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Research article

The impact of environmental practices on financial performance: Do reputation, institutional environment, and industry type matter?

Bernabé Escobar-Pérez, Silvia Fresneda-Fuentes and María del Mar Miras-Rodríguez*

Accounting and Finance Department, Faculty of Business and Economics, University of Seville, Seville, Spain

Correspondence: Email: mmiras@us.es; Tel: +34954556067.

Abstract: The impact that environmental practices have on companies' performance has often been analyzed in the literature, and the findings are inconclusive. Several researchers argue that further evidence is needed to better understand this relationship, and in particular, the effect that some variables could have on it. Consequently, the main aim of this research was to analyze whether company reputation, the institutional environment, and industry affect the impact of environmentally friendly practices on financial performance. The research found its theoretical foundation in eco-efficiency, trade-off, institutional, and agency theories. The sample comprised 198 high-performing manufacturing companies across 9 countries. Data were collected using a specific questionnaire designed to capture managers' perceptions of the relevant variables and analyzed through partial least squares structural equation modeling. The findings indicate that environmentally friendly practices positively influence companies' financial performance. However, contrary to previous evidence, company reputation does not appear to mediate this relationship. Instead, the institutional environment as well as the subsector in which a company operates play a moderating role. These findings are particularly valuable for managers since they reinforce the rationale for adopting proactive environmental strategies. This research contributes to previous literature, providing new insights about the impact of environmentally friendly behaviors on financial performance within the context of manufacturing companies, as well as the roles that reputation and institutional environments play in this relationship.

Keywords: environmental practices; financial performance; reputation; institutional environment

JEL Codes: M14

1. Introduction

Organizations are increasingly compelled to address sustainability challenges because investors are increasingly concerned about sustainability and less tolerant of companies that harm the natural ecosystem (Bolton and Kacperczyk, 2021; Fleitas-Castillo et al., 2025). Additionally, environmental regulations are becoming increasingly stringent globally (Pérez et al., 2011). This pressure is higher in sectors such as manufacturing (Baah et al., 2021b), whose production activities are often associated with significant environmental pollution (Bello-Pintado et al., 2023).

Adopting environmentally friendly practices (EP) often requires companies to face high costs associated with investments in new machinery or materials (Hart and Ahuja, 1996). This high initial cost could be compensated, at least partially, by cost savings, since technological advancements facilitate lower energy consumption and less environmental impact (Lafont et al., 2023). Based on the literature, engaging in specific EP can enhance organizational outcomes by meeting stakeholders' expectations (Ahmadi-Gh and Bello-Pintado, 2022), since consumers increasingly consider the environmental impact of companies (Feng and Wang, 2016; Khan et al., 2023) in their purchase decisions. Consequently, carrying out EP can be long-term profitable (Porter and Van der Linde, 1995).

Although most findings from the prior literature on manufacturing support the positive effect (Baah et al., 2021b; Habib, 2023; Jum´a et al., 2021; Liu et al., 2022; Tzouvanas et al., 2020), some non-significant effects are found (Aigbedo, 2021; Alexopoulos et al., 2018). Consequently, the importance of examining the moderating and/or mediating roles of certain variables in this relationship has been suggested, as these could help explain the observed disparities (Sarfraz et al., 2023; Turkcan, 2025; Zhang et al., 2019).

Even though several scholars have argued that reputation could be key to better understand the relationship between EP and financial performance (FP) (Hammami and Othmani, 2024), the results do not always support the existence of a mediator role (Afum et al., 2020; Baah et al, 2021a; Farza et al., 2021; Jing et al., 2023), but the majority of the samples are from one developing country.

Furthermore, the link between sustainability issues and FP varies depending on the cultural characteristics of the countries where companies operate (Miras-Rodríguez et al., 2018; Saha et al., 2024; Scholtens and Kang, 2013) and the key role of industry (Aigbedo, 2021). Analyzing the moderator role of the institutional environment and subsector would help to better understand the EP–FP relationship. The objectives of this research are twofold: (1) to analyze the impact of EP on companies' FP, and (2) to investigate the mediating role of reputation and the moderating role of the institutional environment and industry in this relationship.

To conduct our research, an international database of companies participating in the High-Performance Manufacturing (HPM) project will be examined, which includes data from three industries: machinery, electronics, and automotive components. This database was created based on responses from managers of manufacturing companies to a regular survey that addressed sustainability topics in its most recent round (Ahmadi-Gh and Bello-Pintado, 2022; Bello-Pintado et al., 2023). The sample contains data from nine countries. To test our hypotheses, structural equation modeling (SEM)

will be employed, specifically using partial least squares (PLS) methodology following most of the research in the field (Afum et al., 2020; Baah et al., 2021b).

The findings indicate that implementing environmentally sustainable practices has a beneficial effect on FP. Notably, while the hypothesized mediating role of reputation was not substantiated, the data do support the moderating effects of the national context, influenced by institutional environments and industry subsectors.

Our findings contribute to the debate on the EP–FP relationship by providing evidence of a positive impact when considering a multi-country sample. In addition, the supported moderator role of the institutional environment and the subsector should lead researchers to control their analyses by considering both variables.

The remainder of the paper is organized as follows: first, the theoretical framework and hypotheses will be developed. The subsequent section will focus on the sample and methodology. Following that, the results will be shown. Finally, the research will be discussed, as well as the conclusions and limitations.

2. Theoretical background

The existing academic literature employs a variety of theoretical frameworks to elucidate the adoption of sustainability practices (Dos Reis Cardillo and Cruz Basso, 2025; Habib, 2023). In this context, stakeholder theory, legitimacy theory, and institutional theory offer significant insights into the motivations behind organizational engagement in sustainability.

Stakeholder theory, as posited by Freeman (1984), asserts that by prioritizing the interests of a broad spectrum of stakeholders beyond merely shareholders, organizations can foster sustainable value creation, thereby enhancing FP. In the same line, legitimacy theory, as articulated by Suchman (1995), posits that organizations actively seek to align their operations and strategies with society's prevailing norms and expectations. This alignment is crucial for organizations to acquire, sustain, or restore legitimacy amongst their stakeholders. In essence, organizations must engage in practices that are perceived as socially acceptable to secure their standing and credibility within the community. Within the realm of sustainability, firms often undertake initiatives to secure financial returns and bolster their legitimacy. To do so can also be considered an "informal" prerequisite for operating in specific markets (Peloza, 2006). Moreover, as discussed by DiMaggio and Powell (1983), institutional theory posits that isomorphic processes may serve as mechanisms for enhancing organizational legitimacy.

Concerning environmentally sustainable initiatives, the trade-off theory (Friedman, 1970) provides a framework that underscores the potential negative implications of such initiatives on a company's FP. Implementing environmentally friendly practices often necessitates considerable investments (Hart and Ahuja, 1996), which are readily observable. In contrast, the benefits derived from these practices may be more challenging to quantify, as not all initiatives yield direct and immediate outcomes (Iatridis, 2013; Meng et al., 2016). Conversely, the eco-efficacy theory (Porter and Van der Linde, 1995) and the resource-based theory (Barney, 1996) contend that environmentally sustainable practices are strategic resources that confer competitive advantages upon firms. Following the initial investment, organizations can realize "certain" cost savings through resource optimization (Al-Tuwaijri et al., 2004; Ali et al., 2025), reductions in pollutant emissions (Gallego, 2012; Smale et al., 2006), or the mitigation of penalties associated with regulatory non-compliance (Carballo and Castromán, 2015). Additionally, indirect benefits may arise, such as the attraction of consumers who

favor environmentally responsible companies (Luo and Bhattacharya, 2006) and the reduction of capital costs (Godfrey et al., 2009).

In light of the agency theory, as described by Jensen and Meckling (1976), it is suggested that managers might pursue sustainability initiatives primarily for their gain (incentives) or to enhance their reputation. Therefore, engaging in certain practices can either enhance or undermine an organization's FP, depending on whether incentive schemes are linked to FP, sustainability, or both (Cohen et al., 2023; Jang et al., 2022; Keddie and Magnan, 2023; Velte, 2016). In addition, managers usually have a short-term vision, while shareholders also consider the long-term. Based on this premise, it should also be considered that investments and returns of environmentally friendly initiatives could be lagged.

3. Literature review and hypothesis development

The relationship between EP and FP has been the subject of several meta-analyses (Albertini, 2013; Dixon-Fowler et al., 2013; Endrikat et al., 2014; Hang et al., 2019). While there is a consensus that greater resource availability increases the likelihood of engaging in environmentally friendly practices (Čater et al., 2023; Laguir et al., 2018; Testa and D'Amato, 2017), the results regarding the impact of such practices on a company's performance are heterogeneous (Aigbedo, 2021; Alexopoulos et al., 2018; Ali et al., 2025; Baah et al., 2021b; Farza et al., 2021; Habib, 2023; Jum´a et al., 2021; Liu et al., 2022). In other words, is it truly beneficial to adopt green initiatives?

Having an answer to this question is critically important for companies, particularly those that face greater pressure to adopt environmentally friendly practices due to their operations' negative environmental impacts.

Although companies would obtain a positive performance from implementing sustainable initiatives from a legitimacy point of view and from satisfying all stakeholders' expectations, practices focused on the environment have a distinctive characteristic: the high initial investment that most of them imply.

Based on the trade-off arguments, the initial investments are "certain", while some associated costs are more challenging to identify because some are indirect and/or there is a lag in obtaining the benefits. In the same line, Goss and Robert (2011) argue that large expenditures in Environmental, Social and Governance (ESG) tie up financial resources and reduce business value.

On the other hand, based on the eco-efficiency arguments and resource-based view, the balance between the cost/investment and the associated returns is positive. Together with the "certain" cost-saving, the indirect benefits supported by the literature should be considered.

The certainty of the "investments/expenses" and the uncertainty of the indirect "benefits" associated with them could lead to agency conflicts (Wu and Xie, 2024) among managers and shareholders. The level of managerial engagement in environmentally sustainable initiatives may vary based on the specific inputs utilized in determining incentive structures. If they are only linked to FP, the high cost of implementing EP or those with uncertain returns would not be carried out (Jang et al., 2022; Mansour et al., 2024). When the incentives depend only on sustainable performance, there is an increase in engagement with sustainability, although FP does not improve (Cohen et al., 2023). Nonetheless, if the incentive structure encompasses sustainable and FP metrics, managers may be more committed to sustainability while focusing on financial viability (Flammer et al., 2019).

Considering that most of the empirical evidence regarding manufacturing industries indicates a positive impact of EP on companies' performance (Ali et al., 2025; Baah et al., 2021b; Habib, 2023;

Jum´a et al., 2021; Liu et al., 2022; Pons et al., 2013; Sen, 2015; Tzouvanas et al., 2020), our first hypothesis is stated:

H1: EP has a positive impact on companies' FP.

Numerous researchers have highlighted the crucial mediating role of reputation, as an intangible asset, in the relationship between EP and FP (Brammer and Pavelin, 2006; Jing et al., 2023; Larrán et al., 2015; Neville et al., 2005; Surroca et al., 2010). According to Newbert (2007), establishing competitive advantages through intangible resources like reputation is vital for a firm's success (resource-based theory) due to the difficulty of imitation. Although empirical research on the direct effects of sustainability practices on corporate reputation is limited (Baraibar-Diez and Luna-Sotorrio, 2018), a company's environmental friendliness can significantly influence its reputation—either positively or negatively—depending on whether the actions are perceived as symbolic or substantive (Truong et al., 2021). If the practices are seen as symbolic gestures, reputation tends to decline, while substantive actions typically enhance it.

All stakeholders take into account the company's reputation as a significant factor influencing their decision-making processes. However, it is important to note that price remains a critical component in these evaluations (Bendixen et al., 2004). Previous research on the manufacturing industry is mixed. While Farza et al. (2021) supported the mediation effect, Afum et al. (2020) and Baah et al. (2021a) found no significant mediation role. Hence, we established our second hypothesis:

H2: The relationship between EP and FP will be mediated by a company's environmental reputation.

Previous literature has highlighted the significant role that the institutional environment plays in shaping how EP impacts organizations' FP (Horváthová, 2010; Hou et al., 2016; Miras-Rodríguez et al., 2018; Saha et al., 2024; Waldman et al., 2006). This notion is theoretically grounded in institutional theory (Baughn et al., 2007; Matten and Moon, 2008). Given that legal requirements vary across countries, stakeholder expectations are likely to be more aligned in nations that share greater similarities (Jamali and Mirshak, 2006). Bai and Chang (2015) noted that sustainability initiatives tend to be valued more in developed countries, although the evidence in emerging economies remains ambiguous (Tsai et al., 2020). In the context of manufacturing companies, evidence supports the long-term implementation of EP in developed countries (Chen et al., 2015). Nevertheless, Naeem et al. (2022) discussed that companies within environmentally sensitive industries, such as manufacturing, from developed countries report a positive effect, while the undertakings from emerging countries present a lack of significant effect. In this line, Baah et al. (2021b) contended that some companies in developing nations deny integrating EP, while others try to incorporate them, considering their limited resource capacity. Maldonado-Guzman (2024) argued that manufacturing firms in Mexico have ignored the environmental consequences of their operations. Nevertheless, other studies suggested that there has been a growing concern over environmental issues in recent years within developing and emerging countries, largely driven by the necessity to export (Chen et al., 2015). Furthermore, Zhu and Sarkis (2004) emphasized the crucial role of FP in motivating engagement in EP.

Taking into account the approach of Barnett and Salomon (2012), variations in FP can be attributed to the differing stages of commitment to environmental issues among various enterprises or countries. For Western companies that have a long-standing tradition of EP, strong ethical practices may not yield significant rewards, while bad practices are likely to face negative consequences (Margolis and Walsh, 2003). In contrast, institutional environments that have recently adopted EP

often experience significant financial benefits and are not penalized for lacking commitment (Dallocchio et al., 2025; Ha et al., 2024).

The EP implemented by companies with a longstanding commitment to environmental responsibility may receive comparatively less recognition than organizations from countries with a more recent commitment. This leads to our third hypothesis:

H3: The relationship between EP and FP will be moderated by the institutional environment.

Numerous researchers have highlighted the industry's significant role in this relationship (Aigbedo, 2021; Margolis and Walsh, 2003; Waddock and Graves, 1997). They have claimed that the lack of consensus previously argued can be attributed to the compensation or overlapping of results derived from cross-sectional samples because stakeholder pressures differ across industries (Patten, 2002).

Manufacturing companies are highly aware of environmental issues. Nevertheless, since there are three sectors involved in the sample, it is important to test for differences among them. Consequently, the fourth hypothesis states that:

H4: The relationship between EP and FP will be moderated by the subsector.

Figure 1 shows a representation of all the hypotheses previously stated.

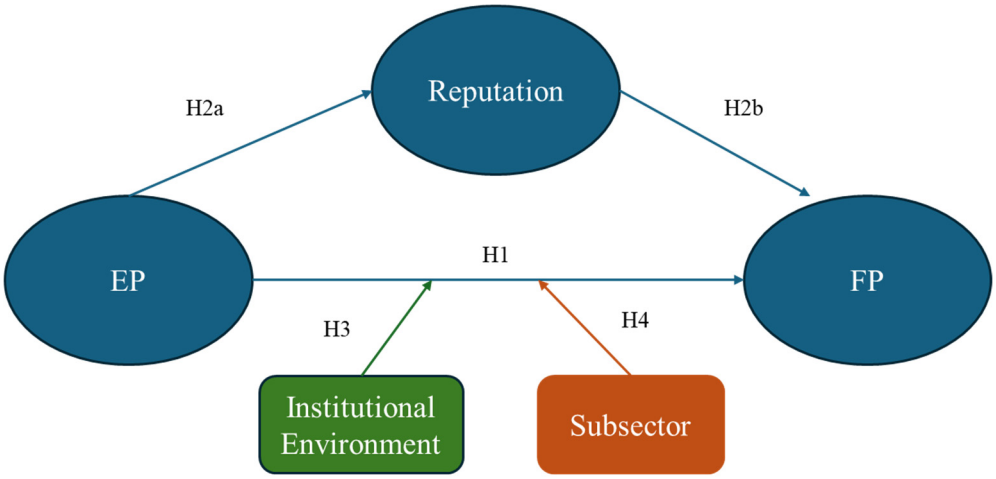


Figure 1. Map of the hypotheses.
Source: Authors' own work

4. Methodology

The sample is composed of companies engaged in the High-Performance Manufacturing (HPM) project, which involves the machinery, electronics, and automotive components industries.

The HPM project database represents an international compilation of data derived from responses provided by managers through a systematic survey administered to a representative sample of manufacturing plants. The questionnaire, designed for the collection of sustainability-related metrics, is grounded in measures that have been rigorously validated in the academic literature (Ahmadi-Gh and Bello-Pintado, 2022; Bello-Pintado et al., 2023). Each sustainability item is assessed using a Likert scale, with values ranging from 1 to 5.

The sample encompasses companies from nine countries: Brazil, China, Germany, Israel, Italy, Japan, South Korea, Spain, and Sweden. A total of 198 observations have been aggregated. The distribution of these observations, categorized by country and industry, is presented in Table 1.

Table 1. Sample distribution.

Country	Machinery	Electronics	Automotive components	Total
Brazil	3	7	9	19
China	6	7	9	22
Germany	6	12	8	26
Israel	14	3	0	17
Italy	7	17	5	29
Japan	8	5	13	26
South Korea	9	18	1	28
Spain	5	6	11	22
Sweden	4	4	1	9
TOTAL	62	79	57	198

The present analysis incorporates several key variables: environmental practices (EP), financial performance (FP), reputation, institutional environment, and industry. The EP variable is derived from a comprehensive evaluation of 41 distinct indicators outlined in the HPM project (Miras-Rodriguez et al., 2018).

The FP and reputation variables are each represented by a single item measured on a Likert scale ranging from 1 to 5. Specifically, the FP variable encapsulates managers' perceptions of the FP attained by the organization as a result of implementing environmental initiatives. In contrast, the reputation variable reflects managers' perceptions of the enhancement in reputation that arises from engaging in environmentally sustainable practices.

The majority of the existing literature on this subject tends to concentrate either on a singular group of countries or comparative analyses across different nations (Chapple and Moon, 2005; Welford, 2005). Among the various methodologies available for assessing the institutional environment, the Governance Environment Index, as proposed by Li and Filer (2007), has been selected due to its robust complexity and ability to mitigate some of the limitations associated with alternative cultural classifications (Miras and Escobar, 2016). Recognizing the countries involved in the HPM project and utilizing the classification framework established by Li and Filer (2007), the total sample can thus be categorized into two distinct sub-samples: rule-based countries (comprising Germany, Italy, Japan, Korea, Spain, and Sweden) and relation-based countries (including Brazil, China, and Israel).

Finally, the analysis identifies three sub-industries within the sample—machinery, electronics, and automotive components—pertinent to the industry variable.

4.1. Method

Structural equation modeling (SEM) represents a sophisticated multivariate technique that integrates components of multiple regression and factor analysis to concurrently estimate a series of interrelated dependence relationships. This methodological approach has gained considerable traction in recent years across various disciplines, particularly within the social and management sciences.

SEM analysis can be executed through two principal statistical techniques (Roldán and Sánchez-Franco, 2012): covariance-based approaches, exemplified by LISREL and AMOS, and variance-based methods, such as partial least squares (PLS). Given the nature of our model, which incorporates formative indicators, PLS is deemed more appropriate for analysis (Henseler et al., 2009).

In the context of SEM, it is imperative to assess both the measurement model, which delineates the composition of each latent variable, and the structural model, which elucidates the causal relationships among the latent variables. This dual evaluation is crucial for ensuring the robustness and validity of the resulting analysis. This study uses SmartPLS 4 software (Ringle et al., 2022).

4.1.1. Measurement model

Consistent with the existing literature, the latent variable (EP) is constructed using formative indicators, as each indicator or item contributes to its formation (Chin, 1998). As was argued by Hair et al. (2021, 2022) and Cheah et al. (2018), it is considered that the variables are theoretically designed to be formative, assessing collinearity and the significance and relevance of the formative indicators. To evaluate the validity of the measurement model, it is essential to assess the weights of the indicators, given that parameters are not applicable for reflective indicators. These weights provide insights into which indicators significantly influence our latent variable.

4.1.2. Structural model

Once the validity of the outer model was established, it was possible to test the hypotheses. This involves quantifying the proposed causal relationships using the PLS algorithm, which calculates each dependent construct's path coefficients and R2 values. To assess the significance of the parameters, a bootstrapping analysis was conducted with 10,000 resamples, as recommended in the literature (Streukens and Leroi-Werelds, 2016).

Furthermore, additional tests are necessary to examine the mediating and moderating roles of the variables. To test the mediating effect of reputation, a comparison must be made between the model without the mediator variable and the model that includes it. This mediation can be classified as either partial or total, depending on the significance of the parameters. If the path coefficient of the primary relationship is significant but loses significance once the mediator variable is introduced, the mediation is considered total. Conversely, if the primary relationship remains significant after adding the mediator variable, the mediation is deemed partial. When a mediator variable is included in the analysis, the total path coefficient effects are presented, and their significance is calculated using bias-corrected bootstrapping with 10,000 resamples (Chin, 2010).

A multi-group analysis is imperative to evaluate the moderating effect of the cultural environment (Henseler and Fassott, 2010). This analytical approach entails partitioning the sample into distinct groups based on the moderator variable and applying the model to each subgroup.

In the context of moderation analysis, it is essential to give careful consideration to measurement invariance (Sarstedt et al., 2011). In particular, the advanced measurement invariance through the measurement invariance of composite models (MICOM) based on the permutation technique developed by Henseler et al. (2016) was used. Among the different techniques, the permutation multigroup analysis was used (Chin, 2003; Chin and Dibbern, 2010) when the number of groups was two. For robustness, bootstrap multigroup analysis (Henseler, 2012) was also performed.

5. Results

First, the measurement model should be validated. Then, collinearity, significance, and relevance of EP, as a formative construct, were assessed. Thus, a collinearity analysis was carried out, and the variance inflation factor (VIF) was examined considering the threshold of 3.3 (Diamantopoulos and Siguaw, 2006). Consequently, 10 items were deleted[1]. In addition, the significance and relevance of the items were assessed by considering those whose weights would be higher than 0.5 or, on the contrary, those whose loadings are statistically significant (Hair et al., 2021). Then, only 29 items remain (Table 2).

Table 2. Weights of final items for EP.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)
EP01	0.246	0.217	0.135	1.822
EP02	0.063	0.042	0.138	0.458
EP04	−0.351	−0.305	0.137	2.568
EP05	−0.13	−0.116	0.149	0.873
EP06	0.048	0.036	0.164	0.295
EP07	0.336	0.286	0.156	2.156
EP08	−0.18	−0.143	0.185	0.976
EP09	−0.162	−0.125	0.147	1.102
EP12	0.342	0.284	0.152	2.255
EP13	−0.035	−0.049	0.15	0.236
EP14	0.091	0.079	0.169	0.536
EP15	−0.064	−0.045	0.196	0.326
EP17	0.047	0.026	0.142	0.333
EP18	0.092	0.072	0.168	0.547
EP20	−0.226	−0.181	0.141	1.607
EP21	−0.25	−0.224	0.15	1.671
EP22	0.039	0.036	0.158	0.247
EP24	0.4	0.341	0.156	2.563
EP29	0.412	0.349	0.186	2.215
EP30	0.112	0.08	0.141	0.793
EP31	−0.15	−0.118	0.151	0.999
EP32	0.152	0.127	0.174	0.876
EP33	−0.009	0.026	0.17	0.055
EP34	−0.17	−0.141	0.146	1.166
EP35	−0.004	−0.016	0.2	0.018
EP36	0.052	0.054	0.161	0.325
EP37	−0.135	−0.108	0.138	0.982
EP38	0.149	0.141	0.159	0.933
EP39	0.311	0.27	0.146	2.124

Table 2 outlines the indicators that exert a strong positive influence on EP: (1) energy efficiency or renewable energy, (2) seeking or maintaining an ISO14001 certification, (3) encouraging suppliers to improve the environmental performance of their processes, and (4) providing design specifications to suppliers in line with environmental requirements. Conversely, improving the workforce environment, the life-cycle analysis of the "cradle-to-grave" environmental impact of materials/products, and environmentally preferable direct packaging for the products you produce adversely affect EP.

[1] EP10, EP11, EP16, EP19, EP25, EP26, EP27, EP28, EP40, EP41.

After assessing the measurement model, we test our hypotheses through structural model analysis. The results for the first hypothesis are illustrated in Figure 2. The relationship between EP and FP is statistically significant, with a p-value of 0.001 according to the one-tailed t-student distribution. Additionally, the model demonstrates good predictability for EP, with an R^2 value of 0.287.

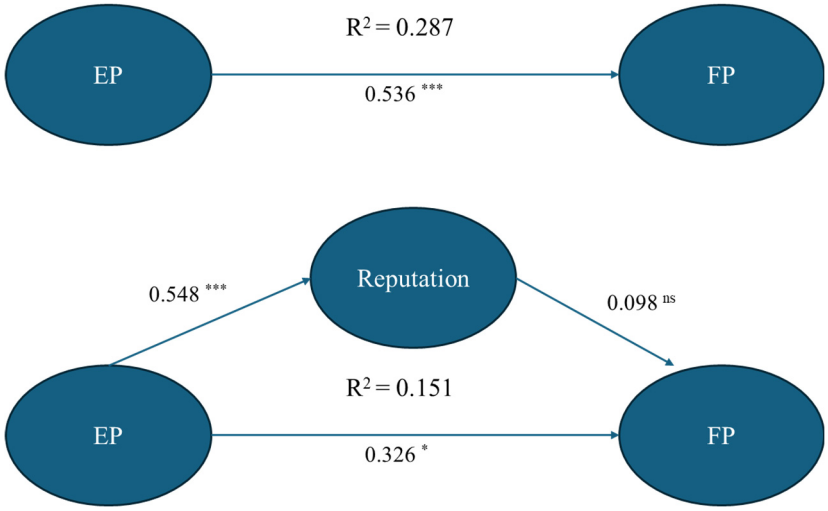


Figure 2. Structural model results.
Path coefficients are presented. * p-value < 0.05; ** p-value < 0.01; ***p-value < 0.001, ns: non-significant.

Also, Figure 2 illustrates the results of the mediation test concerning reputation. To assess this effectively, we divided the hypothesis into 2a (EP and reputation) and 2b (reputation and FP). The findings indicate that the impact of EP on FP is reduced when the reputation is included in the analysis. Additionally, the coefficients for both H2a show a statistically significant impact, while H2b is non-significant. It is essential also to consider the results presented in Table 3. The total effect on FP is smaller than that reported in the base model, which did not account for the mediator role; also, the indirect effect remains insignificant. Also, VAF (variance accounted for) is calculated (Wong, 2016), and the indirect impact explains 14.21% of the total effect. While the introduction of reputation appears to influence this relationship, the results do not allow for a conclusive determination of mediation.

Table 3. Path coefficient and indirect effects for the mediation model.

	Total effect	**Direct effect on FP**	**Indirect effect**
EP > FP	0.380***	0.326*	
EP > Reputation > FP			0.054^{ns}

*** Statistical significance of 99%, * statistical significance of 95% (one-tailed t-student distribution)

To be sure about the mediator role of reputation, the previous analysis was complemented by comparing both models (the one with the mediation analysis and the one without mediation; the base model), such as Riggs et al. (2024) suggested, through the Bayesian Information criterion (BIC) test (Sharma et al., 2019). BIC values are higher for the model that includes the mediation (−57.414 vs. −17.501), so this test does not support the mediation model. The next step was to conduct two robustness checks (Table 4) to assess the potential presence of nonlinear effects and endogeneity

(Sarstedt et al., 2020). Regarding testing the existence of nonlinear effects by incorporating the quadratic effect and performing a bootstrapping estimation, the results showed that none of the quadratic terms were significant. Therefore, we assume the robustness of the linear effects. In addition, an endogeneity analysis was performed by applying the Gaussian copula approach (Hult et al., 2018). Before testing endogeneity, the latent variable should show a non-normal distribution to carry out the test. The Cramer–von Mises test corroborated that our variables meet the requirement. The analysis was carried out, and none of the effects presented a statistically significant effect, which means that endogeneity is not present in the model, supporting the robustness of the model.

Table 4. Assessment of nonlinear and endogeneity effects.

	Coefficient	p-value
Non-linear effects		
EP > FP	0.051	0.247
EP > Reputation	0.022	0.327
Reputation > FP	−0.033	0.319
Endogeneity		
EP > FP	−0.221	0.398
EP > Reputation	0.445	0.227
Reputation > FP	−0.077	0.306

p-value based on bootstrapping (n = 10,000 subsamples) using a two-tailed test.

The multi-group analyses examined the moderating effects of the institutional environment and industry. For each moderator variable, the sample was divided into two sub-samples (for the institutional environment) or three sub-samples (for subsectors). Multigroup analyses are carried out through the permutation multigroup analysis, following the procedure established in Hair et al. (2022). As was previously argued, MICOM analysis should be carried out.

The institutional environment subsamples comply with the requirements of MICOM analysis, and the multigroup analysis is presented in Table 5 and Figure 3. Although the multigroup analysis by permutation does not confirm the existence of a moderation effect, bootstrapping multigroup analysis confirms the existence of a moderation effect.

Table 5. Multi-group analysis by institutional environment.

	Path coefficients difference	p-value permutation test	p-value bootstrapping test
Rule-based vs. relation-based	−0.205	0.310	0.048

Figure 3 indicates differences in the EP–FP relationship across the different cultural environments. This relationship is significant in both settings. However, the coefficient and the goodness of fit are higher for companies established in relation-based countries (such as Brazil, China, and Israel) than for those operating in rule-based countries. These findings suggest that the relationship between EP and FP is contingent upon the institutional context in which firms operate, supporting the existence of a moderating role.

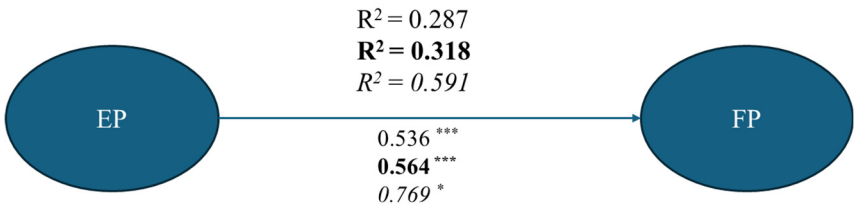


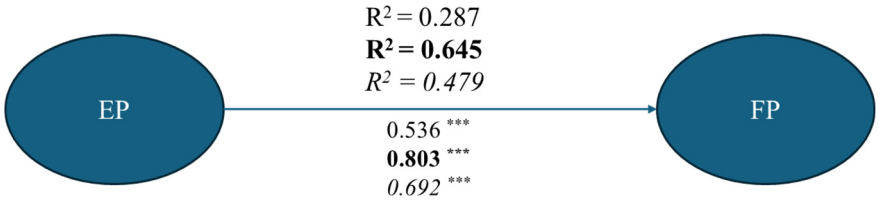
Figure 3. Comparison of the different samples (multi-group analysis by institutional environment).
Note: Normal: complete sample; bold: rule-based countries; italics: relation-based countries. † p-value < 0.1; * p-value < 0.05; ** p-value < 0.01; ***p-value < 0.001, ns: non-significant.

Measurement invariance should also be assessed through the MICOM procedure to test the industry's moderating role. Once the requirements are met, the results of the multigroup analyses are presented in Table 6. Based on these results, the industry moderator role is supported only for machinery and electronic subsamples when the bootstrapping multigroup analysis is considered.

Table 6. Multi-group analysis by industry.

	Path coefficients difference	p-value permutation test	p-value bootstrapping test
achinery; automotive[2]	1.512	0.131	-
Machinery; electronic	0.111	0.297	0.028
Electronic; automotive[2]	1.409	0.114	-

Figure 4 presents the outcomes of the bootstrapping for the groups in which the moderator effect is supported. Sustainability behaviors exert a higher positive and statistically significant influence on the perceived firm performance in the machinery subsector than in the electronics subsector. The goodness of fit for the proposed model in machinery and automotive is higher than that for the general model.



Note: Normal: complete sample; **bold: machinery**; *italics: electronic*. † p-value < 0.1; * p-value < 0.05; ** p-value < 0.01; ***p-value < 0.001; ns: non-significant.

Figure 4. Comparison of the different samples (multi-group analysis by industry).

6. Discussion

Our results corroborate that adopting environmentally friendly practices positively impacts the FP of manufacturing plants engaged in the High-Performance Manufacturing (HPM) initiative. That means that despite uncertain returns, benefits from being involved in EP seem higher than the initial

[2] Automotive subsample size does not allow carrying out the bootstrapping test.

investments. The findings support the arguments of efficiency and resource-based theories and are consistent with previous evidence from the manufacturing industry in multi-country samples (Tzouvanas et al., 2020) and in particular settings (Ali et al., 2025; Baah et al., 2021b; Farza et al., 2021; Habib, 2023; Jum´a et al., 2021; Liu et al., 2022; Pons et al., 2013; Sen, 2015). Considering the agency conflict, it seems that managers are not only worried about their gains but also about improving the company's financial situation. As the literature argues (Flammer et al., 2019), to overcome agency conflicts, it would be key to establish mixed incentive systems that motivate managers to be involved in sustainability and, at the same time, try to improve companies' performance.

Regarding the second hypothesis, our analysis demonstrates that corporate reputation does not mediate the relationship between EP and FP. The lack of significance of the mediating effect may be attributed to its classification as symbolic actions (Truong et al., 2021). Our findings align with Afum et al. (2020) and Baah et al. (2021a). On the contrary, they contrast with those of Farza et al. (2021) and Jing et al. (2023), who identified a significant mediating role for reputation in manufacturing firms. Nonetheless, Farza et al.'s (2021) study encompassed environmental innovation, and Jing et al.'s (2023) was focused generally on sustainability actions (not limited to environmental topics). The third hypothesis is supported since the moderator role of the institutional environment in the EP–FP relationship has been demonstrated. In particular, our analysis reveals that environmentally sustainable practices in relation-based countries are associated with greater financial rewards than those in rule-based countries, which reflects their recent commitments to sustainable practices. This is consistent with the previous evidence found by Baah et al. (2021b), who argued that firms operating within emerging or developing economies that adopt EP exhibit better FP despite encountering limitations in financial resources. This phenomenon is further supported by Miras-Rodríguez et al. (2018), who concluded that in nations that have recently initiated the adoption of EP—predominantly emerging markets—such environmentally conscious behaviors are notably incentivized, aligning with the framework proposed by Barnett and Salomon (2012). Previous evidence focused on developing countries such asChina (Ali et al., 2025; Liu et al., 2022), Ghana (Afum et al., 2020; Baah et al., 2021a; Baah et al., 2021b) and Jordan (Jum´a et al., 2021) also supports the positive relationship.

Nevertheless, Saha et al. (2024) revealed that EP from firms operating in countries with higher government effectiveness and superior regulatory quality has a more pronounced impact on corporate performance. Farza et al. (2020) and Habib (2023) also found a positive impact on Germany and the USA, while Alexopoulos et al. (2018) reported a lack of significant effect on Greek manufacturing companies.

Finally, the moderator role of industry has been statistically demonstrated when machinery and electronic subsectors are considered. Notably, companies engaged in both subsectors exhibit a higher positive influence of their EP on FP than when the complete sample is considered. These results also supported previous evidence from Aigbedo (2021), Margolis and Walsh (2003), and Waddock and Graves (1997), which argues the relevant role that industry plays in the EP–FP relationship.

7. Conclusions and limitations

This research contributes to the ongoing debate regarding the relationship between EP and FP by proving that sustainability and profitability are not mutually exclusive. It argues that adopting environmentally friendly practices is financially beneficial for manufacturing firms. In addition, our findings support the existence of differences among countries with different cultures and subsectors.

These insights are of considerable significance for managerial decision-making, since they support the business case of integrating environmentally friendly strategies; that is, the benefits of carrying out EP would allow for compensating the high initial investment that most of them require. Furthermore, shareholders have mechanisms in place to overcome the potential agency problems and to ensure that managers' own interests are not in conflict with the company's general interest.

Focusing on plants has provided unique evidence since most previous research is focused at the company level, which implies some level of aggregation and, consequently, a potential overlapping of results. However, it also implies some limitations, such as the lack of accounting or market data for FP. As the previous literature argued, this has been overcome by asking managers about their perception of FP. Future research should try to develop an equivalent measure to objective accounting/market measures of FP, which would make it possible to contrast the findings.

In addition, it should be pointed out that this research has been focused on a particular context: high-performance manufacturing (HPM) plants, which limits the generalizability of the results to other industries or types of companies.

Further research should focus on the lack of a significant effect of reputation as a mediator variable between environmental friendliness and companies' FP. In this regard, it would be recommendable to differentiate between favorable and unfavorable reputations, given that building a positive reputation requires time and effort, but it can be rapidly undermined. Moreover, organizations with negative reputations are subject to market penalties, while the advantages associated with a positive reputation remain ambiguous.

Authors' contribution

Bernabé Escobar-Pérez: Conceptualization, Validation, Visualization, Investigation, Supervision, Project administration, Funding acquisition, Writing - original draft. Silvia Fresneda-Fuentes: Methodology, Formal analysis, Visualization, Writing - review & editing. María del Mar Miras-Rodríguez: Methodology, Visualization, Formal analysis, Resources, Data curation, Writing - original draft, Writing - review & editing.

Use of AI tools declaration

The authors declare that they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflicts of interest

The authors declare no conflict of interest.

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