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Analysis of the propensity of Italian and German forest owners towards forest certification for ecosystem services

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Abstract: This study analyses the perception of the relationship between forest certification and the production of ecosystem services by Programme for the Endorsement of Forest Certification (PEFC) and Forest Stewardship Council (FSC) sustainable forest management (SFM) certification holders. In addition, the psychological constructs that govern the use of certification for ecosystem services are investigated. Specifically, online questionnaire surveys were submitted to a sample of Italian and German forest owners and managers to study reasons for and against and global motives to adopt certification for ecosystem services through the application of Behavioural Reasoning Theory (BRT). Results show that respondents believe that certification can better support ecosystem services related to 'regulation and maintenance' and the conservation of biodiversity. On the other hand, the application of BRT has only been partially useful in explaining the psychological factors towards the adoption of ecosystem services certifications. In any case, attitudes and reasons for certainly had a significant influence on the intention to adopt certifications. Apart from the scientific implications, these results have practical applications for policymakers who can focus on the dissemination of the certification of ecosystem services by trying to support through eco-policies, the attitudes and reasons for expressed by forest owners.

Keywords: behavioural reasoning theory; forest ecosystem services' certification; Forest Stewardship Council (FSC); Programme for the Endorsement of Forest Certification (PEFC); sustainable forest management

The European Union's forest territory accounts for about 5% of the world's, and in contrast to the rest of the world is slowly increasing (EUROSTAT 2020), providing not only timber production but also a wide range of non-wood forest products, as well as ecosystem services. According to the CICES classification (Common International Classification of Ecosystem Services), three macro-categories of ecosystem services can be distinguished: supply services, such as timber, spontaneous non-timber forest products, or water; regulation and maintenance services, such as soil erosion control, water purification, or carbon dioxide absorption; cultural services, related to the support of tourism, recreation, sports activities, cultural activities, or the preservation of landscape values. The last decade has seen a steady growth of alternative approaches by the European forestry sector towards a 'forest circular bioeconomy', mainly represented by an improvement in the environmental and cultural values of the forest, as well as the efficiency of forestry workers and the spread of forest certification (Paletto et al. 2017). As Bengston (1994) states, there has been a shift from strictly productive silviculture towards multifunctional silviculture, precisely at a time when demands for non-timber forest resources were beginning to grow. Considering this cultural change, ecosystem services can

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be seen as an innovation to improve the management of renewable biological resources to create new economic opportunities for the forest sector. These include PES (payment for ecosystem services), which can be seen as an effective way to finance the costs of forest conservation by offsetting the opportunity costs of forest development (Meijaard et al. 2011). PES also include certifications for ecosystem services, according to Programme for the Endorsement of Forest Certification (PEFC) and Forest Stewardship Council (FSC) standards. Indeed, certification often has an impact on the local economy, not only for the 'wood' supply chain but rather for the attention given to non-wood services and products. In particular, the ecosystem services generated by forests can help maintain rural and mountain economies through the creation of an ecosystem services market composed of those who use these services and those who ensure their maintenance and continuity. In this perspective, therefore, certification represents a tool that forest owners and managers can use to demonstrate the positive impacts of sustainable forest management (Paluš et al. 2021) also by valuing the ecosystem services that forests provide to the community. Hence the development of certifications for ecosystem services as tools that can enable forest owners and managers to expand the concept of forest management by opening new management directions, monitoring and verification of the impacts of management activities and new business opportunities (FSC Italia 2021b). These standards specifically certify carbon sequestration and storage, biodiversity conservation, water regulation services, soil conservation and recreational services. In Europe, 17 entities are certified for ecosystem services according to the FSC standard, present in France, Germany, Italy, the Netherlands, Portugal and Spain (FSC 2022), and four according to the PEFC standard, present in Italy (PEFC Italia 2022).

Given this background, this study aims to analyse the perception of the relationship between forest certification and the production of ecosystem services by PEFC and FSC certification holders. From this perspective, the adoption of certification results from the combination of personal interests and company resources that influence forest owners and managers in the choice of certification (decision-making process). In fact, the study also aims to investigate the psychological constructs that govern the use of certification for ecosystem services through the analysis of empirical data from a survey conducted among Italian and German FSC and PEFC sustainable forest management (SFM)-certified owners and managers. The behavioural reasoning theory was applied to study the influence of reasons for and against, and global motivations to adopt certification for ecosystem services. The peculiar selection of the study areas is due to the desire to investigate the phenomenon of the spread of forest certification and, more specifically, certification for ecosystem services, with little insight into these two geographical areas. In the Italian case, in fact, although standards to certify ecosystem services were developed by both FSC in 2014 and PEFC in 2021, no study to date has analysed the intentions of forest owners to adhere to the ecosystem services certification standard. A similar situation exists in Germany, where certification standards for ecosystem services are still being disseminated.

Theoretical model and research hypothesis. The work adopts a conceptual framework based on the behaviour reasoning theory (BRT) to assess not only the intention towards the adoption of certification for ecosystem services, but primarily to examine 'resistance factors' and 'adoption factors' with respect to attitude and intention (An et al. 2021). The BRT finds its basis in two theories, the theory of reasoned action (TRA) and the theory of planned behaviour (TPB). They find application in explaining and predicting behaviour in a multitude of domains (Ajzen 2020). Specifically, in forestry, TPB is often used in relation to the forest owners' choice to adopt particular silvicultural methods (Karppinen 2005), or, more generally, to an interest in adopting sustainable management practices (Bieling 2004; Fielding et al. 2005; Rasamoelina et al. 2010; Ofoegbu, Speranza 2017) suitable for example for the production of carbon offsets (Thompson, Hansen 2012) or integrated with techniques for the conservation of biodiversity (Primmer, Karppinen 2010). The theoretical idea characterising TRA is that individuals act on the basis of perceived outcomes of their behaviour (Fishbein, Ajzen 1975; Ajzen, Fishbein 1980). When such outcomes are favourable, individuals form the intention to repeat that same behaviour. In turn, behavioural intention is determined by attitudes towards a specific behaviour (attitudes) and subjective norms (subjective norms). Attitude represents 'a learned disposition to respond favour-

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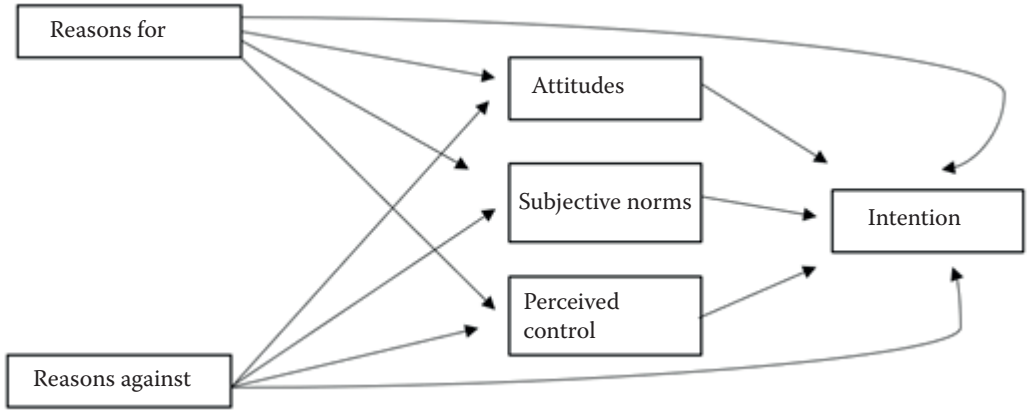

Figure 1. Applied research model

ably or unfavourably to a given object' (Fishbein, Ajzen 1975). Subjective norms refer to the individual consideration whether other individuals or referent groups (significant others, family, friends, neighbours, the community at large) perceive and evaluate their own behaviour favourably or unfavourably (Razali et al. 2020). If attitudes and subjective norms are favourable, intentions will prompt the subject to enact the behaviour. The TRA has certain limitations, as it can only explain voluntary behaviour, which requires skills, resources and opportunities. If the latter are not easily accessible, TRA does not find due application (Sok et al. 2020). For this reason, the theory of reasoned action was extended to include the perception of behavioural control (Ajzen 1991). Perceived behavioural control reflects the degree of perceived control a person has over their ability to perform a behaviour (Lalani et al. 2016). In this sense, intentions result in the execution of a behaviour only when external constraints, such as time and opportunities, and internal constraints, such as knowledge and skills, have been perceived as being under the control of the individual (Ajzen 1991). According to Westaby (2005), who proposed the BRT, specific motives serve as an important link between global motives (subjective norms, perceived behavioural control and attitudes), intention and behaviour. In fact, the author categorised the reasons into two groups: 'reasons for' and 'reasons against' the implementation of a given behaviour. These reasons were conceptualised by Westaby (2005) as 'pros and cons', 'costs and benefits', and 'facilitators and constraints' towards a behaviour. This theory is usually applied extensively in contexts concerning the adoption of innovations in the environmental field (Claudy et al. 2013, 2015) and often focuses on a holistic understanding of consumer behaviour (Dhir et al. 2021; Kumar et al. 2021). In this sense, in the context of forest certification, this theory is not yet applied.

Based on the theoretical frame of reference (Westaby et al. 2010), some specific research hypotheses were formulated as follows (Figure 1).

H_1: Subjective norms directly influence the intention of forest owners/managers to adopt certification for ecosystem services.

H_2: Personal attitudes directly influence intentions.

H_3: Perceived behavioural control positively influences the intentions towards ecosystem services (ES) certification.

H_4: Reasons for directly and positively influence intentions.

H_5: Reasons against directly and negatively influence intentions.

H_6: Reasons for positively influence attitudes, subjective norms and perceived behavioural control.

H_7: Reasons against negatively influence attitudes, subjective norms and perceived behavioural control.

MATERIAL AND METHODS

The survey population consists of forest owners, forest property managers or entities that have adopted PEFC and FSC certifications for SFM in both Italy and Germany, considering that certification for ecosystem services is directly linked to SFM certification. Both countries, but especially Germany, have a large certified forest area. In fact, out of a forest area of 10 982 013 ha, 68 486 ha of Italian forests are FSC certified, while 881 854.43 ha are PEFC certified. In the case of Germany, on the other hand, out of a total of 11.4 million ha of forest, 8 700 643 ha are PEFC certified, and 1 421 457 ha are FSC certified.

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Data collection. The forest owners and managers involved in the survey were identified from the FSC and PEFC international databases, selecting the 'Forest management' option to include SFM certification holders. In the case of Italy in particular, the number of certified companies/bodies is 133, respectively 47 for PEFC and 86 for FSC (although, in reality, the latter number also included those involved in group certification). From the 133 entities contacted, 83 complete questionnaires were received, with a response rate of 62.4%. For Germany, there were 271 certified entities in the FSC database, but, as in the case of Italy, this number also included owners within the group certification. Taking account of the difficulty of finding the contact details of some owners, especially in the case of private individuals, a group of 55 entities was considered (without considering all other entities within the same group certification). In the case of PEFC certification, considering the high number of certified entities, approx. 12 000, following the methodology applied by Jaung et al. (2016a) and Krause and Matzdorf (2019), a sample of 400 entities was examined, using a simple randomisation sampling method, and received 71 completed questionnaires with a response rate of 15.60%. The development of the survey was based on the methods recommended by Dillman (2007), which include an information phone call (in the case of Italy), a pre-notification email, and a first and second email to maximise the response rate. Data were collected between August and December 2021.

The survey was conducted using a structured questionnaire in Google Forms, which in the case of Germany was translated into German, after having pre-tested a sample of eight Italian companies through the administration of the questionnaire through telephone interviews.

Survey. The questions in the questionnaire aimed to obtain information of a mainly quantitative nature and were formulated according to a closed or hierarchical response scheme. The questionnaire was structured in four sections and was preceded by a cover letter in which the title and objective of the research was stated, highlighting the importance of obtaining the requested information as well as the processing of the collected data.

In the first section, 'General characteristics of the company/entity and forestry certifications adopted', aspects relating to the entities interviewed were noted, such as: name; location; legal form; the type of ownership; the total area wooded and the certified forest area in ha; the type of forest species present; the main production that constitutes the core business; the number of employees; main product destination markets; main sales channels; average company turnover in euro; the types of certification adopted and the year of adoption. The second section, 'Characteristics of the forest owner/manager', provided information on the profile of the interviewees, specifically on age, educational qualification and gender, years of experience in the forestry sector. These data are reported in Table S1 in the Electronic Supplementary Material (ESM).

In the third section 'Perception of certification as a tool to support ecosystem services' the perception of forest owners/managers regarding the role of forest certification in guaranteeing ecosystem services was surveyed. Based on the study by Paluš et al. (2021) and the CICES classification [Common International Classification of Ecosystem Services (Haines-Young and Potschin 2012)], three groups of ecosystem services, 'provisioning', 'cultural' and 'regulating', were taken into account and sixteen items were identified. A 5-point Likert scale (Likert 1932) was used for the responses, where a score of 1 corresponds to 'completely disagree' and a score of 5 to 'completely agree'.

In the last section, 'Factors influencing the adoption of certification for ecosystem services', intentions, subjective norms, perceived behavioural control, attitudes, reasons for and against, i.e. the factors underlying BRT, were explored in 29 items. The items for the study constructs were again based on adapted versions of already validated scales (Westaby et al. 2010; Thompson, Hansen 2013; Krause, Matzdorf 2019; Sreen et al. 2021). In particular, the classification proposed by Claudy et al. (2015) and Dhir et al. (2021) into 'financial', and 'environmental' for reasons for and into 'barrier and cost', and 'incompatibility' for the reasons against was used. The scale used was set considering the same parameters as the one adopted in the previous section.

Data analysis. The statistical analysis was developed using SPSS software (Version 25, 2017), and Stata (Version 17, 2021). In the first step, a univariate descriptive analysis of the surveyed variables was carried out, including averages and standard deviations, for Likert scale responses to assess perceptions of certification as a tool to support ecosystem services. Regarding the application of BRT,

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data were analysed using SPSS 25 software for confirmatory factor analysis (CFA) to validate the measurement model, while the application of structural models (SEM) was used to assess the relationships between the component latent constructs of the basic conceptual model. They represent a multivariate statistical analysis technique that allows the consistency of the hypothesised model to be checked against empirical data (Barbaranelli, Ingoglia 2013). Such structural models are based on the implementation of path analysis on observed variables (i.e. those variables that are obtained by summing up, for example, items that make up a scale). Mplus 8 software (Mplus 8.7, 2021) was used to construct the SEM model. Two models were constructed: the first considering 'country' as the control variable, the second with a multigroup analysis considering the German and Italian samples separately. To check the fit of the model, following Bartolo et al. (2019), several statistical indices were considered, whose adopted cut-offs are made explicit in the brackets: chi-squared with its associated *P*-value ($P > 0.05$), the comparative fit index ($CFI \geq 0.95$), the root mean square error of approximation ($RMSEA \leq 0.06$) and its 90% confidence interval, the standard mean residual ($SRMR < 0.08$). The results of the confirmatory factor analysis with principal axis factoring and direct oblimin rotation considering factor loadings with a cut-off value of 0.30, included the Kaiser-Meyer-Olkin (*KMO*) test value, the Barlett test results and the explained variance. The *KMO* provides an index to compare the magnitude of the observed correlations against partial correlations. The closer its value is to 1, the better the evaluation of the results. Values below 0.60 are considered poor/not acceptable, i.e. factor analysis is not advisable. Barlett's test is used to assess the homogeneity of variance and must return a *P*-value of 0.01.

RESULTS AND DISCUSSION

Analysis of the perception of forest certification as a tool to support ecosystem services. Here the perception of owners and managers towards the role and positive effects that forest certification can have in ensuring the availability of forest ecosystem functions and services was analysed. Based on the existing literature in this research area (Haines-Young, Potschin 2012; Vizzarri et al. 2015; Ramanzin et al. 2019; Paluš et al. 2021; FSC Italia 2021a), ecosystem services have been classified into three macro-categories: 'provisioning and availability', 'regulating and maintenance' and 'cultural'. The reliability of the factors was examined using Cronbach's α coefficient. For Italy, a value of 0.95 was obtained, and for Germany a value of 0.96. For both Italy and Germany, the macro-category with the highest average value is 'regulation and maintenance' with values of 3.73 and 3.50, respectively. It is followed, for both countries, by the category 'cultural' with a score of 3.60 for Italy and 3.12 for Germany (Figure 2.). Specifically, the item that has the highest average value for both countries is represented by 'biodiversity conservation' with an average value of 3.96 for Italy and 3.86 for Germany, followed by 'the regulation of climatic conditions through the reduction of greenhouse gas concentrations and through carbon storage' in the Italian case with a value of 3.95, and 'maintaining the health of ecosystems' with a value of 3.77 in the German case (Table S2 in the ESM). These results show that forest owners and managers see certification as a tool to support regulating and maintaining ecosystem services. Indeed, in this context, both the principles and criteria of both certification schemes aim precisely at managing these aspects in a sustainable manner [an example is the high conservation values (HCV) promoted by FSC in principle 9, or criteria 1 and 2 on the maintenance and improvement of forest resources and the maintenance of the health and vitality of ecosystems promoted by PEFC]. These results differ from those obtained by Paluš et al. (2021), according to whom forest certification was seen as an excellent tool to support the availability of water resources and woody biomass. This can be explained by the fact that many ecosystem services forests are complex in nature and highly site-specific (Bösch et al. 2018). Other studies confirm the results of the present case. Jaung et al. (2016b), examining key FSC stakeholder adaptability to the incorporation of forest ecosystem services (FES), highlight high adaptability for biodiversity conservation.

Intentions towards the adoption of certification for ecosystem services. To understand which factors most influence the intentions of forest owners and managers towards the adoption of certification for ecosystem services, structural equation models were applied. This approach made it possible to verify the suitability of behavioural reasoning theory (BRT) for predicting respondents'

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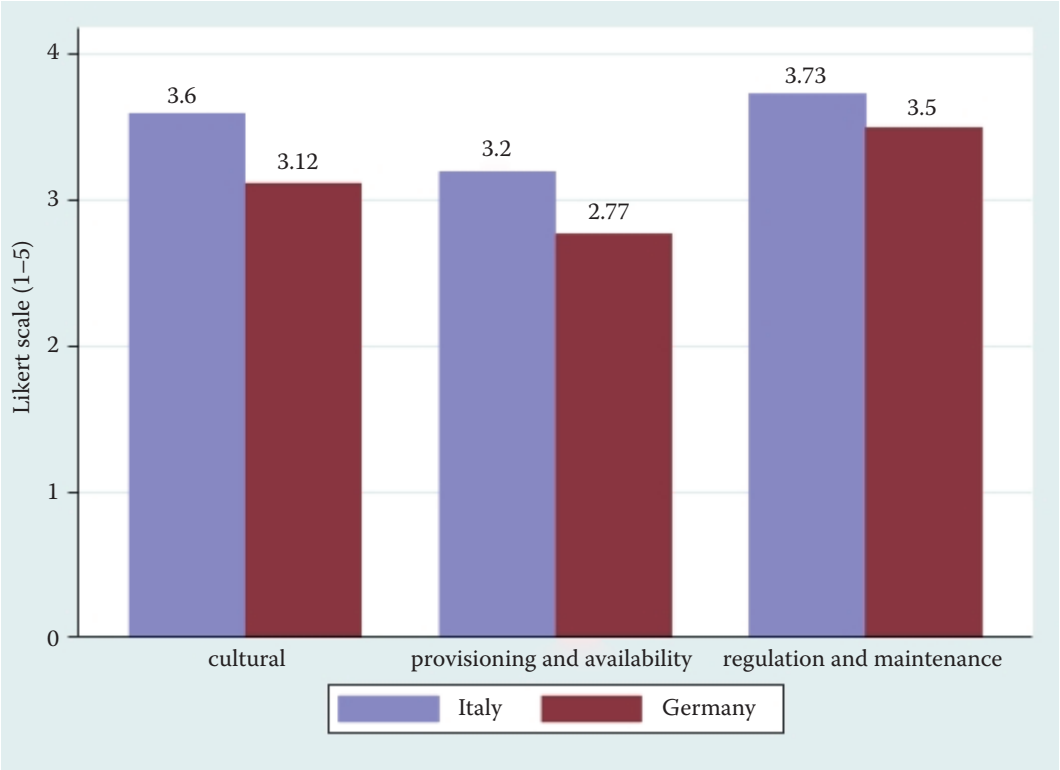

Figure 2. Analysis of the perception of forest certification as a tool to support ecosystem services

intentions, and thus assess the cause-effect relationships between the various constructs. Prior to the development of the path model, descriptive parameters were considered for the items analysed, such as the mean, standard deviation and Pearson correlations between latent variables (Tables S3 and S4, in the ESM), together with some fundamental components of construct reliability, i.e. *KMO* values, explained variance, Cronbach's alpha values (Table S5 in the ESM). Particularly for Intentions, most respondents were 'interested in evaluating the various opportunities that may arise from the certification of ecosystem services' (Table S3 in the ESM). Furthermore, the Attitudes and Reasons for 'financial' and 'environmental' and Subjective Norms were strongly correlated with Intentions (see Table S4 in the ESM).

For what concerns structural models, a model was initially constructed with the country as the control variable, a dummy variable where Germany was coded with 0 and Italy with 1, according to previous studies (Kumar et al. 2021; Yang et al. 2021). In addition, the hypotheses considered for BRT also explore the mediating effect of certain variables on intentions specifically attitudes, subjective norms, and perceived behavioural control. As regards the control variables, as shown in Figure 3, the significant effect ($P < 0.01$) of this variable is exerted only on subjective norms. Italian forest owners and managers are less influenced by subjective norms ($\beta = -0.20$); the β coefficient indicates how much the latent variable has a greater incidence if one comes from Italy. In fact, this coefficient assesses the effect of the latent exogenous variable, assuming values close to zero when this effect is weak and close to 1 or −1 when the effect is strong (Gamel et al. 2022). It can also be stated that attitudes ($\beta = 0.67$), reasons for 'financial' ($\beta = 0.12$) and perceived behavioural control ($\beta = 0.10$) have a direct and positive effect on intentions ($P < 0.01$), therefore hypotheses H_2, H_3, H_4 are accepted. In contrast, subjective norms have a less significant effect on intentions ($\beta = 0.07$, $P < 0.05$); therefore, hypothesis H_1 can only be accepted partially. Furthermore, reasons for 'environmental' have a greater influence on attitudes and perceived behavioural control than reasons for 'financial', but they indirectly influence intentions ($\beta = 0.22$, $P < 0.05$), thanks to the mediating effect played by attitudes, norms and control. In any case, hypothesis H_6, i.e. that reasons for positively influence the attitudes, subjective norms

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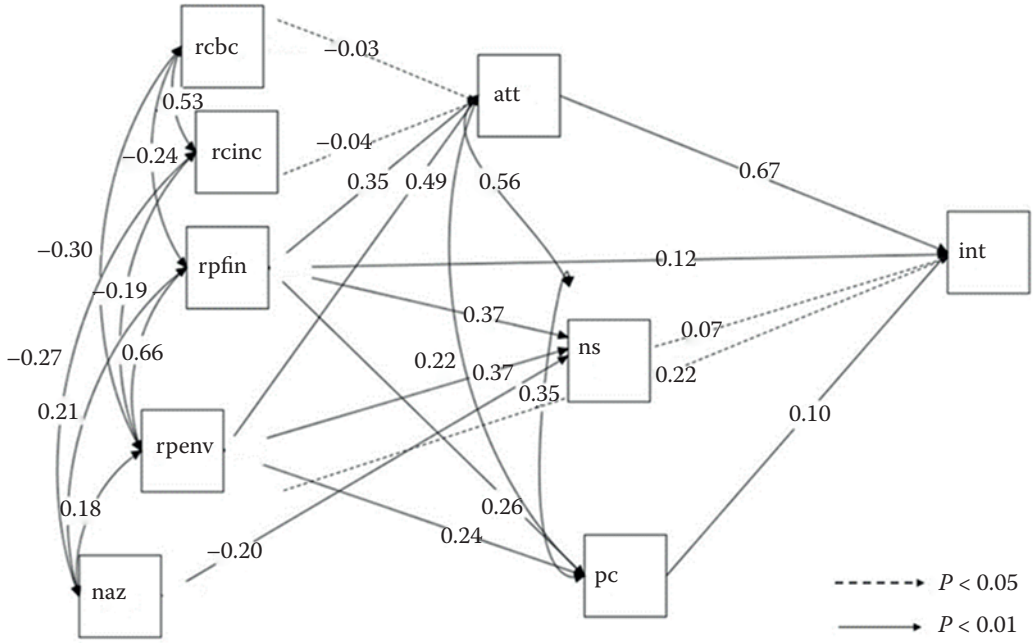

Figure 3. SEM model with control variable 'country' (naz, in the model)

SEM – structural equation model; rcbc – reasons against (barrier and cost); rcinc – reasons against (incompatibility); rpfin – reasons for (financial); rpenv – reasons for (environmental); naz – country; att – attitudes; ns – subjective norms; pc – perceived behavioural control; int – intentions

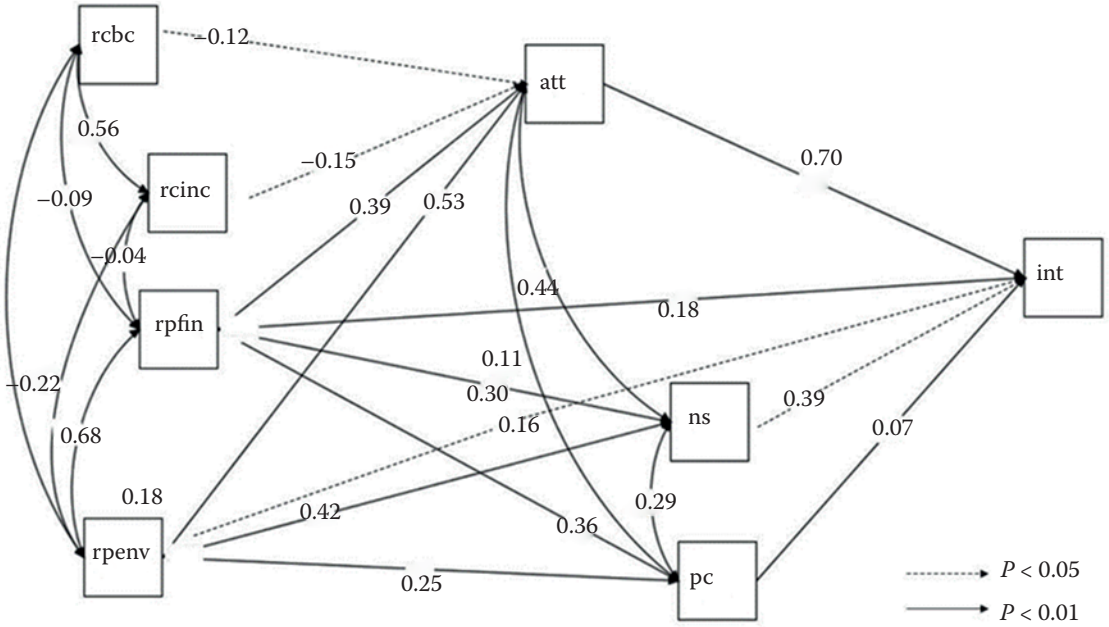

Figure 4. Multi-group SEM model for the Italian sample

SEM – structural equation model; rcbc – reasons against (barrier and cost); rcinc – reasons against (incompatibility); rpfin – reasons for (financial); rpenv – reasons for (environmental); naz – country; att – attitudes; ns – subjective norms; pc – perceived behavioural control; int – intentions

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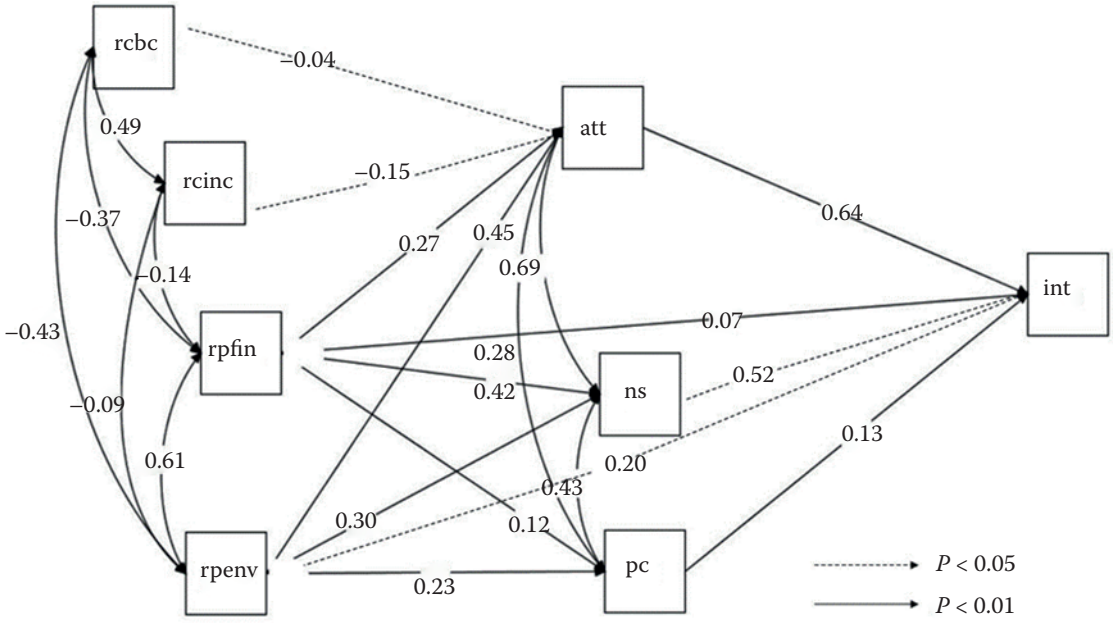

Figure 5. Multi-group SEM model for the German sample

SEM – structural equation model; rcbc – reasons against (barrier and cost); rcinc – reasons against (incompatibility); rpfin – reasons for (financial); rpenv – reasons for (environmental); naz – country; att – attitudes; ns – subjective norms; pc – perceived behavioural control; int – intentions

and perceived behavioural control, is accepted. Conversely, reasons against influence attitudes less significantly ($P < 0.05$), while they have no significant effect on intentions, norms and behavioural control; therefore, hypotheses H_5 and H_7 are rejected. However, the results show an adequate fit of the model (chi-squared with $P = 0.92$; *CFI* = 1.00; *RMSA* = 0.028; *SRMR* = 0.022).

Regarding the comparison between the two countries, in the Italian case, there is a lower correlation between reasons for and against (Figures 4 and 5). For example, while for Italy, the correlation between reasons against 'barrier and cost' and reasons for 'environmental' registers a value of −14, the same comparison for Germany stands at −43. Regarding the influence of attitudes on intentions, the comparison between the two countries shows a higher value in the Italian case, where attitudes have a greater influence on intentions, with β = 0.70. Also, for Italy, perceived behavioural control appears to have less influence than in German respondents who, on the other hand, recognise that they have the appropriate resources, skills and opportunities for the adoption of certification for ecosystem services. Regarding subjective norms, in both cases they were found to be insignificant on intentions ($P < 0.05$). This suggests that the social pressures represented by the very concept of a subjective norm (Gamel et al. 2022), being a voluntary certification related to SFM, are less relevant than the personal assessment of behaviour and the likelihood of its development represented by attitudes. In the case of reasons for, the effect of financial reasons on intentions is greater in the Italian sample. Finally, reasons against have little significant effect on attitudes, but are not found to be predictors of the other latent constructs and especially intentions. However, an adequate fit of the model is also found in this case (chi-squared with $P = 0.18$; *CFI* = 0.99; *RMSA* = 0.059; *SRMR* = 0.043).

CONCLUSION

This study aimed to analyse the intentions of Italian and German forest owners and managers to adopt certification for ES. To meet this goal, the theoretical framework of BRT was adopted. The results, in terms of analysing the role of certification as a tool to support ecosystem services, showed that respondents from both countries believe that certification can best support ecosystem services related to 'regulation and maintenance'

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and, in particular, the conservation of biodiversity. Through the application of BRT, on the other hand, the intentions of forest owners and managers towards the adoption of ES certifications were explored, thus verifying the soundness of the adopted theoretical model. Using the country as a control variable, it was observed that Italian forest owners are less influenced by subjective norms in the adoption of certification. Furthermore, attitudes, reasons for 'financial' and perceived behavioural control had a direct and positive effect on intentions, unlike subjective norms and reasons for 'environmental' that indirectly influence intentions. The reasons against were instead found to have no effect on intentions. The comparison between the two countries conducted in the multi-group model shows that attitudes have a greater influence on intentions in the Italian case, unlike perceived behavioural control, which has greater importance for German respondents. The latter recognise that they have the resources, skills, and opportunities to adopt certification for ES. In both countries, subjective norms have little effect on the intentions. The effect of reasons for, specifically of financial reasons on intentions, is greater in the case of Italy. In both countries, reasons against do not represent predictors of intentions. In both case studies, there is a good propensity to evaluate the various opportunities that may arise from the certification for ES. The results, therefore, only partially confirmed the usefulness of this model to explain the psychological factors that drive owners towards the adoption of ES certifications. In fact, while some assumptions concerning the TPB were fulfilled, others relating to its extension, and in particular to the influence of the reasons against on intentions were not. In any case, attitudes and reasons for had a significant influence on intentions. Therefore, the intentions to adopt certifications for ES are explained by the attitude towards the adoption of such certifications. These results could have interesting implications for policymakers who can focus on the diffusion of certification of ecosystem services by trying to support the attitudes, and reasons for 'financial and environmental' expressed by forest owners and managers towards the intention to adopt such certification through eco-policies. Especially for Italian forest areas, which are almost always not exclusively productive, forest certification, and more specifically certification for ecosystem services, could translate into an improvement in forest management, starting from the very fact that it makes management plans compulsory. However, the study has some limitations due mainly to the number of respondents, a total of 154 (71 for Germany and 83 for Italy), which, particularly in the case of Germany, is an unrepresentative number, considering the large number of certified companies. Furthermore, unlike in the case of Italy, it was not possible to conduct telephone interviews for this sample. However, it should also be pointed out that the study is based on companies, and not individuals, so as Tenenhaus et al. (2005) stated: 'there can be more variables than observations and there may be a small amount of data that are missing completely at random'. Finally, only two European countries were involved in the study, one of them being Germany where certification standards for ES are still being developed (Seizinger 2021). With this in mind, it might be interesting to conduct other cross-country studies involving other countries in order to compare the results obtained and verify the adaptability of the theoretical model adopted to new geographical scenarios.

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