2024 Volume 2, Issue 1
Lecture Notes in Education, Arts, Management and Social Science
ISSN(Online): 2705-053X

The Impacts of Institutional Pressures on Environmental Performance: The Mediating Role of Voluntary Environmental Regulation in Mexico

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Abstract:

This research analyzes the mediating role of voluntary environmental regulation on the relationship between mimetic, normative, and coercive pressures and the environmental performance of certified companies in an emerging country. This study uses an instrumental variable research design and structural equation modeling with survey data from 225 certified companies. It was found that voluntary environmental regulation increases the predictive validity of mimetic and normative pressures on environmental performance. Voluntary environmental regulation also fully mediates the relationship between pressure for compliance with regulation and environmental performance. This study contributes to the body of environmental management and policy literature in two ways: (1) it demonstrates the usefulness of institutional theory in explaining the adoption of voluntary environmental regulation; (2) it offers empirical evidence of the benefits and limits of voluntary environmental regulation in a context characterized by institutional voids.

Keywords:

Voluntary environmental regulation
Institutional theory
Mimetic pressures
Coercive pressures
Normative pressures

Online publication: June 28, 2024

1. Introduction

Voluntary environmental regulation represents an effective tool for pollution control in developed economies as it contributes positively to improving environmental performance [1-4]. In democratic societies, policies involving public-private regulation, transparency, monitoring mechanisms, and a trigger for government intervention in case of ineffectiveness tend to receive greater public support [5]. However, certain types of democracies (e.g., social-liberal democracies with low inequality levels) may favor the adoption of higher voluntary environmental commitments [6]. In developed

countries, companies comply with the guidelines set by voluntary and non-voluntary environmental regulations by implementing environmental practices, adopting an environmentally conscious culture, or implementing green innovations [7,8].

However, it has been found that voluntary environmental regulation is less effective in emerging economies [9]. For instance, studies conducted in Mexico by Camacho [10] analyzed the industrial manufacturing sector to evaluate the effects of inspection and oversight, observing whether companies certified by the Federal Attorney for Environmental Protection (PROFEPA) comply with environmental standards. Elizondo and Hernández [11] focused on describing the official Mexican standard aimed at reducing the negative impacts of the automotive sector. Montiel and Husted [12] and Rivera [13] found that social, political, and economic issues often negatively affect legislation and compliance with environmental regulations in developing countries.

In these contexts, attention must also be paid to institutional voids—the absence or underdevelopment of institutions that enable effective markets (e.g., governance mechanisms to prevent corruption, public infrastructure, constant monitoring, and protection of property rights)—as these hinder companies from achieving appropriate standards in their operations and affect their environmental behavior [14-17].

Research on voluntary environmental regulation in emerging economies is scarce, although some studies have been conducted in this context, such as in Costa Rica [13], Mexico [12,18], India [19], Malaysia [20], and Pakistan [21]. However, the lack of data on environmental performance in emerging economies complicates consistent monitoring and evaluation [13,22].

Investigating voluntary environmental regulation in emerging economies is important because these countries often experience rapid industrialization and economic growth processes, which can lead to greater environmental degradation. Some of these countries play significant roles in global supply chains and could potentially reduce their environmental footprint and mitigate environmental challenges. Moreover, voluntary environmental regulation can create economic opportunities in these countries. By adopting environmentally friendly practices, companies can improve their reputation and competitiveness, attract responsible investors, increase stakeholder commitment and collaboration, and tap into the growing demand for sustainable products and services.

Emerging countries often lack an integrated environmental policy and reinforcement mechanisms to facilitate their implementation and compliance. Fernández-Vázquez [23] highlighted that, although environmental policy in Mexico's agricultural sector provides an open space for discussion among public institutions, it is neither a priority on the political agenda nor an integral policy mandate. Traditional distrust among public agencies complicates the use of environmental policy, leaving it at the personal discretion of politicians in office. Rius [24] confirmed deficiencies in public policies conceived as parallel and autonomous channels, which seem to be the norm in Mexico and other Latin American countries.

Institutional theory [25] has been widely used to analyze voluntary environmental regulation in developed countries. The central point of institutional theory is its focus on the requirements organizations must meet to gain legitimacy, such as acceptance by peers [26]. These requirements arise from companies or widespread belief systems (through mimetic pressures) [26,27], professional associations (through normative pressures), and the state (through coercive pressures).

Mimetic pressures refer to the influences exerted by certain organizations, typically leaders in their field, on other organizations, encouraging imitation [26]. Normative pressures are defined as those arising from standards established by institutions, such as professional or industrial organizations. Coercive pressures, on the other hand, are those imposed by regulatory bodies that directly establish the rules a company must follow [28]. Normative pressures differ from coercive pressures in that institutions exerting normative pressures lack the authority to directly mandate compliance and cannot penalize noncompliance [28].

Therefore, according to Raza [7] and Zhu and Sarkis [29], institutional theory allows us to explore mimetic, normative, and coercive pressures that may influence companies' environmental performance. For instance, Fransen and Burgoon [4] found that social pressures from NGOs, along with consumer and media

influences, determine the types of responsibilities chosen by companies in the European garment industry. Additionally, recent studies have reported a positive relationship between institutional pressures and environmental performance in Italy [9] and China [30].

However, scientific evidence on the effects of voluntary environmental regulation in developing countries is limited and inconclusive. Henriques *et al.* [18] identified a positive effect of voluntary environmental regulation on environmental performance. In contrast, Blackman *et al.* [31] found that such regulation does not have a strong or lasting impact on companies' environmental performance. Other authors have stated that voluntary environmental programs are challenging to evaluate due to poor organizational monitoring and data reporting [32]. Montiel and Husted [12] proposed that institutional entrepreneurs (decision-makers) play a significant role in pursuing voluntary environmental certifications in Mexico, which in turn grant legitimacy to companies. Latif et al. [21] argued that the adoption of voluntary environmental certifications may be motivated by mimetic, normative, and coercive institutional pressures, which, due to their differing origins, should be analyzed separately in a developing country to understand their roles—a subject that has yet to be sufficiently studied. This research aims to address this gap.

To this end, the effects of different types of institutional pressures on voluntary environmental regulation are explored, addressing the following research question: How does voluntary environmental regulation mediate the relationship between different types of institutional pressures and companies' environmental performance in an emerging economy? Based on survey data from 225 companies located across Mexico (all of which held a valid certification in a voluntary environmental program at the time of the survey) and structural equation models, empirical evidence is provided on the mediating effects of voluntary environmental regulation on the relationship between different types of institutional pressures and companies' environmental performance.

This study contributes to the environmental policy and management literature in two ways:

(1) It demonstrates the utility of institutional theory in explaining the adoption of voluntary environmental regulations in an emerging country.

(2) It provides empirical evidence of the benefits and limitations of voluntary environmental regulation in an emerging country characterized by institutional voids.

The remainder of the article is organized as follows: the literature review is presented, and the hypotheses are developed; the research method is then described; the results of the statistical analysis and discussion are presented, and the paper concludes with the conclusions, limitations, implications, and recommendations for future research.

2. Literature review and hypothesis development

2.1. Institutional theory

This theory examines institutional fields or socially constructed normative worlds in which organizations exist [25,33]. Organizations adhere to social rules to gain support and legitimacy. These requirements originate from the state, professional associations, other companies, generalized belief systems, and similar sources [25]. Some authors have used institutional theory to explain certain organizational behaviors, such as the adoption of environmental practices [34] and the development of strategies to combat climate change [9].

According to this theory, institutions exert three types of pressures on organizations: mimetic, normative, and coercive [25]. Mimetic pressures lead organizations to imitate practices considered successful in their institutional field to gain legitimacy [25,35]. Normative pressures arise through norms and values. Regulatory systems specify objectives and how they should be achieved; when new elements become legitimate, organizations react by adopting them in their structures [36,37]. Coercive pressures come from other organizations or society's cultural expectations. These pressures can manifest as force, persuasion, sanctions, or penalties, and are generally imposed by the state [37,38].

Studies have demonstrated that the concept of institutional pressures helps explain organizational behavior in response to growing interest in developing environmental practices [39-41]. In various regions worldwide, institutional pressures have been shown

to drive organizations to improve their environmental performance by complying with environmental regulations [2,13,42].

2.2. Institutional pressure and environmental performance

Institutional pressures have been found to positively influence companies' environmental practices and performance [29,43,44]. Dubey *et al.* [45] discovered that institutional pressures help reduce waste and pollutant gas emissions. Lu *et al.* [30], Phan & Baird [40], and Rivera [13] found that institutional pressures promote environmentally friendly behavior. In a study of Chinese manufacturing companies, Lu *et al.* [30] concluded that the most influential pressures are those that encourage environmental management and regulatory compliance. Babiak & Trendafilova [39] found that institutional motives, such as social expectations and pressure to adopt similar management practices, drive companies to adopt environmental initiatives.

Based on institutional theory, Ma *et al.* [41] identified a positive relationship between green procurement market pressure and environmental certification practices in Chinese manufacturing companies. In a European Union study, Raza [7] found that incorporating green technological innovation benefits both the economy and environmental performance in manufacturing companies, with these benefits directly driven by institutional pressures. Similarly, Qi *et al.* [8] concluded that institutional pressures positively influence firms' green technological innovation, prompting them to establish environmental management systems to improve environmental performance. Based on the above, the following hypothesis is proposed for companies in emerging economies:

Hypothesis 1 (H1): Institutional pressures have a positive effect on companies' environmental performance.

2.2.1. Mimetic pressures

Mimetic pressures can positively impact environmental performance as companies may imitate actions and activities with positive effects on environmental conservation. However, the scientific literature reveals no consensus on the analysis of mimetic pressures. On the one hand, Phan & Baird [40] found that mimetic pressures do not contribute to implementing an efficient environmental management system that enables organizations to improve their environmental performance. Saeed *et al.* [46] found in Pakistan that mimetic pressures are not strong enough to drive the adoption of sustainable practices in supply chains, thus having no favorable effect on environmental performance.

Conversely, Dai *et al.* [47], in a study conducted in China, and Chu *et al.* [48], in a study conducted in Korea, found a positive effect of mimetic pressures on the implementation of sustainable practices, which positively impacted environmental performance. Given these contrasting findings and the foundation of institutional theory, it is proposed that:

Hypothesis 1a: Mimetic pressures have a positive effect on companies' environmental performance.

2.2.2. Normative pressures

Regulatory pressures are those that drive companies to adhere to the standards of their external stakeholders (e.g., customers) to gain social legitimacy [48]. Berrone *et al.* [1], in a study conducted in the United States, found a positive relationship between regulatory pressures and environmental issues in companies, which favorably impacts environmental performance. Similarly, Chu *et al.* [48] found that in South Korea, regulatory pressures from customers significantly impact green supply chain management and, ultimately, companies' environmental performance. Based on these references, the following hypothesis is proposed:

Hypothesis 1b: Normative pressures have a positive effect on companies' environmental performance.

2.2.3. Coercive pressures

Coercive pressures are those exerted by the government, involving sanctions for non-compliance with authority-established mandates [1]. Different studies have independently explored this dimension of institutional pressures, yielding varied results. For instance, Dai *et al.* [47] found a positive effect of coercive pressures on the adoption of sustainable supply chains, which ultimately positively impacts the environment. Moreover, Zhu and Sarkis [29] found that in China, coercive pressures can

positively influence environmental performance.

However, Chu *et al.* [48] and Tate *et al.* [49] found no relationship between coercive pressures and environmental performance. Given these conflicting findings and considering the logic of institutional theory, we propose the following hypothesis:

Hypothesis 1c: Coercive pressures have a positive effect on companies' environmental performance.

2.3. Voluntary environmental regulation

Voluntary environmental regulation involves reaching an agreement between the regulator and the organization on implementing environmental policies without resorting to public coercive pressures [50]. Vargas and Olivares [51] found that voluntary self-regulation instruments encourage the use of better practices in production and supply processes. Furthermore, companies enhance their public image and reduce operating costs.

Voluntary self-regulation also enables companies to prevent pollution by providing alternatives not typically included in command-and-control regulations [32,52]. In Mexico, relevant voluntary environmental regulation programs include ISO 14001 and the National Environmental Audit Program [31].

Mexican voluntary environmental regulation is based on the General Law of Ecological Balance and Environmental Protection [53]. This legal framework established a procedure for manufacturing and service sector companies to obtain certification by verifying improvements in their environmental performance.

The National Environmental Audit Program, administered by PROFEPA, grants three types of certificates:

(1) Clean industry: Directed at the manufacturing and transformation sectors.

(2) Environmental quality: Includes companies in the commercial and service sectors, except tourism services.

(3) Tourism environmental quality: Targeted at companies offering tourism services [54].

On average, it takes a company about three months to obtain certification issued by PROFEPA, which is valid for two years with the possibility of renewal.

Various authors [10,12,18,31] have studied voluntary environmental regulation in Mexico, providing valuable insights into the program's context and progress. However, none have conducted an empirical analysis of the program's effects on the environmental performance of certified companies.

2.4. The mediating effect of voluntary environmental regulation on the relationship between institutional pressures and environmental performance

Studies on the relationship between institutional pressures and environmental performance have commonly analyzed the effects of management relations with suppliers, total quality management [45], ambidexterity [55], and environmental management systems [40].

Environmental regulation has been used as a mediating or moderating variable but never in interaction with institutional pressures and environmental performance, as is the case in this research. For instance, Li *et al.* [56] found that environmental regulation explains the relationship between environmental management and green innovation. Similarly, Cao *et al.* [57] observed that the relationship between industrial structure and technological innovation is mediated by environmental regulation.

This study proposes that voluntary environmental regulation mediates the relationship between institutional pressures and environmental performance. Voluntary environmental regulation can help explain environmental performance in the context of an emerging country. Thus, the following research hypothesis is proposed:

Hypothesis 2 (H2): Voluntary environmental regulation mediates the relationship between institutional pressures and firms' environmental performance.

2.4.1. Mimetic pressures

Firms may perceive that having environmental certification provides significant benefits to certified firms and may decide to imitate this behavior. Generally, these certifications (e.g., ISO 14001 and Clean Industry) result in improved environmental performance, making mimetic pressures a key factor in encouraging compliance with voluntary environmental regulation to enhance firms' environmental performance [22].

Some studies support these ideas. For example, Fikru [58] found that mimetic pressures drive voluntary

international certification in developing countries. Similarly, Zhu *et al.* [2] found that mimetic pressures positively influence the adoption of ISO 14001 international certification in China, which has a positive impact on environmental performance. Based on these findings, the following hypothesis is proposed:

Hypothesis 2a: Voluntary environmental regulation mediates the relationship between mimetic pressures and firms' environmental performance.

2.4.2. Normative pressures

Like mimetic pressures, normative pressures can positively influence environmental performance by promoting voluntary certifications. Rivera [13] found that normative pressures encourage companies to participate in a sustainable tourism certification program aimed at improving environmental performance in Costa Rican hotels.

Similarly, Fikru [58] and Zhu *et al.* [2] observed that normative pressures promote the ISO 14001 voluntary certification, which contributes to implementing environmental management systems that enhance environmental performance. Based on the literature, the following hypothesis is proposed:

Hypothesis 2b: Voluntary environmental regulation mediates the relationship between normative pressures and firms' environmental performance.

2.4.3. Coercive pressures

Coercive pressures originate from institutional actors, such as the government or other institutions, that enforce environmental regulations through sanctions [59]. Such institutional pressures may positively influence firms' decisions to obtain voluntary certification.

For instance, Fikru [58] found that in developing countries, coercive pressures like government inspections encourage the adoption of voluntary environmental certifications, which positively contribute to environmental performance. Similarly, Rivera [13] and Zhu *et al.* [2] found that regulatory compliance and governmental oversight act as coercive pressures positively impacting voluntary certifications that improve environmental performance. Based on this information, the following hypothesis is proposed:

Hypothesis 2c: Voluntary environmental regulation mediates the relationship between coercive pressures and firms' environmental performance.

Figure 1 illustrates the research model, which proposes that institutional pressures (mimetic, normative, and coercive) positively influence firms' environmental performance through voluntary environmental regulation.

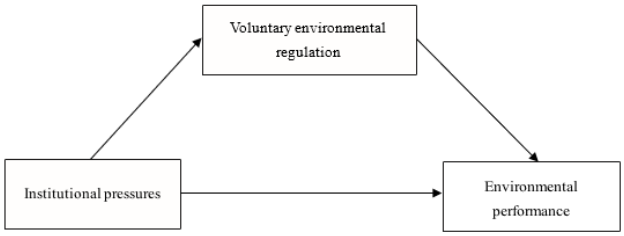

Figure 1. Research model

3. Method

This cross-sectional study employs an instrumental variable research design based on survey data collected from a sample of firms. The research hypotheses are tested using structural equation modeling. Common method variance (the variance attributable to the measurement method) is a concern in cross-sectional studies, especially when all data are collected using the same instrument. To minimize this potential issue, recommendations by Podsakoff *et al.* [60] were followed: survey items were carefully adapted from the literature to avoid vague terminology, questions were kept simple, and their clarity was enhanced. Respondents were assured that there were no right or wrong answers, but that they should answer as honestly as possible. Furthermore, participation in the survey would have no consequences regarding environmental certification.

Instrumental variables were also included in the models to correct for potential endogeneity, isolate the effects of omitted variables, control for common method variance, and account for reverse causality, as recommended by Antonakis *et al.* [61].

3.1. Sample

The companies participating in this research are located across Mexico and include those with some type of certification granted by PROFEPA under the framework of the voluntary environmental regulation program known as the National Environmental Audit Program.

In 2018, PROFEPA recorded 1,043 certified

companies in Mexico. Of this total, 600 companies were randomly selected and invited to participate in the survey voluntarily. A total of 257 questionnaires were returned, yielding a response rate of 42.8%. Ultimately, 225 questionnaires were used for statistical analysis, as they did not contain missing values. This sample represents 21.5% of the total population. **Table 1** provides descriptive statistics of the sample.

3.2. Questionnaire

The data collection instrument consisted of a structured questionnaire comprising 124 items. The questionnaire was divided into five sections:

(1) Identification information

(2) Institutional pressures

(3) Voluntary environmental regulation

(4) Environmental performance

(5) Complementary variables, including control and instrumental variables

The questionnaire was emailed by PROFEPA officials to executives responsible for certification.

The survey instrument was reviewed by PROFEPA officials in close collaboration with the researchers. Both groups determined that, given the nature and purpose of the survey, as well as potential risks, legal requirements, and organizational policies, it was not necessary to seek approval or guidance from an ethics committee. The questionnaire included information about the study's purpose and the confidential use of the data. All participants provided informed consent, voluntarily participating in the survey and sharing their opinions.

3.3. Measures

The validity of the measures is based on both theoretical and statistical principles. The theoretical considerations began with a comprehensive review of the literature on the variables included in the study. Research articles addressing measures and scales were identified and analyzed by experienced researchers to create an initial draft of the questionnaire. This draft was personally tested in Spanish with the manager of a company in Mexico City to refine the items. The questionnaire was also reviewed by PROFEPA staff to ensure that the items were relevant, clear, coherent, and sufficient to capture the constructs included in the research.

Statistically, the validity of the measures was assessed by estimating the cross-factor loadings for each first-order construct. As shown in **Table 2**, all items load significantly on only one factor, demonstrating discriminant validity. **Table 3** shows the Pearson correlations between the first-order constructs and the square root of the average variance extracted (AVE) values along the diagonal. Both convergent and discriminant validity are demonstrated, as no diagonal element is lower than a unique correlation [62].

The reliability of the measures was evaluated using Cronbach's alpha. All reliability coefficients range between 0.772 and 0.951, which are considered acceptable [63] (**Table 2**).

(1) Institutional pressures: Institutional pressures are defined as internal and external pressures perceived by managers that influence decision-making related to improving environmental performance [9,40]. This is a second-order factor composed of four first-order constructs: mimetic pressures, employee environmental awareness, regulatory compliance, and PROFEPA pressure. Employee environmental awareness is a normative pressure, while regulatory compliance and PROFEPA pressure are coercive pressures. These constructs were measured using a seven-point Likert scale. Respondents were asked to indicate the extent to which they agreed with a series of statements on a scale of 1 = strongly disagree to 7 = strongly agree. The items were adapted from the research of Chu *et al.* [48], Daddi *et al.* [9], Dubey *et al.* [45], Phan and Baird [40], Tate *et al.* [49], and Zhu *et al.* [2].

(2) Voluntary environmental regulation: This is a first-order construct defined as the impact of public policies on the motivation to adopt environmental practices in companies [50,64]. This construct was measured using a seven-point Likert scale. Respondents were asked to indicate the extent to which they agreed with a series of statements, using a scale of 1 = strongly disagree to 7 = strongly agree. The items were adapted from the research of Blackman *et al.* [31], Blackman *et al.* [65], Camisón [50], and Ren *et al.* [64].

(3) Environmental performance: Environmental performance is defined as the cumulative result of a company's activities, processes, and procedures in interaction with the natural environment as perceived

by managers [43,45,66]. This is a second-order construct composed of three first-order constructs: natural resource restoration, pollution reduction, and environmental damage prevention. These constructs were measured using a seven-point Likert scale. Respondents were asked to indicate the extent to which they agreed with a series of statements on a scale of 1 = strongly disagree to 7 = strongly agree. The items were adapted from the research of Bae [66], Dubey *et al.* [45], Wang *et al.* [67], and Yu *et al.* [43].

3.4. Instrumental variables

(1) Environmental sensitivity: This is a first-order construct defined as the degree to which managers consider environmental issues significant enough for the company to invest financial and human resources to raise awareness about the company's environmental impacts and implement environmental practices. This construct was measured using a seven-point Likert scale. Respondents were asked to indicate the extent to which they agreed with a series of statements, using a scale of 1 = strongly disagree to 7 = strongly agree. The items were adapted from the research of Oreja-Rodríguez and Armas-Cruz [68]. Managers with high environmental sensitivity will be more aware of environmental issues and interpret signals from various stakeholders regarding environmental concerns as more relevant compared to less environmentally sensitive managers.

(2) Industry field risk: This is a dummy variable (0 = low risk, 1 = high risk) representing the environmental risk assigned to the industry in which each company is classified, as per PROFEPA. Managers in high-risk industrial fields are expected to be more responsive to institutional pressures related to environmental issues because their businesses are more affected by such environmental concerns.

Both variables were used as instrumental variables in the statistical analysis to mitigate potential endogeneity in the model.

3.5. Control variables

(1) Respondent's age: The age of the respondent, coded as follows: 1 = Under 30 years; 2 = 30 to 60 years; 3 = Over 60 years.

(2) Respondent's gender: A dummy variable (0 = male, 1 = female).

(3) Type of certification: The type of certification the company holds at the time of the survey, classified as: 1 = Clean industry; 2 = Environmental quality; 3 = Environmental quality in tourism.

(4) Location: This variable can take values from 1 to 8, depending on the region of the country where the company is located. **Table 1** includes the states comprising each region.

(5) Company size: The size of the company as defined by PROFEPA [69]: 1 = Micro (30 employees or fewer); 2 = Small (31 to 100 employees); 3 = Medium (101 to 500 employees); 4 = Large (501 employees or more).

(6) Years of operation: The number of years the company has been in operation.

(7) Company nationality: The nationality of the company as reported by the respondent (0 = national, 1 = foreign).

Table 4 shows the items included in the scales.

3.6. Data analysis

To test the research hypotheses, the two-step structural equation modeling (SEM) approach recommended by Anderson and Gerbing [70] and Hatcher [71] was employed: first, a measurement model was created, and second, a structural model was run to test the hypotheses. Statistical analysis was conducted using the EQS structural equation modeling software.

The development of a measurement model, which includes all factors, began with exploratory factor analysis (EFA). It was anticipated that some items might load on two or more factors and that some factors might be closely related enough to collapse into a single factor. After a thorough review of factor loadings, the initial measurement structure was identified. Based on this first structure, confirmatory factor analysis (CFA) was performed to evaluate the model fit. Due to the heterogeneous kurtosis of the data and significant multivariate kurtosis, models were estimated using the heteroskedastic kurtosis estimation method provided by EQS.

To refine the measurement model, the Lagrange Multiplier test in EQS was utilized. This test provides information on which item pairs could be freely

Table 1. Descriptive statistics of the sample (n = 225)

Characteristic	*n*	%
Respondent's age		
Under 30 years	34	15
30 to 60 years	186	83
Over 60 years	5	2
Respondent's gender		
Male	138	61
Female	87	39
Type of certification		
Clean industry	166	74
Environmental quality	44	20
Environmental quality in tourism	15	6
Location (state)		
Northwest (Baja California, Baja California Sur, Chihuahua, Durango, Sinaloa, and Sonora)	62	28
Central South (Morelos, Mexico State, and Mexico City)	47	21
Northeast (Coahuila, Nuevo León, and Tamaulipas)	29	13
Central North (Aguascalientes, Guanajuato, San Luis Potosí, Zacatecas, and Querétaro)	28	12
East (Puebla, Veracruz, Tlaxcala, and Hidalgo)	22	10
West (Nayarit, Jalisco, Colima, and Michoacán)	20	9
Southeast (Tabasco, Campeche, Quintana Roo, and Yucatán)	12	5
Southwest (Guerrero, Oaxaca, and Chiapas)	5	2
Years of operation		
Less than 5	7	3
From 5 to 15	33	15
More than 15	185	82
Company size		
Microenterprise (30 employees or fewer)	4	2
Small enterprise (31 to 100 employees)	18	8
Medium enterprise (101 to 500 employees)	67	30
Large enterprise (501 employees or more)	136	60
Company nationality		
Mexican	142	63
Foreign	83	37
Industry field		
Chemistry	41	18
Electronics	20	9
Automotive	14	6
Metallurgy	13	6
Food	12	5
Other	125	56

Table 2. Cross-factor loadings of first-order constructs

Number of items	Institutional pressures				Voluntary environmental regulation	Environmental sensitivity (instrumental variable)	Environmental performance			Community
	Mimetic pressures	Environmental awareness of staff	Compliance with regulations	Pressure from PROFEPA			Restoration of natural resources	Reduction of pollution	Prevention of environmental damage	
61	-0.0256	0.2078	0.0388	0.7227	0.0774	-0.0003	0.1195	0.2632	0.1672	0.685
62	-0.0159	0.3274	0.0475	0.6900	0.2168	0.2215	0.1257	0.0600	0.0921	0.710
69	0.0172	0.1864	0.1466	0.1342	0.8514	0.1782	0.0097	0.1164	0.1037	0.856
70	-0.0151	0.1647	0.1069	0.2318	0.8319	0.1902	0.0722	0.1609	0.1486	0.874
72	-0.0672	0.1227	0.1255	0.2286	0.7799	0.2555	0.1444	0.1638	0.1390	0.828
84	0.0010	0.2215	0.2680	0.2030	0.2126	0.6844	0.1378	0.1734	0.1853	0.759
86	-0.0251	0.2239	0.2401	0.1898	0.1269	0.7554	0.1282	0.1806	0.2758	0.856
87	0.0323	0.2426	0.1779	0.1920	0.2465	0.7332	0.0690	0.1547	0.1917	0.792
88	0.0211	0.2409	0.1873	0.1916	0.1352	0.7940	0.1747	0.1641	0.2178	0.884
90	-0.0024	0.3024	0.2059	0.1693	0.2272	0.7141	0.1151	0.1622	0.2196	0.812
97	0.0793	0.1326	0.1167	0.1700	0.0007	0.0876	0.8130	0.1922	0.0837	0.779
98	0.0991	0.1743	0.0832	0.0387	0.0217	0.1644	0.8440	0.0363	0.1765	0.821
100	0.2282	0.0747	0.0228	0.0032	0.1674	0.1045	0.8184	0.0804	0.1015	0.784
102	-0.0301	0.2361	0.1007	0.1744	0.1581	0.2190	0.0907	0.7821	0.1886	0.826
103	-0.0457	0.1384	0.3879	0.1282	0.1416	0.1469	0.1802	0.855	0.7508	0.1695
104	0.0145	0.1097	0.1726	0.0800	0.2153	0.2964	0.1484	0.7366	0.2316	0.801
107	0.0153	0.1689	0.1900	0.0878	0.1700	0.2160	0.1882	0.2095	0.8173	0.895
108	0.0516	0.1011	0.1933	0.1000	0.1476	0.2997	0.1474	0.1697	0.8348	0.919
109	0.0140	0.1595	0.1955	0.1669	0.1191	0.3116	0.1383	0.1841	0.8167	0.923
Explained variance	3.529	2.826	3.217	2.571	2.664	3.853	2.496	2.316	2.721	3.529
Eigenvalue	3.69	1.36	12.49	1.24	2.11	0.94	1.86	1.12	1.45	
Cronbach's α	0.947	0.818	0.887	0.772	0.911	0.943	0.858	0.880	0.951	

Note: The Kaiser Varimax rotation converged after 5 iterations.

correlated to improve model fit. Based on this information, several items were removed. A well-fitting measurement model was obtained, with a nonsignificant chi-squared test result ($P > 0.05$) [61,72]. **Table 2** displays the cross-factor loadings for the first-order constructs, including environmental sensitivity, one of the instrumental variables used for hypothesis testing.

The next step in building the measurement model was to execute a model that included the second-order structure. **Table 4** shows the regression coefficients for all constructs. Following Hatcher's [71] recommendations, the model was evaluated using a nonsignificant chi-square test result ($P > 0.05$, with values closer to 1.0 being better) and all significant regression coefficients (P-values from the t-test < 0.05, with values closer to 0 being better). The regression coefficients for the first items in the first-order constructs and the first factors in the second-order constructs were set to 1 for model identification purposes. This measurement model confirmed the second-order structure of institutional pressures and environmental performance, with good model fit (chi-squared test $P = 0.937$).

Next, hypothesis testing was performed by running two structural models. The first model (**Model 1**) tested the direct impact of institutional pressures on environmental performance (**H1**). The second model (**Model 2**) tested the mediating effect of voluntary environmental regulation in the previous model (**H2**). **Table 5** presents the unstandardized regression coefficients and fit indicators for both models, with chi-squared test P-values of 0.52 and 0.62, respectively, indicating a good fit.

Instrumental variables were included in both models to address potential endogeneity in the institutional pressures construct. The error term of the instrumented variable was allowed to correlate freely with the error terms of the mediator and dependent variables to correctly specify the model and obtain consistent estimates, as recommended by Antonakis *et al.* [61]. Introducing instrumental variables as predictors of the potentially endogenous variable addresses other threats to causal analysis, including common method variance, reverse causality, and omitted variables. This approach is considered standard best practice in causal analysis in management, psychology, and related fields.

The strength of the instrumental variables, environmental sensitivity and industry field risk, was evaluated by running a full structural model and regressing institutional pressures on both instruments. Model fit and complementary statistics demonstrated their validity as robust instruments, with a chi-squared test P-value of 0.92, Rho reliability coefficient = 0.947, highly significant regression coefficients ($P < 0.01$), and $R^2 = 0.71$.

Table 3. Correlations and bird's square root for first-order constructs as evidence of discriminant validity

First-order constructs	Mean	S	1	2	3	4	5	6	7	8	9
Mimetic pressures (1)	3.80	1.89	0.921								
Environmental awareness of staff (2)	6.46	0.63	0.184	0.694							
Regulatory compliance (3)	6.47	0.75	0.123	0.530	0.786						
Pressure from PROFEPA (4)	6.03	0.98	0.074	0.623	0.319	0.712					
Voluntary environmental regulation (5)	6.18	0.99	-0.004	0.527	0.408	0.587	0.822				
Environmental sensitivity (instrumental variable) (6)	6.35	0.77	0.061	0.683	0.598	0.600	0.575	0.737			
Restoration of natural resources (7)	4.60	1.51	0.278	0.433	0.256	0.334	0.282	0.428	0.825		
Pollution abatement (8)	6.16	0.88	0.034	0.533	0.568	0.455	0.558	0.657	0.416	0.757	
Prevention of environmental damage (9)	6.12	1.00	0.080	0.493	0.523	0.419	0.467	0.675	0.435	0.629	0.823

Table 4. Items and standard coefficients in the measurement model

Second-order constructs	First-order constructs	No. of items	Item content	Standard coefficient	*t*	*P* < (two tails)
Institutional pressures			Pressure from PROFEPA	0.734	2.02	0.044
		59	PROFEPA officials encourage the company to continue in the National Environmental Audit Program and improve environmental performance.	0.764		
		60	Good communication with PROFEPA officials ensures successful certification.	0.450	5.32	0.001
		61	PROFEPA certification is attractive because of its economic, social, and environmental benefits.	0.651	7.95	0.001
		62	PROFEPA effectively incentivizes certification through recognition and awards.	0.841	9.44	0.001
			Voluntary environmental regulation			
		69	Voluntary environmental regulation motivates the creation of a solid waste management program in the company.	0.830		
		70	Voluntary environmental regulation encourages recycling or the extension of the life cycle of products used or produced by the company.	0.926	14.19	0.001
		72	Voluntary environmental regulation encourages the implementation of more efficient processes to reduce air emissions.	0.880	13.41	0.001
			Environmental sensitivity (instrumental variable)			
		84	The company dedicates financial and human resources to train its employees on environmental issues.	0.831		
		86	The company has sensitized its staff to environmental issues as an important part of business operations.	0.914	17.79	0.001
		87	Certification promotes awareness of environmental issues to create environmental awareness.	0.837	14.28	0.001
		88	The company raises awareness of environmental issues among its employees.	0.918	17.88	0.001
		90	Awareness-raising in the company favors learning and implementation of environmental practices.	0.881	16.85	0.001
Environmental performance			Restoration of natural resources	0.542		
		97	The company is involved in ecosystem restoration activities.	0.791		
		98	Improving environmental performance involves taking action to offset the company's impact on the environment.	0.890	14.66	0.001
		100	Certification encourages participation in programs to restore the environment.			0.001
			Pollution reduction	0.794	6.47	0.001
		102	Certification encourages participation in restoration programs.	0.815		
		103	The company reduces water pollutants as a means to improve environmental performance.	0.835	12.52	0.001
		104	The company reduces solid waste as a means to improve environmental performance.	0.851	12.32	0.001
			Prevention of environmental damage	0.788	6.95	0.001
		107	The company has a program to prevent and reduce environmental impacts as a means to improve environmental performance.	0.902		
		108	The company classifies and measures positive and negative environmental impacts.	0.937	20.89	0.001
		109	The company develops and implements actions to mitigate environmental impacts.	0.952	21.90	0.001

Notes: Goodness of fit of the measurement model: Chi-squared = 435.426, degrees of freedom = 482, $P = 0.937$, CFI = 1.000, RMSEA = 0.000, IC 90% of RMSEA (0.000, 0.006), reliability coefficient Rho = 0.966. Estimation method: heterogeneous kurtosis.

Table 5. Unstandardized regression coefficients in structural models

Independent variable	Dependent variable	Model 1 Direct effect	Model 2 Mediation
Institutional pressures			
	Institutional performance	2.783**	2.892**
	Voluntary environmental regulation		2.333**
Voluntary environmental regulation	Environmental performance		0.047
Instrumental variables			
Environmental sensitivity		0.320**	0.294**
Industry field risk	Institutional pressures	0.055***	0.057**
Goodness-of-fit indicators			
Chi-square		742.53	724.18
Degrees of freedom		745	737
Chi-squared *P*-value		0.52	0.62
CFI		1.000	1.000
RMSEA		0.000	0.000
90% CI of the RMSEA		(0.000, 0.020)	(0.000, 0.018)

Notes: Estimation method: Heterogeneous kurtosis. Control variables: age, gender, type of certificate, location, firm size, years of operation, and nationality of the firm. $^{**}P < 0.01$; $^{*}P < 0.05$; $^{***}P < 0.1$ (two-tailed).

4. Results

The structural model estimates confirm **Hypothesis 1**. The impact of institutional pressures on environmental performance is positive and significant ($\beta = 0.973$; $P < 0.02$). This finding indicates that institutional pressures are a critical determinant of the environmental performance of companies participating in PROFEPA's National Environmental Audit Program.

However, **Hypothesis 2** is rejected, as no mediation by voluntary environmental regulation is observed in the relationship between institutional pressures and environmental performance. In this model, the direct impact of institutional pressures on environmental performance remains positive and significant ($\beta = 0.934$; $P < 0.04$), as does the impact of institutional pressures on voluntary environmental regulation ($\beta = 0.678$; $P < 0.03$). Nevertheless, the impact of voluntary environmental regulation on environmental performance is not significant ($\beta = 0.052$; $P < 0.81$).

Further analysis was conducted to evaluate the direct effects of the four dimensions of institutional pressures on environmental performance and the mediating role of voluntary environmental regulation by running eight models: **1a** and **2a** for mimetic pressures, **1b** and **2b** for normative pressures (employee environmental awareness), **1c** and **2c** for regulatory compliance, and **1d** and **2d** for coercive pressures from PROFEPA. The results are presented in **Table 6**.

4.1. Direct effects of institutional pressures

(1) All institutional pressures, except mimetic pressures, have a positive effect on environmental performance. **Hypothesis H1a** is rejected, while **H1b** and **H1c** are accepted.

(2) Certified companies appear to improve their environmental performance not to mimic their competitors' environmental behavior but to respond to employee environmental awareness, comply with regulations, and meet PROFEPA's expectations.

4.2. Mediated effects via voluntary environmental regulation

(1) Mimetic pressures (**Model 2a**): Introducing voluntary environmental regulation reveals a direct effect

of mimetic pressures on environmental performance (β = 2.709; $P < 0.01$), which was not observed in the direct model. This is known as a suppression effect, where a suppressor variable enhances the predictive validity of another variable [73]. Voluntary environmental regulation increases the predictive validity of mimetic pressures, confirming the mediation effect and supporting **H2a**.

(2) Employee environmental awareness (**Model 2b**): A suppression effect is also observed. The impact of voluntary environmental regulation on environmental performance is negative and significant ($\beta = -1.142$; $P < 0.01$), while other effects in the mediated model are positive. The effect of employee environmental awareness on environmental performance becomes even more significant (β = 3.339; $P < 0.001$) with voluntary environmental regulation as a mediator. **H2b** is accepted.

(3) Regulatory compliance (**Model 2c**): A full mediation effect is observed when voluntary environmental regulation mediates the relationship. The direct relationship between regulatory compliance and environmental performance becomes nonsignificant (β = 0.129; $P > 0.10$), while the indirect paths are positive and significant, supporting **H2c**.

(4) PROFEPA pressure (**Model 2d**): No mediation effect is observed. While PROFEPA pressure positively impacts voluntary environmental regulation (β = 0.929; $P < 0.01$), neither PROFEPA pressure nor voluntary environmental regulation significantly impacts environmental performance. Mixed results are observed for **H2c**.

Table 6. Unstandardized regression coefficients in structural models by type of institutional pressure

Model	Independent variable	Dependent variable			
		Environmental performance		Voluntary environmental regulation	
		Unstandardized coefficient	R^2	Non-standardised standardised coefficient	R^2
1a	Mimetic pressures	4.875	0.02		
2a	Mimetic pressures	2.709**	0.32	4.217	0.00
	Voluntary environmental regulation	0.580			
1b	Environmental awareness of staff	1.759**	0.54		
2b	Environmental awareness of staff	3.339**	0.19	1.409**	0.31
	Voluntary environmental regulation	-1.142**			
1c	Compliance with regulation	1.378**	0.49		
2c	Regulatory compliance	0.129	0.45	1.166**	0.22
	Voluntary environmental regulation	1.054**			
1d	Pressure from PROFEPA	1.113**	0.38		
2d	Pressure from PROFEPA	3.446	0.05	0.929**	0.36
	Voluntary environmental regulation	-2.395			

Notes: Control variables: age, gender, type of certificate, location, firm size, years of operation, and nationality of the firm. Instrumental variables: environmental sensitivity and industrial setting. The estimation method used in these models is maximum likelihood, and robust, except for the 2D model, which was estimated using heterogeneous kurtosis. For all models, the chi-squared *P*-value was between 0.18 and 0.75, the CFI was between 0.993 and 1.000, and the 90% confidence interval of RMSEA was between 0.000 and 0.031. **$P < 0.01$ (two-tailed).

4.3. Summary

Voluntary environmental regulation enhances the predictive validity of mimetic and normative pressures on environmental performance. However, mixed results are found for coercive pressures: while it fully mediates the relationship between regulatory compliance and environmental performance, it does not mediate the relationship between PROFEPA pressure and environmental performance.

5. Discussion

The positive relationship found between institutional pressures and environmental performance aligns with the findings of Dubey *et al.* [45] and Lu *et al.* [30]. However, when analyzing institutional pressures separately (mimetic, normative, and coercive), it was observed that both normative pressures (employee environmental awareness) and coercive pressures (regulatory compliance and PROFEPA pressure) have a direct and positive effect on environmental performance. This was not the case for mimetic pressures.

These findings are consistent with Chen *et al.* [74], who reported that normative and coercive dimensions have the potential to promote the implementation of environmentally favorable practices and drive positive changes in environmental performance.

Regarding the mediating effect of voluntary environmental regulation on the relationship between institutional pressures and environmental performance, when institutional pressures were treated as a single second-order construct, the results suggested a positive and significant relationship between institutional pressures and voluntary environmental regulation. However, the relationship between voluntary environmental regulation and environmental performance was not significant.

When analyzing different types of institutional pressures separately, it was found that voluntary environmental regulation mediates the relationship between mimetic and normative pressures and environmental performance. For coercive pressures, voluntary environmental regulation fully mediates the relationship between regulatory compliance and environmental performance but does not mediate the relationship between PROFEPA pressure and environmental performance.

These results are similar to those reported by Henriques *et al.* [18], who found a positive association between voluntary environmental certification and environmental performance. However, they differ from those of Blackman *et al.* [31], who noted that voluntary environmental certification in emerging economies is weak and does not consistently improve environmental performance. Since no previous studies have explored the interaction of voluntary environmental regulation with different types and measures of institutional pressures, further comparison of these results is not possible.

The findings were obtained from a sample that included micro, small, medium, and large companies, both domestic and foreign. The statistical analysis included company size and nationality as control variables. This indicates that the observed relationships between institutional pressures, voluntary environmental regulation, and environmental performance are independent of company size and nationality.

Finally, the results align with those of Challenger *et al.* [75], who suggested that effective environmental policy should adopt a socio-ecosystemic and interdisciplinary approach. Such an approach recognizes that human activities inevitably coevolve with the natural environment. Socio-ecosystems are complex adaptive systems characterized by openness, dynamism, self-organization, non-linearity, nested hierarchies at multiple scales, emergent properties, irreducible uncertainties, and ecological homeostasis and resilience capacities. Voluntary environmental regulation is deemed suitable for addressing environmental issues democratically within this type of system.

6. Conclusions

This study examines the effects of different types of institutional pressures on the environmental performance of companies in developing countries, as well as the mediating effect of voluntary environmental regulation on this relationship. Based on survey data from 225 companies across Mexico certified by the National Environmental Audit Program administered by PROFEPA, the findings indicate that coercive and

normative pressures positively influence environmental performance by encouraging companies to adopt environmental practices that reduce their environmental impact.

Regarding the mediating effect of voluntary environmental regulation on the relationship between various types of institutional pressures and environmental performance, it was found that voluntary environmental regulation has a favorable contribution in all cases except for PROFEPA's pressure. Participants in the National Environmental Audit Program may not perceive PROFEPA as a pressure to seek certification and improve environmental performance.

It was observed that not all institutional pressures have the same effect on environmental performance. Analyzing the mediating effect of voluntary environmental regulation provides insights into the factors driving companies to participate in voluntary environmental programs in emerging economies. The study concludes that institutional pressures effectively promote improvements in environmental performance (e.g., resource restoration, pollution reduction, and environmental damage prevention) through voluntary environmental certification in a developing country characterized by institutional gaps, such as weak legal enforcement and lack of institutional coordination. Voluntary environmental regulation enhances the predictive validity of mimetic pressures and employee environmental awareness of environmental performance. It also fully mediates the relationship between regulatory compliance and environmental performance.

These results are significant in the context of institutional gaps because such gaps accelerate environmental degradation. Excessive bureaucracy and corruption perpetuate these institutional shortcomings. Therefore, further research is needed to identify the specific factors that help reduce these gaps. In this case, the analysis of voluntary environmental regulation may offer valuable insights.

Considering the importance of the business sector in the formulation and evaluation of public policies, this study highlights factors that should be considered when designing effective environmental policies in emerging economies. Voluntary environmental regulation, which promotes corporate self-regulation, is particularly relevant, as it can be more effective in these contexts. Lastly, environmental preservation requires clear rules and an active role for the state in shaping the institutional environment.

6.1. Implications

This study has implications for various stakeholders:

(1) Academics: It demonstrates the utility of institutional theory and the separate analysis of different types of institutional pressures in exploring the role of voluntary environmental regulation in an emerging country.

(2) Managers: It provides evidence of the motivations driving companies to obtain voluntary environmental certifications and how these certifications help improve environmental performance.

(3) Policymakers: It highlights the effectiveness of institutional pressures in encouraging companies to adopt voluntary environmental certifications and offers empirical evidence of the positive impact of this type of regulation on environmental performance.

6.2. Limitations and recommendations for future research

This study has certain limitations. First, the sample only included companies certified by PROFEPA. Second, nonresponse bias may be an issue, as non-responding companies might have provided different responses.

Future research on this topic should consider collecting primary data on environmental performance to analyze the effectiveness of voluntary environmental regulation more objectively. One of the main objectives of such programs is to improve companies' environmental performance beyond legal requirements. Therefore, performance measurements should include indicators that confirm this objective is being met.

Researchers are encouraged to conduct new studies comparing the impact of institutional pressures on the environmental performance of certified and non-certified companies to confirm these conclusions regarding the effectiveness of voluntary environmental regulation. Additionally, employing different measures of institutional pressures may yield new insights into their effects on environmental performance and their interactions with voluntary environmental regulation.

Disclosure statement

The authors declare no conflict of interest.

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