide valuable information on the evolution of both the long and the short-term impacts.

### CRedit authorship contribution statement

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

### Declaration of competing interest

German Arana-Landin reports financial support was provided by Euskampus Foundation.

Mikel Zubizarreta reports financial support was provided by Basque Government.

Waleska Siguenza reports financial support was provided by



University of the Basque Country. German Arana-Landin reports financial support was provided by Basque Government.

Jesus Cuadrado reports financial support was provided by Basque Government.

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

## Data availability

Data will be made available on request.

## Acknowledgements

The authors wish to express their gratitude to the SAREN Research Group (IT1619–22, Basque Government), the T4BSS Research Group (IT1691–22, Basque Government) and Euskampus foundation within the ZIRBOTICS and SOFIA projects (Misiones Euskampus 1.0 y 2.0). The authors also acknowledge the technical and human support of the Centre de Documentation et de Recherches Européennes (Université de Pau et des pays de l'Adour, France) and the Circular Economy Classroom of the Faculty of Engineering, Gipuzkoa (UPV/EHU).

## References

- Abad, J., Lafuente, E., Vilajosana, J., 2013. An assessment of the OHSAS 18001 certification process: objective drivers and consequences on safety performance and labour productivity. *Saf. Sci.* 60, 47–56.
- Agus, P., Ratna Setyowati, P., Arman, H.A., Masduki, A., Innocentius, B., Priyono Budi, S., Otta Breman, S., 2020. The effect of implementation integrated management system ISO 9001, ISO 14001, ISO 22000 and ISO 45001 on Indonesian food industries performance. *Test Eng. Manag.* 82 (20), 14054–14069.
- Alexander, S., Rutherford, J., 2019. A critique of techno-optimism. *Routledge Handb. Glob. Sustain. Govern.* 152–167.
- Arana-Landin, G., Sigüenza, W., Landeta-Manzano, B., Laskurain-Iturbe, I., 2024. Circular economy: on the road to ISO 59000 family of standards. *Corp. Soc. Responsib. Environ. Manag.* 31, 1977–2009.
- Araujo, M., Kant, S., Couto, L., 2009. Why Brazilian companies are certifying their forests? *Forest Policy Econ.* 8, 579–585.
- Arshi, P.S., Vahidi, E., Zhao, F., 2018. Behind the scenes of clean energy: the environmental footprint of rare earth products. *ACS Sustain. Chem. Eng.* 6 (3), 3311–3320.
- Auld, G., Gulbrandsen, L.H., McDermott, C.L., 2008. Certification schemes and the impacts on forests and forestry. *Annu. Rev. Environ. Resour.* 187–211.
- Barbosa de Lima, A., Keppe, A.N., Maule, F.E., Sparovek, G., Alves, M.C., Maule, R.F., 2009. Does certification make a difference? Impact assessment study on FSC/SAN certification in Brazil. *Imaflora*, Sao Paulo, Brazil.
- Barnett, M.L., Cashore, B., Henriques, I., Husted, B.W., Panwar, R., Pinkse, J., 2021. Reorient the business case for corporate sustainability. *Stanf. Soc. Innov. Rev.* 19 (3), 34–39.
- Bass, S., 2001. Certification's Impacts on Forests, Stakeholders and Supply Chains. *Iied. Boiral*, O., 2007. Corporate greening through ISO 14001: a rational myth? *Organ. Sci.* 18 (1), 127–146.
- Boiral, O., Roy, M.J., 2007. ISO 9000: integration rationales and organizational impacts. *Int. J. Oper. Prod. Manag.* 27 (2), 226–247.
- Bollen, K.A., 1989. *Structural Equations with Latent Variables*, vol. 210. John Wiley & Sons.
- 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.
- Burivalova, Z., Hua, F., Koh, L.P., Garcia, C., Putz, F., 2017. A critical comparison of conventional, certified, and community management of tropical forests for timber in terms of environmental, economic, and social variables. *Conserv. Lett.* 1, 4–14.
- Busch, T., Barnett, M.L., Burritt, R.L., Cashore, B.W., Freeman, R.E., Henriques, I., Husted, B.W., Panwar, R., Pinkse, J., Schaltegger, S., York, J., 2023. Moving beyond “the” business case: how to make corporate sustainability work. *Bus. Strateg.* 33 (2), 776–787.
- Butterfield, R., Hansen, E., Fletcher, R., Nikinmaa, H., 2005. Forest Certification and Small Forest Enterprises: Key Trends and Impacts-Benefits and Barriers. *Forest Trends and the Rainforest Alliance*, Washington, DC.
- Buxton, A., 2021. Your Ikea kid's furniture might be tainted by illegal logging, year-long investigation finds. *Green queen—Award-winning impact media—Alt protein & sustainability breaking news*.
- Byrne, B.M., 2013. *Structural Equation Modeling with EQS: Basic Concepts, Applications, and Programming*. Routledge.
- Carlsen, K., Hansen, C.P., Lund, J.F., 2012. Factors affecting certification uptake—perspectives from the timber industry in Ghana. *Forest Policy Econ.* 83–92.
- 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. *Forest Policy 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., Balzarova, M.A., 2008. ISO 26000 and supply chains—on the diffusion of the social responsibility standard. *Int. J. Prod. Econ.* 111 (2), 274–286.
- Castka, P., Balzarova, M.A., 2010. Geographies, motivations and benefits from ISO 9000 standard: a comparison of manufacturing and service organisations. *Int. J. Product. Q. Manag.* 5 (4), 370–383.
- Catena, Andrés, Ramos, Manuel, Humberto, 2003. *Análisis multivariado: un manual para investigadores*. España: Biblioteca Nueva, S.L.
- Chakraborty, D., Biswas, W., 2019. Evaluating the impact of human resource planning programs in addressing the strategic goal of the firm: an organizational perspective. *J. Adv. Manag. Res.* 16 (5), 659–682.
- 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.
- Corvellec, H. (Ed.), 2018. *Stories of Achievements: Narrative Features of Organizational Performance*. Routledge.
- 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. *Forest Policy Econ.* 7, 497–504.
- Darnall, N., Gallagher, D.R., Richard, N.L., Amaral, D., 2000. Environmental management systems: opportunities for improved environmental and business strategy? *Environ. Qual. Manag.* 9 (3), 1–10.
- Del Castillo-Peces, C., Mercado-Idoeta, C., Prado-Roman, M., del Castillo-Feito, C., 2018. The influence of motivations and other factors on the results of implementing ISO 9001 standards. *Eur. Res. Manag. Bus. Econ.* 24 (1), 33–41.
- Dias, F.S., Bugalho, M.N., Cerdeira, J.O., Martins, M.J., 2013. Is forest certification targeting areas of high biodiversity in cork oak savannas? *Biodivers. Conserv.* 1, 93–112.
- Díaz de Junguitu, A., Allur, E., 2019. The adoption of environmental management systems based on ISO 14001, EMAS, and alternative models for SMEs: a qualitative empirical study. *Sustainability* 11 (24), 7015.
- Díaz-Balteiro, L., García de Jalon, S., 2017. Certifying forests to achieve sustainability in industrial plantations: opinions of stakeholders in Spain. *Forests* 8 (12), 502.
- Dobrynin, D., Smirennikova, E., Mustalahti, I., 2020. Non-state forest governance and ‘Responsibilization’: the prospects for FPIC under FSC certification in Northwest Russia. *Forest Policy Econ.* 115, 102142.
- 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.
- Doria, M., Pidgeon, N., Hunter, P.R., 2009. Perceptions of drinking water quality and risk and its effect on behaviour: a cross-national study. *Sci. Total Environ.* 407 (21), 5455–5464.
- 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.
- 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.
- Faggi, A.M., Zuleta, G.A., Homberg, M., 2014. Motivations for implementing voluntary environmental actions in Argentine forest companies. *Land Use Policy* 541–549.
- Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* 18 (1), 39–50.
- Frey, G.E., Cubbage, F.W., Ha, T.T.T., Davis, R.R., Carle, J.B., Thon, V.X., Dzong, N.V., 2018. Financial analysis and comparison of smallholder forest and state forest enterprise plantations in Central Vietnam. *Int. For. Rev.* 20 (2), 181–198.
- FSC Spain, 2023. *FSC, datos de certificación*. <https://www.es.fsc.org/es-es/fsc-espana/datos-de-certificacion-en-espana>.
- Fuchs, D., Sahakian, M., Gumbert, T., Di Giulio, A., Maniates, M., Lorek, S., Graf, A., 2021. Consumption corridors: living a good life within sustainable limits, p. 112.
- 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. *Forest Policy Econ.* 169–176.
- Gavronski, I., Ferrer, G., Paiva, E., 2008. ISO 14001 certification in Brazil: motivations and benefits. *J. Clean. Prod.* 16 (4), 87–94.
- George, A.K., Kizha, A.R., Daigneault, A., 2022. Is forest certification working on the ground? Forest managers perspectives from the northeast US. *Trees Forests People* 7, 100197.
- Gómez-Zamalloa, M.G., Caparrós, A., Ayaz, A.S., 2011. 15 years of Forest certification in the European Union. Are we doing things right? *Forest Systems*. 1, 81–94.
- Gu, F.F., Hung, K., Tse, D.K., 2008. When does guanxi matter? Issues of capitalization and its dark sides. *J. Market.* 72 (4), 12–28.
- Gulbrandsen, L.H., 2005. The effectiveness of non-state governance schemes: a comparative study of forest certification in Norway and Sweden. *Int. Environ. Agreeem.: Politics Law Econ.* 2, 125–149.
- Haigh, N., Hoffman, A.J., 2014. The new heretics: hybrid organizations and the challenges they present to corporate sustainability. *Organ. Environ.* 27 (3), 223–241.



- Hair, Jr., Joseph, Black, William, Babin, Anderson, Barry y, 2014. *Multivariate Data Analysis: Pearson New International Edition*, 7th ed. Pearson, New Jersey: Essex.
- Halalisan, A., Marinchescu, M., Popa, B., Abrudan, I., 2013. Chain of custody certification in Romania: profile and perceptions of FSC certified companies. *Int. For. Rev.* 3, 305–314.
- 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.
- Hälälışan, A.F., Popa, B., Heras-Saizarbitoria, I., Boiral, O., Arana-Landín, G., Nicorescu, A.L., Abrudan, I.V., 2021. Procedural factors influencing forest certification audits: an empirical study in Romania. *Forests* 12 (2), 172.
- Halalisan, F., Romero, C., Popa, B., Landin, G.A., Talpa, N., Abrudan, I.V., 2023. Global assessment of FSC forest management certification auditing through analysis of accreditation reports. *Land Use Policy* 131, 106724.
- Hartsfield, A., Ostermeier, D., 2003. Certification: the view from FSC-certified land managers. *J. For.* 8, 32–36.
- Hayward, J., Vertinsky, I., 1999. High expectations, unexpected benefits: what managers and owners think of certification. *J. For.* 2, 13–17.
- He, M., Wu, Z., Li, W., Zeng, Y., 2015. Forest certification in collectively owned forest areas and sustainable forest management: a case of cooperative-based forest certification in China. *Small Scale Forest.* 2, 245–254.
- Heras, I., Arana, G., Díaz de Junguitu, A., Espí, M., Molina, J.F., 2008. Los Sistemas de Gestión Medioambiental y la competitividad de las empresas de la Comunidad Autónoma del País Vasco. Instituto Vasco de Competitividad, Fundación Deusto, San Sebastián.
- Heras-Saizarbitoria, I., Arana Landín, G., Molina-Azorín, J.F., 2011. Do drivers matter for the benefits of ISO 14001? *Int. J. Oper. Prod. Manag.* 31 (2), 192–216.
- Heras-Saizarbitoria, I., Arana, G., Boiral, O., 2016a. Outcomes of environmental management systems: the role of motivations and firms' characteristics. *Bus. Strateg. Environ.* 25 (8), 545–559.
- Heras-Saizarbitoria, I., Arana, G., Boiral, O., 2016b. Outcomes of environmental management systems: the role of motivations and firms' characteristics. *Bus. Strateg. Environ.* 8, 545–559.
- Hernandez-Vivanco, A., Domingues, P., Sampaio, P., Bernardo, M., Cruz-Cazares, C., 2019. Do multiple certifications leverage firm performance? A dynamic approach. *Int. J. Prod. Econ.* 218, 386–399.
- Hillary, R., 2000. Small and medium sized enterprises and environmental management systems: Barriers, opportunities and drivers. In: *CD Papers of the European Environmental Conference*. Aalborg.
- Hirschberger, P., 2005. *The Effects of FSC-Certification in Estonia, Germany, Latvia, Russia, Sweden and the United Kingdom: An Analysis of Corrective Action Requests*. WWF European Forest Programme. WWF, Switzerland. <http://assets.panda.org/downloads/fscsummaryanalysisallcountries.pdf>. accessed on 20-11-2023.
- Hurlimann, A., Hemphill, E., McKay, J., Geursen, G., 2008. Establishing components of community satisfaction with recycled water use through a structural equation model. *J. Environ. Manag.* 88 (4), 1221–1232.
- Karlsson-Vinkhuyzen, S., Kok, M.T.J., Visseren-Hamakers, L.J., Termeer, C.J.A.M., 2017. Mainstreaming biodiversity in economic sectors: an analytical framework. *Biol. Conserv.* 145–156.
- Ketokivi, M.A., Schroeder, R.G., 2004. Perceptual measures of performance: fact or fiction? *J. Oper. Manag.* 22 (3), 247–264.
- Kitazawa, S., Sarkis, J., 2000. The relationship between ISO 14001 and continuous source reduction programs. *Int. J. Oper. Prod. Manag.* 20 (2), 225–248.
- Kline, Rex, 2011. *Principles and Practice of Structural Equation Modeling*, 3rd ed. The Guilford Press, New York.
- Landeta-Manzano, B., Arana-Landín, G., Ruiz de Arbulu, P., Diaz de Basurto, P., 2015. Sustainability through Eco-Design: Shedding Light on the Adoption of the ISO 14006 Standard. In: *Sustainable Operations Management: Advances in Strategy and Methodology*, pp. 163–181.
- Landeta-Manzano, B., Arana-Landín, G., RuizdeArbulu, P., DíazdeBasurto, P., 2017. Longitudinal analysis of the eco-design management standardization process in furniture companies. *J. Ind. Ecol.* 21 (5), 1356–1369.
- 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. *North. J. Appl. For.* 2, 73–81.
- Lee, Taehun, Cai, Lili, 2012. Power analysis for tests of structural equation models. In: Hoyle, Rick (Ed.), *Handbook of Structural Equation Modeling*. The Guilford Press, New York, pp. 181–194.
- Lewis, R.A., Davis, S.R., 2015. Forest certification, institutional capacity, and learning: an analysis of the impacts of the Malaysian timber certification scheme. *Forest Policy Econ.* 18–26.
- Lidestav, G., Lejon, S.B., 2011. Forest certification as an instrument for improved forest management within small-scale forestry. *Small Scale For.* 4, 401–418.
- Liu, J., Yuan, C., Hafeez, M., Li, X., 2020. ISO 14001 certification in developing countries: motivations from trade and environment. *J. Environ. Plan. Manag.* 63 (7), 1241–1265.
- Lo, C.K., Pagell, M., Fan, D., Wiengarten, F., Yeung, A.C., 2014. OHSAS 18001 certification and operating performance: the role of complexity and coupling. *J. Oper. Manag.* 32 (5), 268–280.
- MacCallum, R.C., Browne, M.W., Sugawara, H.M., 1996. Power analysis and determination of sample size for covariance structure modeling. *Psychol. Methods* 1 (2), 130.
- Maesano, M., Ottaviano, M., Lidestav, G., Lasserre, B., Matteucci, G., Scarascia Mugnozza, G., Marchetti, M., 2018. Forest certification map of Europe. *For. Biogeosci. Forest.* 4, 526.
- Malek, E.J., 2022. A thematic review of forest certification publications from 2017–2021: Analysis of pattern and trends for future studies. *Trees Forests People* 100331.
- Marx, A., Cuyppers, D., 2010. Forest certification as a global environmental governance tool: what is the macro-effectiveness of the forest stewardship council? *Regul. Governance* 4, 408–434.
- Moore, S.E., Cabbage, F., Eicheldinger, C., 2012. Impacts of Forest stewardship council (FSC) and sustainable forestry initiative (SFI) forest certification in North America. *J. For.* 2, 79–88.
- Moratis, L., Cochius, T., 2017. *ISO 26000: The Business Guide to the New Standard on Social Responsibility*. Routledge.
- Mueller, R.O., 2012. *Basic Principles of Structural Equation Modeling: An Introduction to LISREL and EQS*. Springer Science & Business Media.
- Müller, M.J., Wetzel, H., Szegedi, A., Benkert, O., 1999. Three dimensions of depression in patients with acute psychotic disorders: a replication study. *Compr. Psychiatry* 40 (6), 449–457.
- Nair, A., Prajogo, D., 2009. Internalization of ISO 9000 standards: the antecedent role of functionalist and institutionalist drivers and performance implications. *Int. J. Prod. Res.* 41 (16), 4545–4568.
- 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.* 3, 527–563.
- Nebel, G., Quevedo, L., Bredahl Jacobsen, J., Helles, F., 2005. Development and economic significance of forest certification: the case of FSC in Bolivia. *Forest Policy Econ.* 2, 175–186.
- Newsom, D., Hewitt, D., Alliance, R., 2005. *The Global Impacts of Smartwood Certification*. Rainforest Alliance, New York, NY.
- Nordén, A., Coria, J., Villalobos, L., 2016. Evaluation of the Impact of Forest Certification on Environmental Outcomes in Sweden.
- Nussbaum, R., Simula, M., 2004. *Forest Dialogue: A Review of Impacts and Assessment Frameworks*. The Forests Dialogue. Yale University, School of Forestry and Environmental Studies, New Haven.
- Overdeest, C., 2005. Treadmill politics, information politics, and public policy: toward a political economy of information. *Organ. Environ.* 1, 72–90.
- Overdeest, C., Rickenbach, M.G., 2006. Forest certification and institutional governance: an empirical study of forest stewardship council certificate holders in the United States. *Forest Policy Econ.* 1, 93–102.
- Owari, T., Juslin, H., Rummukainen, A., Yoshimura, T., 2006. Strategies, functions and benefits of forest certification in wood products marketing: perspectives of Finnish suppliers. *Forest Policy Econ.* 4, 380–391.
- Oy, S.I., 2005. Effectiveness and Efficiency of FSC and PEFC Forest Certification on Pilot Areas in Nordic Countries. Federation of Nordic Forest Owners' Organisations, Helsinki, Finland.
- Paletto, A., Notaro, S., Pastorella, F., Giacomelli, G., Giovannelli, S., Turco, R., 2017. Forest certification in Calabria (Italy): attitudes, preferences and willingness to pay of manufacturers 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. *Drevno* 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., 2018a. 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., Motík, D., Oblak, L., Jošt, M., Glavonjić, B., Dudík, R., Wanat, L., 2018b. The status of chain-of-custody certification in the countries of central and South Europe. *Eur. J. Wood Wood Prod.* 2, 699–710.
- Panwar, R., Nybakk, E., Hansen, E., Pinkse, J., 2017. Does the business case matter? The effect of a perceived business case on small firms' social engagement. *J. Bus. Ethics* 144, 597–608.
- PEFC Spain, 2023. *Certificación de cadena de custodia*. <https://cdn.pefc.org/pefc.es/media/2021-08/7788bea6-96e8-47ea-9e1c-ea2bb0cf06ca/6a2640fc-6a94-5572-86f6-48511a528e20.pdf>.
- PEFC Spain, 2024. *Spanish sustainable forest management standard*. <https://pefc.org/discover-pefc/our-pefc-members/national-members/pefc-spain>.
- Peña-Claros, M., Blommerde, S., Bongers, F., 2009. Assessing the Progress Made: An Evaluation of Forest Management Certification in the Tropics. WUR.
- Pirard, R., Pacheco, P., Romero, C., 2023. The role of hybrid governance in supporting deforestation-free trade. *Ecol. Econ.* 210, 107867.
- Podsakoff, P.M., Organ, D.W., 1986. Self-reports in organizational research: problems and prospects. *J. Manag.* 12 (4), 531–544.
- Prajogo, D.I., 2009. Experiences of Australian firms in implementing ISO 9001: a comparison of the 1994 and 2000 versions. *Int. J. Prod. Qual. Manag.* 4 (4), 383–399.
- Rametsteiner, E., Simula, M., 2003. Forest certification—an instrument to promote sustainable forest management? *J. Environ. Manage.* 1, 87–98Ratnasingam, J., Macpherson, T., Ioras, F., 2008. An assessment of Malaysian wooden furniture manufacturers' readiness to embrace chain of custody (COC) certification. *Holz Roh Werkst.* 5, 339–343.
- Ratnasingam, J., Macpherson, T.H., Ioras, F., Abrudan, V., 2008. Chain of custody certification among Malaysian wooden furniture manufacturers: status and challenges. *Int. For. Rev.* 10 (1), 23–28.
- Riera, P., Aranda, L., Mavsar, R., 2007. Efficiency and equity of forest policies: a graphic analysis using the partial equilibrium framework. *Forest Policy Econ.* 7, 852–861.
- Robinson, J.P., 1991. *Criteria for Scale Selection and Evaluation in Measures of Personality and Social Psychological Attitudes*. Academic Press, New York, NY.

- Rode, J., Heinz, N., Cornelissen, G., Le Menestrel, M., 2021. How to encourage business professionals to adopt sustainable practices? Experimental evidence that the 'business case' discourse can backfire. *J. Clean. Prod.* 283, 124618.
- Ross, V.L., Fielding, K.S., Louis, W.R., 2014. Social trust, risk perceptions and public acceptance of recycled water: testing a social-psychological model. *J. Environ. Manag.* 137, 61–68.
- Schepers, D.H., 2010. Challenges to legitimacy at the Forest stewardship council. *J. Bus. Ethics* 2, 279–290.
- Scherer, A.G., Palazzo, G., Seidl, D., 2013. Managing legitimacy in complex and heterogeneous environments: Sustainable development in a globalized world. *J. Manag. Studies* 50 (2), 259–284.
- Shahangian, S.A., Tabesh, M., Yazdanpanah, M., 2021. How can socio-psychological factors be related to water-efficiency intention and behaviors among Iranian residential water consumers? *J. Environ. Manag.* 288, 112466.
- Singels, J., Ruel, G., van de Water, H., 2001. ISO 9000 series – certification and performance. *Int. J. Q. Reliability Manag.* 18, 62–75.
- Siougle, E., Dimelis, S., Economidou, C., 2019. Does ISO 9000 certification matter for firm performance? A group analysis of Greek listed companies. *Int. J. Prod. Econ.* 209, 2–11.
- Steiger, J.H., 2007. Understanding the limitations of global fit assessment in structural equation modeling. *Personal. Individ. Differ.* 42 (5), 893–898.
- 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. Thesis/Dissertation. University of British Columbia Library.
- Tari, J.J., Molina-Azorín, J.F., Heras, I., 2012. Benefits of the ISO 9001 and ISO 14001 standards: a literature review. *J. Indust. Eng. Manag.(JIEM)* 5 (2), 297–322.
- Taylor, B., Sinha, G., Taposh, G., 2007. *Research Methodology – A Guide for Researchers in Management and Social Sciences*. Prentice-Hall, London.
- Tayo Tene, C.V., Boiral, O., Heras-Saizarbitoria, I., 2021. Does quality management improve the internalization of environmental practices? An empirical study in Africa. *Bus. Strateg. Environ.* 30 (7), 3053–3064.
- Tenenhaus, M., 2008. Component-based structural equation modelling. *Total Qual. Manag.* 19 (7–8), 871–886.
- Terziowski, M., Power, D., Sohal, A.S., 2003. The longitudinal effects of the ISO 9000 certification process on business performance. *Eur. J. Oper. Res.* 146 (3), 580–595.
- Tham, L.T., Darr, D., Pretzsch, J., 2021. Analysis of Acacia hybrid timber value chains: a case study of woodchip and furniture production in Central Vietnam. *Forest Policy Econ.* 125, 102401.
- Thornber, K.D., Plouvier, D., Bass, S., 1999. Certification: Barriers to Benefits. A Discussion of Equity Implications. European Forest Institute.
- Tian, N., Poudyal, N.C., Lu, F., 2018. Understanding landowners' interest and willingness to participate in forest certification program in China. *Land Use Policy* 271–280.
- Tibor, T., Feldman, I., 1996. *ISO 14000: A Guide to the New Environmental Management Standards*. Irwin Professional, Chicago, IL.
- Tikina, A., Kozak, R., Larson, B., 2008. What factors influence obtaining forest certification in the U.S. Pacific northwest? *Forest Policy Econ.* 4, 240–247.
- Tricallotis, M., Gunningham, N., Kanowski, P., 2018. The impacts of forest certification for Chilean forestry businesses. *Forest Policy Econ.* 82–91.
- Tuppura, A., Toppinen, A., Puumalainen, K., 2016a. Forest certification and ISO 14001: current state and motivation in forest companies. *Bus. Strateg. Environ.* 25 (5), 355–368.
- Tuppura, A., Toppinen, A., Puumalainen, K., 2016b. Forest certification and ISO 14001: current state and motivation in forest companies. *Bus. Strateg. Environ.* 5, 355–368.
- Ulybina, O., Fennell, S., 2013. Forest certification in Russia: challenges of institutional development. *Ecol. Econ.* 178–187.
- Valmohammadi, C., Kalantari, M., 2015. The moderating effect of motivations on the relationship between obtaining ISO 9001 certification and organizational performance. *TQM J.* 27 (5), 503–518.
- van der Ven, H., Cashore, B., 2018. Forest certification: the challenge of measuring impacts. *Curr. Opin. Environ. Sustain.* 104–111.
- Vidal, N., Kozak, R., Cohen, D., 2005. Chain of custody certification: an assessment of the north American solid wood sector. *Forest Policy Econ.* 3, 345–355.
- Wang, Y., Zhang, L., Sun, Y., Yu, Z., Li, F., 2005. Analysis on the impacts of forest certification in Changhua forest farm. *J. Beijing Forest. Univ.* 2, 57–60.
- Williams, S., Schaefer, A., 2013. Small and medium-sized enterprises and sustainability: managers' values and engagement with environmental and climate change issues. *Bus. Strateg. Environ.* 3, 173e186.
- Wilson, B., Takahashi, T., Vertinsky, I., 2001. The Canadian commercial forestry perspective on certification: national survey results. *For. Chron.* 2, 309–313.
- Wolff, S., Schweinle, J., 2022. Effectiveness and economic viability of Forest certification: a systematic review. *Forests* 13, 798.
- Woodside, G., Yturri, J., Auricho, P., 2004. *ISO 14001 Implementation Manual*. Butterworth-Heinemann, Boston, MA.
- Worthington, Roger, Whittaker, T., 2006. Scale development research: a content analysis and recommendations for best practices. *Couns. Psychol.* 34 (6), 806–838.
- Yuan, Y., Eastin, I., 2007. Forest Certification and its Influence on the Forest Products Industry in China.
- Zhao, J., Xie, D., Wang, D., Deng, H., 2011. Current status and problems in certification of sustainable forest management in China. *Environ. Manag.* 6, 1086–1094.
- Zubizarreta, M., Arana-Landín, G., Cuadrado, J., 2021. Forest certification in Spain: analysis of certification drivers. *J. Clean. Prod.* 294, 126267.
- Zubizarreta, M., Arana-Landín, G., Wolff, S., Egiluz, Z., 2023. Assessing the economic impacts of forest certification in Spain: a longitudinal study. *Ecol. Econ.* 204, 107630.