“Firm size and pro-environmental behavior in Cameroon”

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FIRM SIZE AND PRO-ENVIRONMENTAL BEHAVIOR IN CAMEROON

Abstract

Previous studies indicate a lack of analysis of pro-environmental behavior adoption in enterprises of various sizes. Very small enterprises, especially in the informal sector, have always been overlooked in the literature, although they are in the majority in most countries. This paper aims to examine the effects of firm size on pro-environmental behavior adoption in Cameroon. The analysis focuses on a sample of 141,926 firms drawn from the Second General Census of Enterprises (RGE-2) in Cameroon (NIS, 2018). The study adopted a statistical and econometrical approach based on the logit model. The results showed that the adoption of pro-environmental behavior increases with firm size. The probability of having a health, safety, and environment system increases by 16.70 points in large enterprises compared to 8.40 points in small enterprises. The probability of having a wastewater management system increases by 5.30 points in large enterprises compared to 2.30 points in small enterprises. The probability of having an air pollution management system increases by 2.20 points in large enterprises compared to 1.50 points in small enterprises. However, company size does not significantly influence the adoption of a solid waste management system. It is recommended to (i) raise awareness among large companies of the challenges of environmental protection and to strengthen controls on compliance with environmental standards, and (ii) to implement actions aimed at the migration of companies from the informal to the formal sector.

Keywords firm size, solid waste management, wastewater management, air pollution management, health safety and environment system

JEL Classification D21, Q50, Q52, Q53

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INTRODUCTION

The challenges of protecting natural environments and the health of populations, saving raw materials, and combating global warming tend to make waste management a real source of natural resource savings (Blain & Fries, 2009). Integrating sustainable development issues into business practices in Cameroon is not new. Decree No. 2013/0172/PM[1] of 14 February 2013 laying down the modalities for carrying out the environmental and social audit[2] requires companies to carry out an environmental and social audit periodically[3]. This exercise aims to assess the impact that all or part of the company has or is likely to have on the environment. The promoter of a project or an establishment must conduct an environmental audit on pain of the sanctions provided for by the laws and regulations in force. For small and medi-

1 PM is Prime Minister.

2 Prime Minister (2013) considers that "environmental and social auditing within the meaning of this decree is understood to be a systematic, documented and objective evaluation of the activities of an entity, structure and facilities of an establishment, their operation and their environmental management system, with a view to assuming responsibility for environmental protection."

3 The Ministry in charge of the environment specifies the periodicity of the environmental and social audit according to the sectors of activity. This audit is carried out without prejudice to environmental controls.

um enterprises (SMEs), the regulations recommend that an environmental impact notice be drawn up in accordance with Order No. 00002/MINEPDED of 8 February 2016, defining the standard terms of reference and content of the environmental impact notice (MINEPDED, 2016).

Environmental protection must be a significant concern for companies. Their activities have a considerable environmental impact (liquid, solid and gaseous waste, imbalance in forest, marine, and coastal ecosystems, noise and air pollution, etc.). Thus, to minimize these impacts, companies must voluntarily commit to considering sustainable development in their production process. In this respect, they must, among other things, set up an HQSE (Health, Quality, Safety, Environment) system. Unfortunately, the consideration of environmental protection in the strategy of companies in Cameroon remains low, although the proportion of companies concerned increased by 2.7 points between 2009 and 2016 (NIS, 2018). In fact, only 17.40% of companies reported having an environmental protection mechanism in 2016 compared to 14.70% in 2009 (NIS, 2018). Furthermore, 16.21% of companies reported having an HQSE system (NIS, 2018). Cameroon is no exception to this reality, as 16.61% of very small enterprises have an HQSE system, compared to 39.66% of small enterprises (SEs), 52.18% of medium-sized enterprises, and 57.03% of large enterprises (NIS, 2018).

1. LITERATURE REVIEW

The industrialization of society has led, for several decades, to the manufacture of products that are increasingly efficient and complex to produce but also to treat at the end of their life. Indeed, the improvement of the intrinsic qualities of products results from the incorporation of substances and/or composite materials; at the end of their use, these products become waste that is more difficult to treat or recover and, ultimately, present a greater danger for the environment (Blain & Fries, 2009). A good can be produced in many sectors of activity, either by using or transforming raw materials or by recycling waste. The decision of companies to integrate pro-environmental behaviors, for example, by replacing the traditional mode of production with recycling, depends on comparing their respective private costs (Henry-Wittmann, 1996).

For a given product, a company compares the cost of extracting and transporting the raw material and transforming it into a finished or semi-finished product and the cost of waste collection and recycling operations. It chooses the mode of production or a combination of modes that enables it to minimize its costs (Henry-Wittmann, 1996). The development of recycling, by requiring recourse to waste that is increasingly difficult to recover, may increase the cost of recycled inputs. At the same time, the reduction in demand for raw materials will weigh on prices, all of which will restore the cost advantage of the traditional production mode (Henry-Wittmann, 1996). Recycling may also discourage raw material producers, resulting in compromised supplies and firms being forced to recycle more than the cost-minimizing quantities of goods (Henry-Wittmann, 1996). In addition, recycling in certain industries requires the implementation of specific processes. It implies investments that a company will not make without the assurance of maintaining a cost advantage over its previous production mode. Also, waste collection, sorting, and reuse activities are labor-intensive and mainly unskilled (Gillet, 2002). In addition, other reasons have been put forward to justify the relatively weak integration of sustainable development principles in small companies (Ben Larbi et al., 2013):

(i) the pressure from stakeholders in the service of sustainable development is weak (non-governmental organizations concentrate their action on large groups, and employee unions act mainly in large companies and the public sector); and

(ii) the associated risks of sanctioning behavior that does not comply with sustainable development principles are also weak (particularly the reputational risk, which is a determining factor in large groups, but only very marginally concerns small structures).

SMEs generally have fewer technological, financial, and human resources than larger firms. As a

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result, they may lack the means to adopt pro-environmental behaviors, including eco-innovations (Galliano & Nadel, 2013). SMEs recognize the lack of financial resources as one of the main barriers to environmental commitment (Hillary, 2000; Bowen, 2002). On the other hand, large enterprises can easily access many resources, which promotes green innovations (Liang & Liu, 2017).

Larger firms, with greater resources and economies of scale, would have fewer constraints to adopting pro-environmental measures than smaller firms. However, empirical works on this relationship reached mixed conclusions. Some studies seem to confirm this relationship (Rehfeld et al., 2007; Frondel et al., 2007; Rave et al., 2011; Papagiannakis & Lioukas, 2012; Galliano & Nadel, 2013; Da Silva Rabêlo & de Azevedo Melo, 2019; Chen et al., 2018a). Rehfeld et al. (2007) apply a logit and a multinomial logit on a sample of 371 firms in the manufacturing sector in Germany. These authors measure firm size by the logarithm of the number of employees. Based on a sample of 142 firms in Greece with at least 12 employees, Papagiannakis and Lioukas (2012) use the principal component analysis method to construct an index of firms' environmental responsiveness from 16 indicators. Using the ordinary least square (OLS) method, they obtain that company size measured by the number of employees significantly favors at the 5% threshold the environmental responsiveness of companies in 4 sectors of activity. Da Silva Rabêlo and de Azevedo Melo (2018) exploited a database of 35,060 firms in Brazil using three econometric models: multinomial logit, ordered logit, and binomial logit.

Based on a sample of 4,186 firms operating in the OECD, Frondel et al. (2007) use a multinomial logit to explain the eco-innovation captured by cleaner production technologies and end-of-pipe technologies. They show that firm size has

(i) a significant effect on adopting an end-of-pipe technology; and

(ii) a non-significant effect on a cleaner production technology adoption.

However, their sample does not include firms with less than 50 employees. Galliano and Nadel (2013) also exclude very small enterprises (VSEs) from their analysis conducted in France on a sample of 4,686 firms. They use a Heckman-type model with sample selection since they assume that an eco-innovation adoption follows an innovation adoption (product, process, organization, or marketing). Thus, it is a question of dissociating the effects of the choice to innovate from those of choice to eco-innovate. The study shows that, overall, the growth in firm size significantly favors the practice of eco-innovation. However, this effect varies according to the type of eco-innovation practice indicator. Regarding marginal effects, size has a weaker impact on eco-innovation practices linked to customer demand. This impact is stronger for eco-innovation practice

(i) linked to the cost reduction objective; and

(ii) in response to "existing environmental regulations or pollution taxes," "future environmental regulations or taxes," or "the existence of government subsidies, grants or other financial incentives for environmental innovations."

On the other hand, Tran-Dieu and Vernier (2017), Sanni (2018), and Han and Chen (2021) do not find a significant relationship between firm size and environmental innovation. Tran-Dieu and Vernier (2017) use data from a survey conducted from November 2011 to June 2014, five years after the launch of the "Grenelle de l'Environnement" on the practices of SMEs in France concerning waste management and prevention policies. Their sample consists of 404 companies, 11% of which are considered large firms (they consider large companies as those with more than 150 employees). It was found that firm size does not significantly influence waste prevention strategy adoption. In Myanmar, Han and Chen (2021), on a sample of 800 SMEs with 50 or fewer employees, show that SMEs are increasingly vocal about their commitment to the principles of sustainable development. According to Aragon-Correa and Matias-Reche (2005), European SMEs attach primary importance to the environmental aspect. This observation is confirmed by Ben Larbi et al. (2013), who consider the environmental aspect a potential source of productivity gains. The practice of recycling, in some instances, makes it possible to decrease raw materials and energy proportion used and avoid the accumulation of waste. It also is one of the main in-

struments of an economic policy which, by respecting the environment and sparing natural resources for future generations, makes it possible to increase the general level of well-being without sacrificing growth (Henry-Wittmann, 1996). Collection and sorting activities can also lead to the sale of sorted waste to private companies for processing, e.g., paper waste.

Ben Larbi et al. (2013) show that in France, the environmental issue constitutes the essential axis of sustainable development (71%) for unlisted companies, while the economic (19.4%) and social (9.7%) 'pillars' are considered less critical. This marked preference for the environmental pillar can be explained by actions in favor of the environment, such as waste recycling or pollution prevention, which have a concrete and noticeable impact outside the company. However, Dupuis et al. (2006) show that 93% of SME managers (in the Rhone-Alpes region of France) declare they carry out actions favoring sustainable development. However, a gap may exist between the discourse, will, and implementation. In the same vein, Ben Larbi et al. (2013) prove that although more than 90% of company managers are concerned about sustainable development issues, the concept still needs to be better understood since less than 10% of them feel they can define it precisely. This can be explained by the fact that VSEs/SMEs, mainly in the informal sector, are not currently under any legal obligation to report on social issues. This gives their statements a declarative value that is difficult to prove in practice. The study shows that among all the items submitted for assessment by companies, waste management, monitoring of environmental regulations, electronic and computerized document management, and optimization of resources mobilized occupy a privileged place in environmental concerns with a score on a scale of 5, that is higher than the average (3.24).

The practices of VSEs/SMEs, and more generally of informal sector companies, in sustainable development are still insufficiently known. The analysis of the factors explaining the pro-environmental behavior of companies has mainly focused on developed countries (Marzucchi & Montresor, 2017; Li-Ying et al., 2018; Mothe et al., 2018; Jové-Llopis & Segarra-Blasco, 2018; Rhaiem & Doloreux, 2022) and emerging countries (Cai & Zhou, 2014; Aloise & Macke, 2017; Chen et al., 2017; Chen et al., 2018a; Fernández et al., 2021). There is little research on this particular group of firms in Africa: Nigeria (Sanni, 2018) or Egypt (Mady et al., 2022). All these studies focus on manufacturing firms and do not view very small enterprises, particularly those in the informal sector.

Therefore, this study aims to examine the effects of firm size on pro-environmental behavior adoption in Cameroon. Specifically, it aims to analyze the effect of firm size on

(i) wastewater management system adoption;

(ii) air pollution control device adoption;

(iii) standardized recycling or waste treatment system adoption; and

(iv) a health, safety and environment system adoption.

2. METHODOLOGY

This section successively describes the econometric model, discusses the choice of variables in this model, and then presents the data source. The aim is to define an econometric model to measure the impact of firm size on pro-environmental behavior adoption.

2.1. Data

The data for this study come from the Second General Census of Enterprises (RGE-2) conducted by Cameroon NIS. Field collection was conducted in late 2016, and the results were disseminated in 2018. The RGE-2 allowed it to count 209,482 economic units in activity and operating in a fixed professional location, divided into 203,419 head office enterprises and 6,063 establishments. Geographically, these economic units are mainly located in the Littoral region (37%) and Centre region (27%) regions, with the metropolises of Douala and Yaoundé accounting for 33.5% and 23.9%, respectively. The regions of Adamaoua, the South, the North, the Far North, and the East are the least provided with economic units. They each account for less than 4% of the total units surveyed. Generally speaking, economic units have a high propensity to set up in urbanized areas with a minimum economic infrastructure to support

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their activities. Consequently, the departments housing the regional capitals (to which must be added certain historical cities such as Kribi, Kumba, Limbé, and Nkongsamba) are relatively the most endowed with businesses.

As this study focused on the firms that answered the questions concerning pro-environmental behavior and employees number, the sample size is 141,926.

2.2. Model specification

According to the economic theory of well-being, the marginal utility can decrease or increase. That is why a discrete choice model inspired by random utility theory was preferred (McFadden, 1974).

This model is presented as follows:

$$Y_i^* = \beta X_i + \varepsilon_i. \quad (1)$$

The dependent variable representing the environmental protection attitude is dichotomous:

$$Y_i = \begin{cases} 1 & \text{firms adopt pro-environmental behavior} \\ 0 & \text{otherwise} \end{cases}. \quad (2)$$

Categorical variable models assume that the observed phenomenon manifests a latent variable Y_i^* unobservable continuous variable. This conceptually leads to an analysis of the variance model on this latent variable; the problem to be solved is the estimation of this model. ε_i represents the error term with $\varepsilon_i/\sigma_\varepsilon$ which follows a logistic distribution function $F_{ij}(X, \beta)$. In this model, the probability associated with the occurrence of an event j is given by:

$$Prob\left(Y_i = j\right) = F_{ij}(X, \beta). \quad (3)$$

The distribution function is expressed as a function of the explanatory variables X and the vector of parameters β.

Specifically, this logistic model is:

$$Y_i^* = a_0 + a_1 TAIL_i + a_2 X_i + \varepsilon_i, \quad (4)$$

where Y_i is the dependent variable; it measures the firm's pro-environmental behavior adoption. The following four variables are used to assess pro-environmental behavior:

- WATER takes the value 1 if the company has a wastewater management system and 0 otherwise;
- AIR is set to 1 if the company has an air pollution control device and 0 otherwise;
- WASTE is set to 1 if the company has a standardized recycling or waste treatment system and 0 otherwise;
- HSE takes the value 1 if the company has a health, safety and environment system and 0 otherwise.

TAIL is a quantitative variable that provides information on the size of the enterprise. Its creation was inspired by Law No. 2010/001 of 13 April 2010 on the promotion of small and medium enterprises in Cameroon. Thus, this variable takes the value 0 if it is a very small enterprise (i.e., between 1 and 5 employees), 1 if it is a small enterprise (i.e., between 6 and 20 employees), 2 if it is a medium enterprise (i.e., between 21 and 100 employees), and 3 if it is a large enterprise (i.e., more than 100 employees).

INTER is the dummy variable, which provides information on Internet use within the enterprise. It takes the value 1 if the company uses the Internet and 0 otherwise.

MOMO is the dummy variable that provides information on a firm's use of mobile money. It takes the value 1 if the firm uses mobile money and 0 otherwise.

AGE is a quantitative variable that measures the firm's experience based on age. It takes the value 0 if the firm has been in business for 5 years or less, 1 if it has been in business for between 6 and 10 years, and 2 if it has been in business for more than 10 years.

SACTIV is the qualitative variable that provides information on the sector of activity of the enterprise. It takes the value 0 if it belongs to the primary sector, 1 to the secondary sector, and 2 to the tertiary sector.

OHADA is a variable that provides information on whether the firm belongs to the formal sector. It takes the value 1 if the firm belongs to the formal sector and 0 otherwise.

ENEO is the qualitative variable that provides information on access to hydroelectric power, provided by ENEO[4]. It takes the value 1 if the company is subscribed to the ENEO electricity network and 0 otherwise.

GROUP is the dummy variable that informs about a firm's use of a generator. It takes the value 1 if the company uses a generator and 0 otherwise.

BANK is the qualitative variable, which provides information on the source of bank financing of the enterprise at the time of its creation. It takes the value 1 if the firm benefited from bank financing at the time of its creation and 0 otherwise.

LOC is the qualitative variable that provides information on the rental status of the company. It takes the value 1 if the firm is renting and 0 otherwise.

SEX is the dummy variable that allows the gender of the firm's promoter. It takes the value 1 if male and 0 if female.

SM is the variable that provides information on the marital status of the firm's promoter. It admits the modality 1 if he is married and 0 otherwise.

EDU is a variable that informs about the educational level of the firm's promoter. It takes the value 0 if he/she has no diploma, 1 if he/she is a graduate of primary education, 2 if he/she is a graduate of secondary education, and 3 if he/she is a graduate of higher education.

3. RESULTS

Table 1 shows that 16.10% of companies have an HSE system. Similarly, companies have invested in environmental protection against:

(i) wastewater (2.90%);

(ii) solid waste (25%); and

(iii) air pollution (1.2%).

As regards the size of the enterprises, 97.80% are very small enterprises, 1.60% are small enterprises, 0.4% are medium enterprises, and 0.2% are large enterprises. Also, 3.10% of the enterprises are engaged in informal activities.

Table 1. Descriptive statistics

Variables		Mean	Standard deviation	Min	Max
WATER	No	0.971	0.167	0	1
	Yes	0.029	0.167	0	1
WASTE	No	0.750	0.433	0	1
	Yes	0.250	0.433	0	1
AIR	No	0.988	0.110	0	1
	Yes	0.012	0.110	0	1
HSE	No	0.839	0.367	0	1
	Yes	0.161	0.367	0	1
TAIL	Very small enterprise	0.978	0.146	0	1
	Small enterprise	0.016	0.125	0	1
	Medium enterprise	0.004	0.063	0	1
	Large enterprise	0.002	0.044	0	1
BANK	No	0.963	0.189	0	1
	Yes	0.037	0.189	0	1
LOCAL	Not a tenant	0.152	0.359	0	1
	Tenant	0.848	0.359	0	1
OHADA	Informal sector	0.969	0.172	0	1
	Formal sector	0.031	0.172	0	1
SEX	Female	0.373	0.483	0	1
	Male	0.627	0.483	0	1
SM	Not married	0.350	0.477	0	1
	Married	0.650	0.477	0	1
EDU	Without a diploma	0.200	0.400	0	1
	Graduate of primary education	0.312	0.463	0	1
	Graduate of secondary education	0.409	0.492	0	1
	Graduate of higher education	0.078	0.269	0	1
INTER	No	0.950	0.218	0	1
	Yes	0.050	0.218	0	1
MOMO	No	0.771	0.420	0	1
	Yes	0.229	0.420	0	1
SACTIV	Primary sector	0.001	0.030	0	1
	Secondary sector	0.166	0.372	0	1
	Tertiary sector	0.833	0.373	0	1
ENEO	No	0.194	0.395	0	1
	Yes	0.806	0.395	0	1
GROUP	No	0.986	0.117	0	1
	Yes	0.014	0.117	0	1
AGE	Up to 5 years	0.562	0.496	0	1
	Between 6 and 10 years	0.254	0.435	0	1
	More than 10 years	0.184	0.388	0	1

4 ENEO: Energy of Cameroon. This firm provides hydroelectric power in the Cameroon market.

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Table 2. Bivariate statistics (in %)

Firm size	HSE		Proportion of firms with an HSE system in place	WATER		Proportion of firms with a water management system in place	WASTE		Proportion of firms with a solid waste management system in place	AIR		Proportion of firms with an air pollution management system in place
	No	Yes		No	Yes		No	Yes		No	Yes	
Very small enterprise	82.720	15.140	15.471	95.200	2.650	2.708	73.520	24.330	24.865	96.780	1.080	1.104
Small enterprise	0.950	0.620	39.490	1.430	0.140	8.917	1.080	0.490	31.210	1.480	0.090	5.732
Medium enterprise	0.190	0.200	51.282	0.330	0.060	15.385	0.250	0.140	35.897	0.360	0.030	7.692
Large enterprise	0.080	0.110	57.895	0.160	0.030	15.789	0.110	0.080	42.105	0.160	0.020	11.111

Looking at Table 2, the adoption rate of HSE devices is 15.47% for VSEs, 39.49% for SMEs, 51.28% for MEs, and 57.89% for EGs. For wastewater management, the adoption rate is 2.65% for MSEs, 14% for SMEs, 6% for MEs, and 3% for EGs. Concerning solid waste management, the adoption rate is 24.86% among MSEs, 31.21% among EPs, 35.89% among MEs, and 42.10% among EGs. Finally, for the air pollution control system, the adoption rate is 1.10% for MSEs, 5.73% for SMEs, 7.69% for MEs, and 11.11% for EGs. These results suggest that pro-environmental behavior adoption tends to increase with the firm size.

Firm size significantly influences pro-environmental behavior adoption in models 1, 2, and 4. Pro-environmental behavior adoption (wastewater management system, air pollution management system, solid waste management system, and a health, safety and environment system) has also been significantly influenced by

(iv) the source of bank financing of the enterprise at the time of its creation;

(v) Internet access;

(vi) access to mobile money;

(vii) the firm's experience;

(viii) the sector of activity of the enterprise;

(ix) the belonging to the formal sector;

(x) access to hydroelectric power;

(xi) the firm's use of a generator;

(xii) the firm's rental status;

(xiii) the firm's promoter sex,

(xiv) the firm's promoter marital status; and

(xv) the firm's promoter educational attainment.

4. DISCUSSION

The coefficients of the TAIL variable are all positive and significant in models 1, 2, and 4. The proportion of firms with an HSE system increases with company size. The same analysis is made for wastewater management and air pollution control systems. These results do not align with previous studies conducted in Africa (Sanni, 2018; Mady et al., 2022). This confirms that the implementation of environmental protection system is not costless; it often imposes costs that can be prohibitive for small businesses. In Cameroon, the costs of the ESA and NIS are borne by the firm's promoter. The fee for the review of the terms of reference of the NIE cannot exceed 50,000 CFA franc. The sum of the fees for the examination of the NIE report may be at most 100,000 CFA franc; in addition, there are charges for administrative corruption.

The variable OHADA has a positive and significant coefficient in models 1 and 2. Formal sector firms are more likely to implement an HSE or wastewater management system. The result of the conducted research coincides with the opinion of Chen et al. (2018b), which shows that in China, the level of

Table 3. Logit model results

Variables	Model 1				Model 2				Model 3				Model 4			
	HSE				Water				Solid Waste				AIR			
	Coef.	Std. err.	dy/dx	Std. err.	Coef.	Std. err.	dy/dx	Std. err.	Coef.	Std. err.	dy/dx	Std. err.	Coef.	Std. err.	dy/dx	Std. err.
TAIL (ref: Very small enterprise)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Small enterprise	0.319***	0.042	0.084***	0.012	0.295***	0.060	0.023***	0.006	–0.032	0.043	–0.009	0.013	0.359***	0.072	0.015***	0.004
Medium enterprise	0.450***	0.087	0.126***	0.028	0.339***	0.114	0.030**	0.013	0.127	0.087	0.043	0.029	0.304**	0.137	0.014*	0.007
Large enterprise	0.581***	0.167	0.167***	0.058	0.545***	0.200	0.053*	0.029	0.225	0.166	0.073	0.058	0.496**	0.237	0.022	0.017
BANK (ref: No)	0,030	0.025	0.007	0.006	0.194***	0.036	0.012***	0.002	0.203***	0.022	0.062***	0.007	0.081	0.051	0.002	0.001
LOCAL (ref: Not tenant)	–0.084***	0.013	–0.017***	0.003	–0.183***	0.021	–0.010***	0.001	0.009	0.012	0.005	0.004	–0.260***	0.027	–0.006***	0.001
OHADA (ref: Informal sector)	0.456***	0.031	0.102***	0.007	0.129***	0.049	0.008**	0.003	0.008	0.032	0.002	0.010	0.054	0.063	0.001	0.002
SEX (ref: Female)	0,064***	0.010	0.016***	0.002	–0.041**	0.017	–0.002	0.001	0.020**	0.009	0.007***	0.003	0.074***	0.024	0.003***	0.001
SM (ref: Unmarried)	–0,024**	0.010	–0.004*	0.002	0.076***	0.017	0.005***	0.001	0.098***	0.009	0.031***	0.003	0.175***	0.025	0.006***	0.001
EDU (ref: Without a diploma)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Graduate of primary education	–0.069***	0.014	–0.013***	0.003	–0.051**	0.025	–0.001	0.001	0.087***	0.012	0.028***	0.004	0.088**	0.039	0.003***	0.001
Graduate of secondary education	–0.003	0.013	0.001	0.003	0.114***	0.023	0.009***	0.001	0.039***	0.012	0.013***	0.004	0.332***	0.036	0.010***	0.001
Graduate of higher education	0.106***	0.021	0.027***	0.005	0.019	0.036	0.002	0.002	–0.054***	0.019	–0.015***	0.006	0.217***	0.051	0.006***	0.001
INTER (ref: No)	0,245***	0.025	0.055***	0.006	0.257***	0.038	0.016***	0.002	0.086***	0.024	0.027***	0.007	0.416***	0.045	0.011***	0.001
MOMO (ref: No)	0,272***	0.011	0.061***	0.002	0.289***	0.018	0.018***	0.001	0.323***	0.010	0.099***	0.003	0.296***	0.024	0.008***	0.001
SACTIV (ref: Primary sector)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Secondary sector	–1.254***	0.024	0.035	0.035	–1.968***	0.039	–0.016	0.020	–0.906***	0.021	0.025	0.045	–2.467***	0.056	–0.005	0.013
Tertiary sector	–1.271***	0.021	0.031	0.035	–1.903***	0.034	–0.012	0.020	–0.959***	0.018	0.009	0.045	–2.522***	0.049	–0.006	0.013
ENEO (ref: No)	0,177***	0.013	0.041***	0.003	–0.031	0.021	–0.001	0.001	–0.004	0.011	–0.001	0.003	–0.019	0.030	0.000	0.001
GROUP (ref: No)	0.103**	0.043	0.024**	0.010	–0.030	0.071	–0.001	0.004	–0.266***	0.043	–0.081***	0.013	–0.041	0.094	–0.001	0.003
AGE (ref: 5 years at most)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Between 6 and 10 years	0.078***	0.011	0.018***	0.003	–0.054***	0.020	–0.003**	0.001	0.071***	0.010	0.022***	0.003	–0.129***	0.028	–0.003***	0.001
More than 10 years	0.079***	0.013	0.019***	0.003	–0.031	0.022	–0.001	0.001	0.108***	0.011	0.034***	0.004	–0.140***	0.032	–0.003***	0.001

Note: ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

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the shadow economy is positively and significantly related to environmental pollution. These authors indicate that an increase in administrative corruption can weaken environmental regulation, leading to the expansion of the informal sector and, ultimately, to an increase in environmental pollution.

The coefficient of the variable BANK is positive and significant in models 2 and 3. Firms that received bank financing at the time of their establishment are more likely to set up a wastewater or solid waste management system. This result highlights the role that credit institutions can play in environmental protection. Environmental sustainability is central to some banks' social responsibility and efforts in Cameroon. Some banks have environmental policies, objectives, and practices that help to guide their activities at all levels. Environmental awareness is integrated into various banking operations, loans, products, services, and community activities. The banks' activities range from participation in conservation projects in communities across the country to commitments to recognized Cameroonian and international standards to reporting arrangements. Some of these banks are subsidiaries of the major banking groups[5] that have committed to the "Equator Principles" (an international standard on social and environmental issues in project finance).

The influence of gender on pro-environmental behavior adoption is mixed. Indeed, the coefficient of the variable SEX is positive and significant in models 1, 3, and 4. Firms managed by men are more inclined to set up an HSE, waste management, or air pollution control systems. However, it should be noted that men are less likely to have a wastewater management system. However, the results contradict Han and Chen (2021), who show that the gender of a firm's promoter has no significant effect on pro-environmental behavior.

Marital status also has mixed effects on pro-environmental behavior. Indeed, the coefficient of the variable SM is negative and significant at the 1% level in model 1. This reveals that a firm's probability of implementing an HSE system decreases when a married person manages it. In contrast, this coefficient is positive and significant at the 1% level in models 2, 3, and 4. Thus, firms managed by married people are more likely to adopt wastewater management, solid waste management, and air pollution control.

The firm's promoter education attainment (EDU) has mixed effects on pro-environmental behavior adoption. In models 1 and 4, the coefficient on the 'higher education' modality is positive and significant. Thus, the probability of setting up an HSE or air pollution control system increases if the firm's promoter is a higher education graduate. However, in model 3, this coefficient is rather negative and significant. This indicates that firms headed by university graduates are less likely to implement solid waste management. The results oppose Han and Chen (2021), who prove that the firm's promoter educational attainment does not significantly influence pro-environmental behavior.

The coefficient of the variable INTER is positive and significant at the 1% level in models 1 to 4. The probability that a firm adopts pro-environmental behavior increases for those with access to the Internet. The coefficient of the MOMO variable is also positive and significant at the 1% level. Thus, firms using mobile money are more likely to adopt pro-environmental behaviors. The digital revolution has brought its share of environmental problems. The Internet and smartphones, which are now indispensable tools, are not very good for the planet. But only some things are red on the digital balance sheet. While polluting, the Internet also helps raise awareness of climate issues and pro-environmental behavior. Advice, practical guides, and other information can be used to educate on pro-environmental attitudes.

The coefficients of the variable SACTIV are negative and significant at the 1% level. The probability that a firm adopts pro-environmental behaviors decreases for firms operating in the secondary and tertiary sectors. Focusing on the manufacturing sector, Sanni (2018) shows that the different branches of this activity do not significantly influence pro-environmental behavior adoption, in this case, the practice of eco-innovation. On the other hand, Galliano and Nadel (2013) show that,

5 These include Access Bank Plc, ECOBANK, HSBC, Société Générale and Standard Chartered Plc.

Table 4. Logit model (sensibility analysis)

Variables	Model 1				Model 2				Model 3				Model 4			
	HSE				WATER				WASTE				AIR			
	Coef.	Std. err.	dy/dx	Std. err.	Coef.	Std. err.	dy/dx	Std. err.	Coef.	Std. err.	dy/dx	Std. err.	Coef.	Std. err.	dy/dx	Std. err.
TAIL1 (ref: Turnover below 10 million)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Turnover between 10 and 50 million	0.177***	0.022	0.043***	0.006	0.033	0.038	0.002	0.002	0.117***	0.021	0.037***	0.007	0.066	0.050	0.002	0.002
Turnover over 50 million	0.253***	0.040	0.064***	0.011	0.225***	0.060	0.017***	0.005	0.152***	0.040	0.049***	0.013	0.319***	0.074	0.012***	0.004
BANK (ref: No)	0.026	0.025	0.006	0.006	0.202***	0.036	0.012***	0.002	0.198***	0.022	0.061***	0.007	0.089*	0.050	0.002*	0.001
LOCAL (ref: Not tenant)	–0.092***	0.013	–0.019***	0.003	–0.194***	0.021	–0.010***	0.001	0.011	0.012	0.005	0.004	–0.271***	0.027	–0.006***	0.001
OHADA (ref: Informal sector)	0.417***	0.033	0.094***	0.007	0.127**	0.052	0.008**	0.003	–0.050	0.033	–0.016	0.010	0.021	0.067	0.000	0.002
SEX (ref: Female)	0.061***	0.010	0.015***	0.002	–0.044***	0.017	–0.002*	0.001	0.017*	0.009	0.006**	0.003	0.068***	0.024	0.003***	0.001
SM (ref: Unmarried)	–0.026***	0.010	–0.005**	0.002	0.074***	0.018	0.005***	0.001	0.096***	0.009	0.030***	0.003	0.177***	0.025	0.006***	0.001
EDU (ref: Non-graduate)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Graduate of primary education	–0.069***	0.014	–0.014***	0.003	–0.051**	0.025	–0.001	0.001	0.089***	0.012	0.029***	0.004	0.098**	0.040	0.003***	0.001
Graduate of secondary education	–0.005	0.013	0.001	0.003	0.112***	0.023	0.008***	0.001	0.038***	0.012	0.013***	0.004	0.340***	0.037	0.010***	0.001
Graduate of higher education	0.104***	0.021	0.027***	0.005	0.025	0.036	0.003	0.002	–0.064***	0.020	–0.017***	0.006	0.233***	0.051	0.007***	0.001
INTER (ref: No)	0.242***	0.025	0.055***	0.006	0.260***	0.038	0.016***	0.002	0.067***	0.024	0.021***	0.008	0.415***	0.046	0.011***	0.001
MOMO (ref: No)	0.276***	0.011	0.063***	0.002	0.295***	0.018	0.018***	0.001	0.326***	0.010	0.100***	0.003	0.299***	0.024	0.008***	0.001
SACTIV (ref: Primary sector)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Secondary sector	–1.233***	0.024	0.031	0.036	–1.960***	0.040	–0.018	0.021	–0.905***	0.021	0.018	0.047	–2.466***	0.056	–0.006	0.014
Tertiary sector	–1.255***	0.021	0.026	0.036	–1.897***	0.034	–0.015	0.021	–0.961***	0.019	0.000	0.046	–2.526***	0.050	–0.008	0.014
ENEO (ref: No)	0.172***	0.013	0.040***	0.003	–0.024	0.021	–0.001	0.001	–0.003	0.011	0.000	0.003	–0.011	0.030	0.001	0.001
GROUP (ref: No)	0.096**	0.044	0.022**	0.010	–0.013	0.071	0.000	0.004	–0.274***	0.044	–0.083***	0.013	–0.056	0.096	–0.001	0.003
AGE (ref: 5 years at most)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Between 6 and 10 years	0.070***	0.011	0.016***	0.003	–0.055***	0.020	–0.003**	0.001	0.067***	0.010	0.021***	0.003	–0.130***	0.028	–0.003***	0.001
More than 10 years	0.071***	0.013	0.017***	0.003	–0.028	0.022	–0.001	0.001	0.102***	0.012	0.032***	0.004	–0.140***	0.032	–0.003***	0.001

Note: ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

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compared to the firms in the agri-food branch, the firms operating in the production of capital goods branches are more inclined to adopt pro-environmental behavior. However, companies in the transport branch show less interest in sustainable development.

The coefficients of the variables ENEO and GROUP are positive and significant at the 1% level in model 1. This shows that firms that subscribe to the hydroelectric network and have a generator are more inclined to set up an HSE system. On the other hand, in model 3, the coefficient of the variable GROUP is negative and significant. Thus, the probability of putting a solid waste management system in place decreases for firms using generators.

The influence of firm age on pro-environmental behavior adoption is mixed. Indeed, the coefficients of the AGE variable are positive and significant in models 1 and 3. Thus, the probability of setting up an HSE or waste management system increases with the firm age. On the other hand, the coefficients of this variable are negative and significant in models 2 and 4. Older firms are likelier to implement wastewater management and air pollution control systems. Overall, the results do not align with Han and Chen (2021), who show that pro-environmental behavior adoption increases significantly with firm age.

A sensitivity analysis of the results was conducted by replacing the number of employees (TAIL) with the turnover of the enterprises (TAIL1) as an indicator of enterprises size. The variable TAIL1 takes the value 0 if the firm has a turnover of less than 10 million CFA francs, 1 if its turnover is between 10 and 50 million CFA francs, and 2 if its turnover is greater than 50 million CFA francs. It should be recalled that Law No. 2010/001 of 13 April 2010 on promoting small and medium-sized enterprises in Cameroon defines VSEs, PEs, MEs, and EGs according to the number of staff or turnover. In doing so, Table 4 shows that the econometric results recorded are mostly identical to those in Table 3. Some studies have measured firm size not by the number of employees or salaried staff but rather by taking into account the total assets of the firm[6] (Li et al., 2019).

Although the study's results provide insight into some of the critical factors affecting pro-environmental behavior in Cameroon, there is a limitation related to the absence of some explanatory variables. They include pro-environmental attitudes, subjective norms or social pressure, regulatory pressures, collaboration with stakeholders (suppliers, customers, and service providers in charge of managing the firm's waste), environmental accreditations, and expenditures related to environmental protection.

CONCLUSION

The production activity of the enterprise is directly related to compliance with environmental standards, maximum income from production, and reducing the environmental impact. Based on the analysis results, essential conclusions were made regarding the relationship between firm size and the adoption of pro-environmental behavior.

The results showed that the probability of adopting pro-environmental behavior increases significantly with firm size. The paper also concludes that formal sector firms are more willing to adopt pro-environmental behaviors. This shows, on the one hand, that very small businesses and SMEs, which are the majority in the entrepreneurial ecosystem, are less involved in environmental protection. On the other hand, they escape the controls of the Ministry of environment, protection of nature, and sustainable development. In addition, findings have shown that access to bank financing is vital. Hence, banks have a major role in educating their clients (firms or individuals) about sustainable development upstream of their investment projects. Finally, Internet and mobile money access can also favor pro-environmental behavior adoption. This confirms the role of information and communication technologies in preserving the environment. Given the above, it would be appropriate to

6 The total assets of the company assets are all the rights and property that a company owns, including fixed assets, receivables, and cash.

(i) raise awareness among large firms of the challenges of environmental protection and strengthen controls on compliance with environmental standards;

(ii) implement actions aimed at the migration of firms from the informal to the formal sector;

(iii) encourage credit institutions to develop ecological banking instruments; and

(iv) improve business access to essential Internet and mobile money services.

AUTHOR CONTRIBUTIONS

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