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Environmental Clean-Up Costs and The Financial Performance of Plastic Companies in Douala

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Abstract

In light of the widely on-going debates about the trade-off between environmental responsibility and financial performance of companies, this study was conducted to investigate the relationship between environmental clean-up costs and the financial performance of large and medium size plastic manufacturing companies in Douala, Cameroon. An ex-post facto research design was employed and the analysis was based on 40 firm-year observations from 2016 to 2023. The data analysis was conducted using the Ordinary Least Square technique applied to the pooled panel data. The empirical evidence disclosed that the direct financial burden of environmental clean-up costs does not significantly impair the overall profitability of large and medium companies. Secondly, the key drivers of financial success in the large and medium plastic manufacturing companies appear to be the size of the company and the operational efficiencies associated with it rather than environmental clean-up costs. Thirdly, successful large and medium size plastic production firms are in a position to likely integrate more efficient processes, that lead to better financial outcomes and a reduced need for reactive environmental clean-up cost spending. Based on these findings, the policy recommendations are that: large and medium size plastic manufacturing concerns should prioritize investments in operational efficiency, modern production technologies, and waste minimization processes; the government should institute a policy approach that supports and enables all plastic manufacturing firms to modernize by creating incentive structures for them such as tax credits or grants to encourage them invest in cleaner plastic production technologies.

Keywords: Environmental Clean-up Costs, Financial performance, Returns on assets, Returns on equity, Net profit margin

1. Introduction

Manufacturing companies have historically been criticized for prioritizing profit maximization, often to the detriment of environmental protection (Socoliuc et al., 2020). Their focus on shareholder wealth could lead to insufficient concern for the environmental dilapidation including land, air, and water pollution caused by their operations (Bassey, Sunday, & Okon, 2013; Nguyen, Ngo, & Nguyen, 2022). The global community finds itself in a dilemma of how to promote essential economic development while maintaining the environment for future generations. To address this quandary requires a robust accounting of environmental impacts, putting resource depletion, pollution, and climate change at the center to sustainable development efforts.

The most pressing environmental challenge seems to be plastic pollution. The production and disposal of plastics have created an environmental crisis that surpasses mitigation efforts. A 2020 study in Science projected that if there is no significant intervention, up to 53 million metric tons of plastic waste could enter aquatic ecosystems very year by 2030, with a worst-case scenario reaching 90 million tons (Borrelle et al., 2020). This projection lends support to the widely cited 2016 prediction from the Ellen MacArthur Foundation that by weight our oceans could contain more plastic than fish by the year 2050. The problem is now ubiquitous with plastic elements contaminating not only oceans and soil but also the air we breathe and the human blood we possess (Leslie et al., 2022). The environmental toll seem quite huge. An estimated 90% of seabirds and half of all marine turtles ingest plastic materials that lead to injury and death. In addition, plastic waste apart of their effects on marine turtles destroy fragile ecosystems (Wilcox et al., 2015; Schuyler et al., 2014).

Environmental clean-up costs concerns originate from poor waste management infrastructure, a lack of extensive public awareness, economic incentives preferring single-use plastics, and the intricacies of global trade (Lyons, Neo, Lim et al., 2020). Since the 1950s, humanity has produced an estimated 8.3 billion tons of plastic, yet only 9% has ever been recycled. A majority of the plastic waste (79%) gather in the natural environment (Borrelle et al., 2020). The persistence of this plastic waste suggests that environmental contamination may get worse unless fundamental changes to plastic production and waste management take place.

Consequently, the concept of Corporate Social Responsibility (CSR) has gained prominence, proposing that companies balance profit-making with their social and environmental obligations (Dahlsrud, 2008). This involves internalizing environmental costs expenses related to preventing, monitoring, and remediating environmental damage within a company's financial decision-making (Okafor, 2018). Proponents contend that strong environmental performance, managed through CSR initiatives will enhance corporate reputation, attract investment, and ultimately boost long-term financial performance. This perspective views environmental expenditures not as mere costs, but as strategic investments in sustainability and brand equity.

In Cameroon the government has taken some legislative steps to address the issue. On October 24th 2012, the Ministry of the Environment, Nature Protection and Sustainable

Development passed a decree banning non-biodegradable plastic packaging of 60 or less microns. This took effect in April 2014 and carried significant penalties for non-compliance. Furthermore, Law No. 96/12 of August 5, 1996, legally requires companies to integrate environmental protection into their policies and conduct impact assessments to mitigate their ecological footprints (MINFOF, 2018).

Despite these regulations, the visible persistence of plastic pollution in Cameroon's urban centers clogging drainage systems and resulting in floods suggests a disconnection between policy and on-the-ground reality. This raises questions about corporate social responsibility and the perceived trade-off between environmental responsibility and profitability. While some companies may view environmental clean-up cost expenses as a drain on profits, an alternative view holds that these costs can lead to long-term financial benefits through improved efficiency, reduced waste, and an enhanced public image. As key contributors to environmental pollution, plastic manufacturers and major users of plastic packaging in Cameroon are central to this dynamic.

Motivated by the need to empirically investigate this relationship between environmental clean-up costs and financial performance, a study of large and medium size plastic manufacturing companies in Douala in Cameroon was conducted. Specifically, it examined how environmental clean-up costs being a key component of CSR impact three distinct measures of financial performance: return on assets (ROA), return on equity (ROE), and net profit margin (NPM).

2. Literature Review

The evolving global business landscape increasingly demands that corporate financial reporting should go beyond its traditional boundaries to include the impacts of environmental and social externalities. This paradigm shift has given rise to specialized fields of study, notably Environmental Cost Accounting (ECA), which seeks to systematically identify, quantify, and report the financial consequences of a firm's interaction with the environment. ECA is not merely a compliance mechanism but a strategic management tool designed to internalize environmental costs, such as those associated with pollution prevention, waste management, remediation, and habitat restoration (Makori & Jagongo, 2013; Muhammed, 2018). As conceptualized by Bucior and Irwanda (2021), ECA provides a framework for apportioning costs arising from environmental degradation. Previously hidden expenses are therefore expected to be made visible and manageable. An effective implementation of ECA is posited to yield substantial benefits, such as the spur to innovate production processes, reduction of long-term liabilities, enhancement of corporate decision-making, and an overall increase in organizational competitiveness and financial strength (Sirisom & Sonthiprasat, 2011).

The ultimate objective of such a cost accounting system is to enhance organizational value conventionally appraised through proxies of financial performance. Financial performance itself is a multifaceted construct, reflecting an organization's overall financial health and its efficiency in achieving strategic objectives through the mobilization and allocation of capital

(Fatihudin, Jusni, & Mochklas, 2018). Although it can be assessed through various lenses including liquidity and solvency, this study focuses on profitability which is a primary indicator of a firm's operational success and value creation.

To capture a holistic view of profitability, three distinct and widely accepted metrics have been adopted. The first one being Return on Assets (ROA). This is calculated as net profit relative to total assets. It serves as a crucial indicator of managerial efficiency in deploying the firm's entire asset base to generate earnings, irrespective of its capital structure (Van Horne & Wachowicz, 2005; Hery, 2015). The second metric, Return on Equity (ROE) measures net profit as a percentage of shareholders' equity and is paramount from an investor's perspective because it reveals the rate of return generated on the capital they have directly invested in the company (Sudana, 2015; Kasmir, 2016). Finally, the Net Profit Margin (NPM) assesses the proportion of revenue that translates into clean profit after all operating costs, taxes, and interest expenses have been deducted. It offers insight into a company's pricing and cost control abilities. In other words, it portrays how much profit an enterprise makes for each FCFA of revenue generated (Brown, 2022).

The decision by corporate managers to incur and disclose environmental costs is not made in a vacuum; it is guided by powerful social and organizational pressures, which can be understood through two predominant theories: Legitimacy Theory and Stakeholder Theory. Legitimacy Theory posits that organizations operate under an implicit social contract, wherein their continued existence and access to resources depend on how their actions are perceived as being desirable or undesirable according to the norms, values, and beliefs of the society (Deegan, 2002). Legitimacy is therefore a critical (although intangible) resource that is maintained by aligning corporate behaviour with societal expectations (Dowling & Pfeffer, 1975). In the context of this study, the act of incurring and reporting environmental clean-up costs by a plastic manufacturing company is not simply accounting for an expense but also a symbolic gesture intended to announce the company's commitment to environmental stewardship. This action maintains or repairs the company's social license to operate particularly in a context of heightened public and regulatory scrutiny over plastic pollution.

Complementing this broad societal perspective, Stakeholder Theory according to Freeman, Wicks, and Parmar (2004) posits that firms must create value not only for their shareholders but also for all their stakeholders in order to ensure long-term sustainability. The other stakeholders include customers, employees, suppliers, regulators, and the local community. The operations of plastic companies directly impact the environmental well-being of local communities, making them a particularly salient stakeholder group. From this perspective, investments in environmental clean-up are a direct reply to the genuine claims and concerns of these communities. By addressing the negative effects of their production, companies can build trust, mitigate regulatory risk, and foster goodwill, which constitute a solid foundation to long-term success (Gilbert & Rasche, 2008). While Legitimacy Theory provides the societal context for corporate action, Stakeholder Theory offers the strategic imperative for identifying and responding to the specific pressures that threaten a firm's operational stability and reputation.

The theoretical imperative for environmental responsibility has laid a rich and diverse framework for empirical research. It examines the physical financial consequences though the findings present a complex mosaic rather than a monolithic conclusion. An extensive stream of research corroborates the notion that environmental performance is positively associated with financial performance. In a study of two South African plastic manufacturers, Aliamutu, Bhana, & Suknunan (2023) demonstrated a positive relationship between environmental cost management and profitability. This finding is echoed across various sectors in Nigeria, where Major & Nwadighoha (2024) found that waste management costs enhanced the financial performance of food and beverage firms.

Several other studies confirmed a positive link between environmental investments and performance in the oil and gas, and consumer goods industries (Oti & Mbu-Ogar, 2018; Okegbe & Ofurum, 2019; Uzoh, 2022). In Cameroon, a study by Shiyghan, Mukah, & Vukenkeng (2024) on manufacturing firms in Douala also indicated a positive correlation between pollution prevention costs and Return on Assets (ROA). On a global scale, a large-sample analysis by Manrique & Martí-Ballester (2017) affirmed that environmental investments are financially beneficial; noting that corporations in developing countries may reap even greater rewards from such strategies.

On the other hand, the idea to adopt practices and products that reduce environmental harm and promote sustainability isn't always true. Some evidence shows it might even affect financial performance negatively. For example, Ayayi & Wijesiri (2022) found that Asian microfinance institutions that focused more on environmental responsibility had very bad financial sustainability. Other studies show mixed results, like Abdullahi & Muhammad (2023), who found that environmental spending by Nigerian firms' boosted their accounting performance (ROA) but did not affect their market performance. So, the impact of CSR on finances is complex and depends on the context and metrics used.

However, the review of the empirical literature reveals a scholarly consensus that a relationship between environmental and financial performance exists, but its direction and magnitude are highly contingent on geographical context, industry specifics, and the chosen performance metrics. Despite the global urgency surrounding plastic pollution and the existence of specific environmental legislation in Cameroon, a focused empirical investigation into this dynamic within the Cameroonian large and medium size plastic manufacturing firms is conspicuously absent from the existing literature. While studies in neighbouring Nigeria and other African nations provide valuable insights, their findings cannot be freely extrapolated to Cameroon's unique regulatory and business environment. This research, therefore, addresses this critical contextual and industry-specific lacuna in Cameroon. By empirically examining the impact of environmental clean-up costs on the ROA, ROE, and NPM of large and medium plastic manufacturing firms in Douala, the study aims to contribute a vital piece of evidence to a globally germane but locally under-researched subject.

3. Methodology

An ex-post facto quantitative research design was considered appropriate and adopted in the study because data on both independent and dependent variables already exist and the researcher had no control over them. The research took place in Douala, in the Littoral Region of Cameroon. The city of Douala is the industrial hub and economic capital of the Republic of Cameroon. The highest concentration of plastic production companies in the country is in Douala with its industrial zones of Bassa and Bonaberi being the main locations of large/medium plastic manufacturing firms. The target population of the study comprised large and medium formal plastic manufacturing companies that operate in Douala. This was derived from CCIMA Littoral registry plus listings of large/medium plastic manufacturing firms by BusinessList.co.cm, 2026.

Large companies have 200 to 500 workers and generate 10 to 49 million dollars of revenue annually. Six of them are formally identified in Douala including PLASTICAM, STRATEX, and SAPAM. On the other hand, Medium size plastic companies have 50 to 200 employees. The population size of listed large and medium size plastic companies stood at 10. However, there are over 40 small plastic companies in Douala and these small firms were not considered in this study.

A purposive sampling technique was adopted in the selection of five large and medium plastic companies out of 10. The selection criteria focused on that they are large or medium, and that they have complete financial statements and environmental clean-up cost data for the period 2016 to 2023. Generally, a sampling proportion of at least 30% is considered adequate for a finite population. The study registered 50% coverage with n=5, leading to 4 degrees of freedom for regression analysis. Even though this meets the minimum requirement for correlation and regression, the small absolute size of 5 is acknowledged as a limitation to statistical power. A census would have been preferred if all the 10 large/medium companies had all the required data over the study period. However, the sample size is still considered large enough to generate conclusions which could be generalized for the entire industry of large and small plastic producers in Douala, Cameroon.

Validity of the data was assured by using audited financial statements, which had been verified by external auditors. Consequently, reliability was ensured because secondary data from the audited financial reports were consistent and could be replicated across periods. However, no ethical approval was required in this study considering that only available secondary data made public were used, and there was no collection of primary data that involved interaction with people. To avoid plagiarism, citations were properly maintained.

The hypotheses were tested with data from the audited annual reports of the selected firms where all variables were defined and collected. Financial performance was measured through three standard profitability ratios to ensure a comprehensive assessment. The ratios were: Return on Assets (ROA), calculated as net income divided by total assets; Return on Equity (ROE), calculated as net income divided by total shareholders' equity; and Net Profit Margin (NPM), calculated as net income divided by total revenue. All ratios are expressed as

percentages. The primary independent variable is Environmental Clean-up Cost (LogECC), is log-transformed for the analysis. The key control variable is Firm Size (LogFSize), which is measured as the natural logarithm of total assets, denominated in millions of FCFA.

The analysis of the data was conducted using the Ordinary Least Square (OLS) technique applied to the pooled panel data. This method estimates a single regression equation for all 40 firm-year observations combined, effectively treating them as a single cross-sectional dataset. The underlying assumption of this approach is that the relationship between Environmental Clean-up costs and financial performance is stable across all five firms and over the entire 2016-2023 period. Prior to conducting the regression analysis, descriptive statistics and a correlation matrix were generated to summarize the variables and assess the potential for multicollinearity. All data processing and statistical analyses were performed using Stata software (See Appendix).

The specified models are as follows, where the independent variable logECC represents the natural logarithm of Environmental Clean-up Costs:

$$ROA_{it} = \beta_0 + \beta_1 LogECC_{it} + \beta_2 LogFSIZE_{it} + \mu_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

$$ROE_{it} = \beta_0 + \beta_1 LogECC_{it} + \beta_2 LogFSIZE_{it} + \mu_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

$$NPM_{it} = \beta_0 + \beta_1 LogECC_{it} + \beta_2 LogFSIZE_{it} + \mu_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

4. Presentation and Discussions of Results

This section presents the empirical findings of the study. It begins with descriptive statistics and a correlation analysis to provide an overview of the data, followed by the results of the multiple regression models. The section concludes with a discussion of these results, interpreting them in line with the theoretical framework and existing literature, and acknowledging the limitations of the analysis.

Descriptive Statistics

Descriptive statistics for all dependent and independent variables were computed for the 40 firm-year observations of the 5 firms. These statistics provide a foundational understanding of the data's central tendency, dispersion, and range.

Table 1. Descriptive Statistics

Variable	Observations (N)	Mean	Standard Deviation	Minimum Value	Maximum Value
Return on Equity (ROE) (%)	40	30.1	15.2	7.32	79.74
Return on Assets (ROA) (%)	40	14.4	6.3	3.08	26.52
Net Profit Margin (NPM) (%)	40	2.7	1.3	0.68	5.49
Firm Size (FSize)[2]	40	7.6	0.5	6.87	8.55
Environmental Clean-up Cost (ECC)[1]	40	0.7	0.2	0.38	0.93

Source: Computed by author (2025)

The descriptive statistics presented in Table 1 provide a comprehensive overview of the financial performance and environmental cost variables for the five sampled plastic manufacturing firms over the 2016-2023 period. On average the firms demonstrated robust profitability with a mean Return on Equity (ROE) of 30.1% and a mean Return on Assets (ROA) of 14.4%. However, a key feature of these performance metrics is their significant variability, as indicated by large standard deviations (15.2 for ROE and 6.3 for ROA) as well as their wide max-min ranges, with ROE spanning from a modest 7.32% to a substantial 79.74%.

This suggests a high degree of heterogeneity in performance across the sampled firms and years. In contrast, the average Net Profit Margin (NPM) was considerably lesser at 2.7%, implying that while the firms are effective at leveraging their asset and equity bases, their core profitability on sales remains tight.

Regarding the primary variable of interest, Environmental Clean-up Cost (ECC), the mean was 0.70 with a standard deviation of 0.2, and values ranged from 0.38 to 0.93, indicating that while there is a general level of environmental expenditure, there is sufficient variation to examine its potential impact on performance.

Finally, firm size, measured as the logarithm of total assets, showed less relative variation (mean of 7.6, SD of 0.5), suggesting that the sample consists of firms of a relatively comparable scale, which helps to control for size-related confounding effects in the subsequent regression analysis. To visualize the evolution of these variables over time, Figure 1 plots the annual average percentage (%) change of ROA against the annual average percentage (%) change of environmental clean-up cost. The chart illustrates a general fluctuation in profitability and a noticeable increase in environmental costs in the middle of the study period.

Correlation Analysis

Prior to conducting the regression analysis, a Pearson correlation matrix was generated to examine the bivariate relationships between the variables and to screen for potential multicollinearity. The results of this analysis, including statistical significance, are presented in Table 2.

Table 2: Pearson Correlation Matrix

Variable	ROE	ROA	NPM	LogECC	LogFSize
ROE	1				
ROA	0.868**	1			
NPM	0.664**	0.486**	1		
LogECC	-0.233	-0.054	-0.275*	1	
LogFSize	0.300*	-0.042	0.602**	-0.457**	1

Source: Computed by the author (2025)

Note: ** denotes significance at the 1% level ($p<0.01$), * denotes significance at the 10% level ($p<0.10$). N = 40.

The correlation matrix provides several crucial insights into the relationships between the variables. As expected, the three measures of financial performance are all positively and highly significantly correlated with one another, confirming their internal consistency as indicators of profitability.

Of primary interest to this study, the relationship between Environmental Clean-up Cost (LogECC) and financial performance is nuanced. There is no statistically significant correlation between LogECC and either ROE ($r = -0.233$) or ROA ($r = -0.054$). This suggests that at the bivariate level there is insufficient evidence to conclude that higher environmental costs are associated with lower returns on equity or assets. However, there is a weak negative correlation between LogECC and Net Profit Margin (NPM) ($r = -0.275$) that is significant at the 10% level, offering marginal evidence that these costs might slightly erode profit margins.

The analysis also reveals other significant relationships. Firm Size (LogFSize) is strongly and positively correlated with Net Profit Margin ($r = 0.602$, $p<0.01$), indicating that larger firms in the sample are significantly more profitable. Most notably, there is a moderate and statistically significant negative correlation between LogFSize and LogECC ($r = -0.457$, $p<0.01$). This important finding suggests that larger firms tend to report lower environmental clean-up costs, a dynamic that requires further exploration in the discussion.

Finally, the correlation between the two independent variables (-0.457) is well below the common threshold for concern, allowing us to proceed with the multiple regression analysis without the risk of severe multicollinearity distorting the results.

Regression Results

To formally test the hypotheses while controlling for firm size, three Ordinary Least Square (OLS) regression models were estimated. The models assess the impact of Environmental Clean-up Cost (LogECC) and Firm Size (LogFSize) on Return on Assets (ROA), Return on Equity (ROE), and Net Profit Margin (NPM), respectively. The complete results are presented in Table 3.

Table 3. OLS Regression Results of the Impact of Environmental Clean-up Cost on Financial Performance

	Model 1	Model 2	Model 3
Dependent Variable	**ROA (%)**	**ROE (%)**	**NPM (%)**
Independent Variables			
LogECC	-1.78	-5.11	-1.54*
	-2.99	-6.21	-0.83
LogFSize	0.94	8.23	2.51***
	-2.09	-4.34	-0.58
Constant	10.15	3.45	-13.77***
	-15.98	-33.22	-4.43
Observations (N)	40	40	40
R-squared	0.019	0.103	0.401
Adjusted R-squared	-0.034	0.054	0.368
F-statistic	0.36	2.11	12.42***

Source: Computed by the author

*Note: Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.10.*

The regression analysis reveals a set of nuanced findings that largely align with the preceding correlation analysis. The F-statistic indicates that Model 1 (predicting ROA) and Model 2 (predicting ROE) lack overall statistical significance, suggesting that environmental cost and firm size, as specified, are poor predictors of these performance measures. The R-squared values for these models are exceptionally low, further confirming that they explain very little of the variance in ROA and ROE.

In Model 1, the coefficient for LogECC is negative (-1.78) but statistically insignificant, providing no evidence that environmental clean-up costs adversely affect Return on Assets. Similarly, in Model 2, the coefficient for LogECC on ROE is also negative (-5.11) and statistically insignificant. In glaring contrast, Model 3 which examines Net Profit Margin (NPM), is statistically significant at the 1% level (F = 12.42). This model explains approximately 37% of the variation in NPM (Adjusted R-squared = 0.368). Within this model, two key findings emerge: Environmental Clean-up Cost (LogECC) has a negative coefficient (-1.54) that is statistically significant at the 10% level. This provides marginal evidence of a trade-off, suggesting that for every 1% increase in environmental costs, a firm's net profit margin is expected to decrease by approximately 0.015 percentage points, holding firm size constant. Firm Size (LogFSize) is a strong, positive, and highly significant predictor of NPM. The coefficient of 2.51 ($p<0.01$) indicates that larger firms are substantially more effective at converting revenue into net profit.

In summary, the regression results show that the hypothesized negative relationship between environmental cost and financial performance is largely unsupported for broad measures like ROA and ROE. A weak negative relationship is only observed for Net Profit Margin. The

most powerful and consistent predictor of profitability in this context is not environmental expenditure, but rather the size of the firm itself.

Discussion of Findings

The central objective of this study was to determine the relationship between environmental clean-up costs and the financial performance of plastic manufacturing firms in Douala. The empirical results present a more complex picture than a simple trade-off or a "win-win" scenario. The primary finding is that environmental clean-up costs have a largely negligible or, at best, a marginal negative impact on financial performance. This conclusion contradicts the strong trade-off theory advanced by scholars such as Major & Nwadighoha (2024); Shiyghan, Mukah, & Vukenkeng (2024) and Aliamutu, Bhana, & Suknunan (2023). The conclusion rather aligns with the negative link identified by Ayayi & Wijesiri (2022).

The lack of a significant negative relationship between LogECC and the broad performance metrics of ROA and ROE is a critical finding. It suggests that for the firms in this sample, environmental clean-up costs may not be material to significantly impact overall returns on assets or equity. These expenditures not withstanding may represent a manageable "cost of doing business", a necessary outlay to maintain their social license to operate as prescribed by the Legitimacy Theory. It would appear companies incur these costs not as a strategic investment for profit, but as a baseline requirement to satisfy regulatory and community expectations, thus defusing a potential threat rather than actively generating value.

The only area where a statistically significant relationship is found is the marginal negative impact of LogECC on Net Profit Margin. This is a logical outcome since clean-up costs are direct operational expenses and all things being equal will reduce the profit derived from revenue. However, the effect is weak, reinforcing the impression that these clean-up costs do not constitute the primary driver of profitability for these firms.

The most compelling finding of this study is the dominant and positive role of Firm Size. The strong, positive relationship between LogFSize and NPM suggests that economies of scale, higher operational efficiencies, and greater market power are the key determinants of profitability in this sector. This finding, when combined with the correlation analysis which revealed that larger firms actually have lower environmental clean-up costs ($r = -0.457$) portrays a bigger picture. It suggests that large firms may have already invested in more efficient modern production technologies that generate less waste, thereby reducing their need for costly reactive clean-ups. This proactive investment while not directly measured in this study, could explain both their higher profitability and their lower environmental cost burden. This aligns with a more sophisticated view of Stakeholder Theory which holds that strategic long-term investments to satisfy environmental stakeholder concerns can lead to operational efficiencies that reinforce financial performance.

5. Conclusion and Policy Recommendations

The aim of this research was to determine the relationship between environmental clean-up costs and the financial performance of large and medium plastic manufacturing companies in

Douala, measured by Return on Assets (ROA), Return on Equity (ROE), and Net Profit Margin (NPM). The analysis of 40 firm-year observations from 2016 to 2023 revealed no statistically significant relationship between environmental costs and the general profitability measures of ROA and ROE. A weak, statistically marginal negative association was identified with Net Profit Margin.

The most powerful and consistent determinant of profitability was not environmental expenditure but rather firm size, which was positively correlated with NPM and negatively correlated with environmental clean-up costs. Based on this evidence, the study concludes that:

- The direct financial burden of environmental clean-up costs does not significantly impair the overall profitability of large and medium size plastic manufacturing companies in Douala.
- The environmental clean-up costs are more of investments to maintain stakeholder trust, avoid reputation damage, and comply with regulations, than an investment to increase profitability.
- The key drivers of financial success in large and medium size plastic manufacturing businesses in Douala appear to be the firm size and the operational efficiencies associated with it that reduce the need for clean-ups in the first place.

As a result, the policy recommendations are that:

- Managers of large and medium size plastic manufacturing concerns should underscore the need to prioritize investments in operational efficiency, modern production technologies, and waste minimization processes. In this way proactive operational excellence, rather than reactive cost-cutting on clean-ups will lead to both higher profitability and better environmental performance.
- For policymakers, the study suggests that while punitive measures for non-compliance environmental sustainability remain necessary, a policy approach that supports and enables firms to modernize and adopt cleaner production technologies will be more effective. Creating incentive structures such as tax credits or grants could encourage firms of all sizes to invest in such technologies.
- Given the clear advantages of firm size observed in the data, particular focus should be placed on targeted programmes that help all plastic manufacturing enterprises to access the capital and technical expertise needed to upgrade their facilities and adopt more sustainable practices.

6. Limitations

The study focused on large and medium size plastic companies and completely ignored the small companies which are more than four times the number of large and medium plastic firms. This means that the findings cannot be generalized to the entire plastic industry. The research design establishes correlation, not causation. Moreover, the LogECC variable only

captures one facet of environmental strategy (clean-up cost), and does not account for proactive investments in pollution prevention, research and development for sustainable materials, or other "green" initiatives that could have different financial implications.

Despite these limitations, this study provides crucial, context-specific evidence as it suggests that the debate over environmental clean-up costs may be secondary to the fundamental business drivers of firm size and operational efficiency.

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Appendix: Data analysis using Stata version 1

Fin. year	Panel	Companies	ROE	ROA	NPM	FSize	ECC
2016	1	CIAC	16.36	8.58	1.27	7.14	0.50
2017	1	CIAC	16.24	10.46	1.09	7.12	0.55
2018	1	CIAC	15.00	9.11	0.87	7.21	0.55
2019	1	CIAC	15.67	9.85	0.72	7.26	0.50
2020	1	CIAC	10.67	5.92	0.69	7.35	0.78
2021	1	CIAC	10.67	5.40	0.68	7.43	0.78
2022	1	CIAC	14.98	8.88	0.76	7.43	0.78
2023	1	CIAC	11.33	7.33	0.96	7.43	0.78
2016	2	STRATEX	23.43	13.29	2.67	6.98	0.89
2017	2	STRATEX	25.20	19.26	2.25	7.08	0.90
2018	2	STRATEX	25.20	13.42	2.25	7.17	0.88
2019	2	STRATEX	25.63	12.83	1.92	7.25	0.86
2020	2	STRATEX	26.48	12.96	1.64	7.34	0.86
2021	2	STRATEX	23.65	11.14	2.69	7.42	0.85
2022	2	STRATEX	14.28	6.60	2.78	7.45	0.86
2023	2	STRATEX	7.32	3.08	1.83	7.50	0.67
2016	3	NOVA PLAST Sarl	32.18	16.21	3.01	7.86	0.92
2017	3	NOVA PLAST Sarl	42.95	18.33	3.08	7.87	0.92
2018	3	NOVA PLAST Sarl	40.17	17.52	3.61	7.89	0.93
2019	3	NOVA PLAST Sarl	44.50	19.44	3.92	7.96	0.93
2020	3	NOVA PLAST Sarl	36.81	13.41	3.95	8.03	0.67
2021	3	NOVA PLAST Sarl	25.77	9.80	3.88	8.08	0.67
2022	3	NOVA PLAST Sarl	21.25	7.23	2.82	8.12	0.79
2023	3	NOVA PLAST Sarl	16.12	6.38	2.27	8.09	0.79
2016	4	PLASTICAM	33.73	17.35	4.95	6.87	0.78
2017	4	PLASTICAM	39.78	22.59	1.76	6.91	0.78
2018	4	PLASTICAM	33.26	21.95	2.77	6.88	0.78
2019	4	PLASTICAM	38.90	21.93	1.80	7.00	0.78
2020	4	PLASTICAM	42.06	25.88	1.54	7.03	0.78
2021	4	PLASTICAM	39.17	23.62	3.03	7.06	0.78
2022	4	PLASTICAM	29.60	14.87	2.78	7.10	0.78
2023	4	PLASTICAM	29.71	12.92	1.64	7.21	0.80
2016	5	PLASTGRY	79.74	24.61	4.35	8.02	0.54
2017	5	PLASTGRY	59.93	26.09	4.20	8.03	0.50

2018	5	PLASTGRY	60.46	26.52	5.18	8.06	0.43
2019	5	PLASTGRY	48.92	16.14	3.46	8.37	0.43
2020	5	PLASTGRY	40.71	15.00	4.05	8.40	0.38
2021	5	PLASTGRY	38.34	17.04	5.49	8.40	0.46
2022	5	PLASTGRY	24.73	12.18	4.16	8.54	0.53
2023	5	PLASTGRY	22.08	10.68	3.55	8.55	0.53

Source: The author