Correlational Analysis on the Profile and Greening Practices of Small Manufacturing Enterprises in Nueva Ecija

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ABSTRACT

This study, anchored on the Green Business Theory, is aimed at determining the greening practices of small manufacturing enterprises in Nueva Ecija, assessing the benefits and challenges in adopting such practices, and exploring the relationship of the respondents' profiles with their greening practices. This research centers on the seven greening hotspots of the Department of Trade and Industry's (DTI) Green Economic Development (GED) initiative, namely the management of natural resources, energy efficiency, wastewater, solid and toxic waste, transport, local supplies, and raw materials. The study employed a quantitative research design utilizing a researcher-developed questionnaire composed of survey items and open-ended questions. Data collection was facilitated with the assistance of Negosyo Center Business Counselors. Using statistical tools such as frequency, percentage, mean, weighted mean, and Spearman's rho, the responses of 78 small manufacturers were analyzed to determine patterns, relationships, and levels of significance. It was found that small manufacturers in Nueva Ecija generally engage in greening initiatives. Variations in perceptions and practices were evident across key demographic and organizational variables, including the sex of the owner, type of ownership, number of employees, and years in operation. Greening efforts were perceived to enhance regulatory compliance, stakeholder well-being, and corporate and product image. However, small manufacturers face constraints such as a lack of budget, low employee awareness, and weak implementation. These challenges, particularly low awareness and poor implementation, were closely linked to budget limitations, as effective training and sustained implementation require sufficient funding.

Keywords: Green Economic Development, Greening Practices, Small Manufacturing Enterprises, Sustainable Development, Green Business Theory

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I. INTRODUCTION

Businesses and their operations have a substantial impact on society, the environment, and the economy. Economic activities and growth are seen as one of the major contributors to environmental degradation (Acheampong & Opoku, 2023). As concerns about the environment continue to evolve, businesses are compelled to be conscious of their impacts on the environment and carry out measures to address these possible impacts (Tham & Wu, 2023).

Sustainability discourse in the business sector has gained prominence, particularly following the adoption of the 2030 Agenda for Sustainable Development in 2015. It highlights the role of businesses in contributing to changing unsustainable consumption and production patterns through the mobilization of financial and technical assistance to strengthen developing countries' scientific, technological, and innovative capacities to move towards more sustainable patterns (United Nations [UN], 2015).

At the regional level, the ASEAN Comprehensive Recovery Framework laid out strategies that focus on advancing towards a more sustainable and resilient future, underscoring ASEAN's commitment to safeguarding the region's natural resources, social fabric, and the prosperity of its people (ASEAN, 2020). This strategy has been translated to the Micro, Small, and Medium Enterprise (MSME) Development Plan 2023-2028 of the Philippines, which identifies the promotion of circular economy and green growth as cross-cutting strategies towards attaining an innovative and resilient MSME sector (Department of Trade and Industry [DTI], 2024).

Despite these policies and frameworks, MSMEs' social and environmental actions are fragmented and informal, and few have formal policies and intentions (Maniu et al., 2021). In particular, the manufacturing industry is still operating in a largely linear and unsustainable manner (Kazancoglu et al., 2021; Verma et al., 2022). The active and voluntary involvement of MSMEs in environmentally sustainable actions depends on their awareness of good practices and on the existence of environmental leaders. In addition, the small and medium sectors are lagging in terms of greening and green innovation due to their limited size and small resource base (Gupta & Barua, 2018). Businesses noted the lack of capital as the central barrier to adopting and implementing green business practices (Purwandani & Michaud, 2021). It was also observed that smaller firms and those located in urban areas are more familiar with green business practices as compared to larger firms and firms that are located in rural areas (Purwandani & Michaud, 2021).

Regmi et al. (2023) showed that entrepreneurship strategy and natural resources management—specifically extraction and utilization, conservation and prevention, and the management of water and land resources—enhance sustainable performance by reducing risks related to resource scarcity, regulatory pressures, and stakeholder demands. Adu et al. (2023) likewise noted that SMEs can reduce their carbon footprints by identifying green barriers through owner-driven initiatives. Nonetheless, Al-Swidi and Saleh (2021) found that green organizational culture positively influences employees' environmental behaviour and overall organizational environmental performance, underscoring the importance of leadership in advancing green practices. This highlights

the role of the business owners or executives in advocating and implementing green practices. While Industry 4.0 technologies can support the shift to a circular economy, managerial skills and initiatives remain essential (Kazancoglu et al., 2021).

In the Philippine setting, it was found that there is a low level of awareness regarding circular economy principles among women-led MSMEs in Metro Manila (Katigbak & Villaruel, 2023). The low level of awareness translates to a low level of circularity, which was ascertained through strategy and vision, business model, post-sales services, resource recovery, waste management, resource consumption, and eco-design strategies of MSMEs. San Jose et al. (2025) explored the perceptions, barriers, and drivers of renewable adoption among 50 enterprises in Muntinlupa City and found that although most were aware of renewable energy technologies, their willingness to adopt them remained low due to high costs. Similar findings were observed by Santos-Recto (2022) among blue entrepreneurs in Nueva Ecija, where sustainability practices were generally well-observed, but engagement in researching eco-friendly technologies and participating in capacity-building activities was minimal.

Nationally, the MSMEs in the country comprise 99.63 percent of all businesses (Philippine Statistics Authority [PSA], 2023). The same statistics are somewhat mirrored in the Province of Nueva Ecija, which recorded 25,341 registered businesses in 2023, with 99.91 percent categorized as MSMEs. The manufacturing sector comprises 23.99 percent or a total of 3,041 businesses. Of this figure, there are 2,923 micro manufacturers, 113 small manufacturers, 4 medium manufacturers, and 1 large manufacturer in the province.

This research was anchored on the Green Business Theory, which emphasizes balancing profitability with environmental and social responsibility through sustainable operations. It aligns with ISO 14001: 2015, which provides a framework for organizations and businesses to ensure that they are taking proactive measures to minimize their environmental footprint (International Organization for Standardization [ISO], 2015). The framework covers resource usage, waste management, monitoring environmental performance, and the involvement of stakeholders in environmental commitments. Relatedly, corporate environmental responsibility (CER) extends corporate social responsibility (CSR) to ecological impacts, emphasizing proactive strategies that exceed compliance with environmental laws and regulations (Kan, 2024; Kasych et al., 2020). From the legal point of view, it means that the responsibility for environmental damage is transferred to those who cause harm. Meanwhile, from the economic point of view, environmental responsibility is reflected in the costs incurred in fulfilling a company's obligations to the environment (Kasych et al., 2020).

Aligned with the CER principles, the study centers on the seven greening hotspots of the Department of Trade and Industry (DTI) Philippines' Green Economic Development (GED) initiative, namely the management of natural resources, energy efficiency, wastewater, solid and toxic waste, transport, local supplies, and raw materials. This initiative is aimed at propelling MSMEs and government institutions to increasingly implement inclusive, environment-friendly, and climate-smart strategies and measures.

Specifically, this research examines the green business practices of small manufacturing enterprises in the Province of Nueva Ecija, aiming to (1) describe the demographic and organizational profile of small manufacturing entrepreneurs in Nueva Ecija, (2) assess their green business practices across DTI's greening hotspots, 3) identify benefits and challenges of adopting greening practices, and 4) determine the relationship between the profile and green business practices of small manufacturers.

The results of the study intend to provide a basis for laying out recommendations to mainstream or replicate greening practices among businesses in Nueva Ecija. This will help in advancing the importance of sustainability and mainstreaming sustainable green practices in business administration, particularly in operations management and resource use of organizations and companies.

II. METHODS

The study used a quantitative research design utilizing a researcher-made questionnaire containing a survey and open-ended questions. Each variable or environmental hotspot is composed of two to three questions corresponding to the focus of the hotspots.

The opinion of experts in research and industry, including representatives from the government, academe, non-government organizations, civil society organizations, and the private sector, was sought to improve the research tool. The questionnaire recorded High Validity to Very High Validity in terms of the criteria for evaluating survey questionnaire set forth by Good and Scates (1972), content validity by Polit and Beck (2004; 2006), Cultural Equivalency Model for Translating and Adapting Instruments by Chávez and Canino (2005), and face validation by Johnson (2013).

To assess the reliability of the questionnaire, Cronbach's alpha coefficient was used. All four sections of the questionnaire demonstrate acceptable internal consistency, as shown by their Cronbach's alpha values (0.7469 to 0.7996). Therefore, all scales are appropriate for this study.

Table 1.
Cronbach's alpha coefficient of the questionnaire

Particulars	Cronbach Alpha Coefficient	Verbal Description
Business and Environmental Laws	0.7469	Acceptable
Seven Environmental Hotspots	0.7704	Acceptable
Environmental Awareness among Stakeholders	0.7922	Acceptable
Benefits of your Greening Practices	0.7996	Acceptable

Legend: Cronbach's alpha: values ≥ .9 are considered excellent, ≥ .8 good, ≥ .7 acceptable, ≥ .6 questionable, ≥ .5 poor, and ≤ .5 unacceptable

In deploying the research tool, the researcher sought the assistance of the Negosyo or Business Centers and respondents. The researcher used purposive sampling, wherein specific elements of the population were deliberately chosen. In this case, the criterion of

being a small manufacturer was considered. The researcher likewise noted the participant's 1) availability to participate, 2) willingness to participate, and 3) categorization consistent with the definition of small enterprise as indicated in the Philippines' Republic Act No. 9501 or the Magna Carta for MSMEs.

Based on the 2023 PSA data, the total population of registered small manufacturers in Nueva Ecija is 113 enterprises. Using the formula for sample size estimation for proportion, the study used a margin of error of 5% and arrived at 87 respondents. This translates to 77% of the total population of small manufacturers in the province.

The response of the small manufacturers was processed and analyzed through SPSS Version 26, considering the statistical tools such as frequency, percentage, mean, weighted mean, and Spearman's *rho* to assess greening practices and to determine the relationship between the profile and green business practices of small manufacturers. On the other hand, manual coding with spreadsheets was done to process open-ended questions on the benefits and challenges of adopting greening, and to describe the demographic and organizational profile of respondents.

III. RESULTS AND DISCUSSION

A. Profile of the Respondents

Out of the 113 population of small manufacturers in the study area, there were 78 respondents who answered the survey. Forty-eight are women manufacturers (61.54%), while 30 are male (38.46%). As for the form of ownership, the majority (n=57) are categorized as sole proprietorship (73.07%), 11 are cooperatives (14.10%), five are partnerships (6.41%), four are associations (5.13%), and one corporation (1.28%).

On the number of years in business, 24 are operating for three years and below (30.77%), tied with 24 manufacturers operating for four to six years (30.77%), followed by 19 manufacturers operating for seven to nine years (24.36%), and 11 manufacturers operating for ten years and above (14.10%). Most or 60 of the respondents have 10-39 employees (76.92%), 16 manufacturers with 40-69 employees (20.51%), and two manufacturers with 70-99 employees (2.56%). In addition, the respondents' asset size falls under the small enterprise categorization of the Philippines' Republic Act. No. 9501 or the Magna Carta for MSMEs, at PhP 3,000,001 to PhP 15,000,000.00.

Table 2.
Basic Profile of the Respondents

Socio-Demographic Profile	Frequency (n=78)	Percentage (%)
Sex		
Male	30	38.46
Female	48	61.54
Form of Ownership		
Sole Proprietorship	57	73.07
Cooperative	11	14.10

Partnership	5	6.41
Corporation	1	1.28
Association	4	5.13
Number of Years in Business		
3 years and below	24	30.77
4 – 6 years	24	30.77
7 – 9 years	19	24.36
10 years and above	11	14.10
Number of Employees		
10-39	60	76.92
40-69	16	20.51
70-99	2	2.56

Most or 19 of the respondents are manufacturing handicrafts (24.36%), followed by 14 manufacturers of chips, nuts, and crackers (17.95%), 13 manufacturers of drink beverages (16.67%), 11 manufacturers of dairy products (14.10%), and 7 manufacturers of clothing/ fashion accessories (8.97%).

Table 3.
Products of the Respondents

Products	**Frequency (n=78)**	**Percentage (%)**
Handicrafts	19	24.36
Chips, Nuts, and Crackers	14	17.95
Drink Beverages	13	16.67
Dairy	11	14.10
Clothing and Fashion Accessories	7	8.97
Fruits and vegetables	7	8.97
Bread and Pastries	5	6.41
Fish products	3	3.85
Soybean products	2	2.56
Mushroom products	2	2.56
Herbal Medicine	2	2.56
Chili oils	1	1.28
Marinated meat	1	1.28
Food coating and flavoring	1	1.28
Organic rice	1	1.28
Food bars	1	1.28

B. Green Economic Development Practices

When respondents were asked about their practices related to the environmental laws, the small manufacturers are always observing and practicing greening strategies in their operations (M=4.31). It can be inferred that small manufacturers in Nueva Ecija are generally aware of the environmental laws and are practicing greening strategies. Nonetheless, it was noted that the greening practices of some manufacturers are not always incorporated in their business documents, including in their business plans (M=4.17) and in their financial decisions (M=4.10).

In some cases, small manufacturers have documentation outlining their sustainability goals (M=4.19) and are involved in environmental certification programs (M=4.05). This poses a challenge to the continuity of their greening practices, noting that documentation and certifications also require financial resources. This is related to the result that greening practices are included in their financial decisions.

Table 4.
Business and Environmental Laws

Particulars	Mean	SD	Verbal Description
1. Our business is aware of relevant environmental laws, regulations, and frameworks.	4.44	0.52	Strongly Agree
2. Our business is compliant with relevant environmental laws, regulations, and frameworks.	4.35	0.51	Strongly Agree
3. Our business creates a culture of sustainability within their businesses.	4.37	0.54	Strongly Agree
4. Our business has a documented environmental policy or management system outlining business sustainability goals.	4.19	0.67	Agree
5. Our business incorporates environmental targets and performance metrics in their business plans.	4.17	0.54	Agree
6. Our businesses is involved in environmental certification programs.	4.05	0.74	Agree
7. Our business can impact the environment in many ways.	4.40	0.52	Strongly Agree
8. Our business owners are aware of our business's impacts to the environment.	4.37	0.54	Strongly Agree
9. Our business is involved in environmental protection or preservation.	4.22	0.57	Strongly Agree
10. Our businesses help in addressing environmental challenges.	4.33	0.57	Strongly Agree
11. Our business implements nature-friendly practices/ strategies.	4.42	0.57	Strongly Agree
12. Our business considers environmental risks into our financial decisions	4.10	0.69	Agree
13. Our business invests in nature-friendly practices/ strategies.	4.33	0.62	Strongly Agree
14. Our business considers that applying green novation in business operations is beneficial to the environment.	4.33	0.57	Strongly Agree
15. The application of technology can help businesses to better address environmental challenges.	4.36	0.56	Strongly Agree
16. Applying greennovation in business operations is beneficial to businesses.	4.36	0.60	Strongly Agree
17. The government should support businesses in implementing green economic/ greennovation practices.	4.44	0.55	Strongly Agree
OVERALL	**4.31**	**0.35**	**Strongly agree**

Legend: 4.20-5.00 Strongly Agree: Practices at all times/ always

3.40-4.19 Agree: Practices often or in some cases
2.60-3.39 Neither Agree or Disagree: Practices sometimes
1.80-2.59 Disagree: Practice rarely
1.00-1.79 Strongly Disagree: Never practices

Manufacturing enterprises in Nueva Ecija are aware and are compliant with relevant environmental laws and regulations. This is supported by the findings of Tham and Wu (2023) that environmental regulations can compel manufacturing enterprises to engage in technological innovation and achieve green development to enhance their resilience. In Nueva Ecija, manufacturing enterprises incorporate environmental targets in their performance metrics, and environmental risks are factored into their financial decisions. Nonetheless, Tham and Wu (2023) also suggest that various environmental regulations must be leveraged to accelerate enterprises' green transformation.

C. Greening Practices in the Seven Environmental Hotspots

With regards to the seven environmental hotspots, Strongly Agree means the small manufacturers practice the strategies at all times/ always, Agree means they practice often or in some cases, Neither Agree nor Disagree means they practice sometimes, Disagree means they rarely practice the strategies, and Strongly Disagree means they never practice the identified strategy.

The small manufacturers answered strongly agree, meaning they are always practicing greening strategies in all the environmental hotspots. It can be inferred from this that the respondents are aware of the importance of greening strategies in their business operations. Of the seven environmental hotspots, raw materials management recorded the highest mean score (M=4.44). This relates to the fact that the manufacturers are using raw materials in their products. On the other hand, natural resources management about the overall environment recorded the lowest mean score (M=4.24).

It is noted in literature that effective management of natural resources assists businesses in mitigating risks that are associated with resource scarcity, environmental regulations, and stakeholder expectations. Entrepreneurship strategies have the potential to play a vital role in the management of natural resources (Regmi et al., 2023), for energy enhancement that could directly promote climate change mitigation and sustainable development (Tavarov et al., 2023), and waste management, which mediates the effect of environmental accounting strategy on sustainability performance (Latifah & Soewarno, 2023).

Small manufacturers in Nueva Ecija report consistently practicing greening strategies related to natural resources management (M=4.24). The businesses strongly agree that their products and services enhance the quality of life while supporting a healthy ecosystem, and they recognize the sensitivity of their operations to the natural resources and the environment. This aligns with literature indicating that effective natural resources management helps mitigate risks arising from resource scarcity, environmental regulations, and stakeholder expectations (Regmi et al., 2023). Complementing this, Adu et al (2023), in their study of 252 SME owners, highlight the crucial role of owners in identifying barriers to green practices, which facilitates carbon

footprint reduction. Such proactive leadership enables firms to adopt energy-efficient production methods, resulting in lower energy costs and improved profitability.

On wastewater management, the respondents strongly agree or are always practicing greening strategies (M=4.42). By and large, the small manufacturers strongly agree that they track and manage the use of water and wastewater, and that businesses should have a proper wastewater management system. Singh et al. (2023) emphasized that the handling of industrial wastewater is critical due to its impacts on the environment and public health. While there are impediments such as inadequate infrastructure, researchers highlight the need to leverage emerging technologies, process optimization, and efficient treatment methodologies (Singh et al., 2023) to avoid impacts on the environment and the public.

On energy efficiency, the respondents strongly agree or are always practicing greening strategies (M= 4.29). For the most part, small manufacturers are energy efficient. They strongly agree and are practicing tracking and managing their energy consumption, and when they are upgrading their businesses' equipment, they choose the most energy-efficient option available in the market. This orientation of manufacturers is advantageous, noting that scholars found that energy efficiency among businesses is positively related to increased identification of green barriers, green planning, green networking, and the selection of innovation practices they implement (Adu et al., 2023).

On solid and toxic waste management, the respondents strongly agree or are always practicing greening strategies (M= 4.34). Generally, the small manufacturers relayed strong agreement in the avoidance of using hazardous materials, using environmentally friendly packaging materials, and in observing the 3Rs (reduce, recycle, reuse). While the respondents practice waste management strategies, they should also invest in adopting and developing novel technologies for managing waste to further advance eco-efficiency (Derhab & Elkhwesky, 2022).

On transport management, the respondents strongly agree or are always practicing greening strategies (M=4.35). Small manufacturers also strongly agree or are ensuring efficiency and cost effectiveness in the delivery of their products, and that they optimize their delivery routes to reduce their fuel usage. Aside from optimizing delivery routes, Mulchandani et al. (2023) highlight that the digitalization of trade is crucial, particularly to reduce transportation costs and increase competitiveness among MSMEs.

On local supplies management, the respondents strongly agree or are always practicing greening strategies (M= 4.35). The respondents strongly agree that they source their raw materials locally or within their immediate community. The respondents likewise source their supplies from eco-conscious suppliers. Researchers found that sustainable supply chain management, including green manufacturing and reverse logistics, positively affects or increases the environmental performance of businesses (Mugoni et al., 2024).

On raw materials management, the respondents strongly agree or are always practicing greening strategies (M=4.44). In general, the small manufacturers strongly agree that they manage their raw materials efficiently, and their businesses track and maintain an inventory of the raw materials they use. In relation to this, it should be noted

that raw materials criticality as an entrepreneurship strategy allows the identification of a potential supply disruption and the vulnerability of a system to the disruption (Schrijvers et al., 2020). This, in turn, is helpful to avoid wastage of raw materials and other resources.

The table presents the processed responses of small manufacturers in Nueva Ecija in terms of their greening practices in the seven greening hotspots, including the management of natural resources, wastewater, energy efficiency, solid and toxic waste, transport, local supplies, and raw materials.

Table 5.

Practices of Small Manufacturers in Relation to the Environmental Hotspots

Particulars	**Mean**	**SD**	**Verbal Description** (Practices at all times)
NATURAL RESOURCES MANAGEMENT			
1. Our business is sensitive to the natural resources/ environment.	4.09	0.63	Agree
2. Our products and services enhance the quality of life while supporting a healthy ecosystem.	4.38	0.56	Strongly Agree
Overall Mean	***4.24***	***0.50***	***Strongly Agree***
WASTE WATER MANAGEMENT			
1. Our business tracks and manages our use of resources, including water and wastewater.	4.35	0.53	Strongly Agree
2. Business should have proper waste water management.	4.49	0.53	Strongly Agree
Overall Mean	***4.42***	***0.44***	***Strongly Agree***
ENERGY EFFICIENCY MANEGEMENT			
1. Our business tracks and manages our use of resources including energy or electricity.	4.26	0.55	Strongly Agree
2. Our business operation is energy efficient.	4.24	0.56	Strongly Agree
3. Whenever necessary, our business upgrades our equipment choosing the most energy-efficient option.	4.37	0.51	Strongly Agree
Overall Mean	***4.29***	***0.40***	***Strongly Agree***
SOLID AND TOXIC WASTE MANAGEMENT			
1. Our business avoids using hazardous materials in our products or operations.	4.38	0.52	Strongly Agree
2. Our business uses environmentally friendly packaging materials.	4.31	0.54	Strongly Agree
3. Our business observes the 3Rs (reduce, reuse, recycle).	4.33	0.53	Strongly Agree
Overall Mean	***4.34***	***0.44***	***Strongly Agree***
TRANSPORT MANAGEMENT			
1. Our business plans and executes well the delivery of products to ensure efficiency and cost-effectiveness.	4.36	0.48	Strongly Agree
2. Our business optimizes our delivery routes to reduce fuel usage.	4.33	0.60	Strongly Agree

Overall Mean	***4.35***	***0.50***	***Strongly Agree***
LOCAL SUPPLIES MANAGEMENT			
1. As much as possible, our business locally sources our raw materials.	4.35	0.53	Strongly Agree
2. Our business sources our supplies from eco-conscious suppliers.	4.35	0.62	Strongly Agree
Overall Mean	***4.35***	***0.49***	***Strongly Agree***
RAW MATERIALS MANAGEMENT			
1. Our business manages our raw materials efficiently.	4.56	0.62	Strongly Agree
2. Our business tracks and maintains an inventory of our raw materials.	4.50	0.58	Strongly Agree
Overall Mean	***4.44***	***0.55***	***Strongly Agree***

Legend: 4.20-5.00 Strongly Agree: Practices at all times/ always
3.40-4.19 Agree: Practices often or in some cases
2.60-3.39 Neither Agree or Disagree: Practices sometimes
1.80-2.59 Disagree: Practice rarely
1.00-1.79 Strongly Disagree: Never practices

D. Environmental Awareness among Stakeholders

In general, the respondents answered that their stakeholders are aware of their greening practices. This is beneficial in the replication of sustainability initiatives across the value chain in that these manufacturers are involved. The small manufacturers strongly agree or are always ensuring that their stakeholders are aware of their sustainability initiatives (M=4.25). Nonetheless, it was noted that small manufacturers are not always conducting training sessions (M=4.12). In addition, greening practices are not always incorporated in their marketing and advertising campaigns (M=4.19).

It may be understood that the cited activities require additional financial resources, which may not be included in the financial plans or decisions of the respondents. This leads to the importance of environmental leadership with firm performance, namely, environmental performance and financial performance (Su et al., 2020).

Table 6.
Environmental Awareness Among Stakeholders

	Particulars	**Mean**	**SD**	**Verbal Description** (Practices at all times)
1.	Our business communicates our environmental commitment to our stakeholders.	4.37	0.62	Strongly Agree
2.	Our business documents our environmental best practices for sharing to other businesses.	4.23	0.60	Strongly Agree
3.	Our employees are engaged in our business's nature-friendly initiatives/ strategies.	4.23	0.60	Strongly Agree

4.	Our business encourages other business owners to adopt nature-friendly practices.	4.33	0.70	Strongly Agree
5.	Our business regularly conducts training or information sharing on environmental awareness and best practices.	4.12	0.68	Agree
6.	Our marketing and advertising incorporate environmental awareness.	4.19	0.60	Agree
	OVERALL	**4.25**	**0.48**	**Strongly Agree**

Legend: 4.20-5.00 Strongly Agree: Practices at all times/ always
3.40-4.19 Agree: Practices often or in some cases
2.60-3.39 Neither Agree or Disagree: Practices sometimes
1.80-2.59 Disagree: Practice rarely
1.00-1.79 Strongly Disagree: Never practices

While green upskilling is not always conducted, it is noted that sustainable business conduct requires green training programs to enhance employees' environmental awareness (Barakat et al., 2023). The conduct of such training improves sustainable business advantage. As highlighted by Barakat et al. (2023), allocating resources towards eco-friendly training initiatives creates a sustainable competitive edge among businesses. In particular, investments in energy efficiency result in financial returns, risk reduction, regulatory compliance, improved brand image, and competitive advantages (Cara et al., 2025).

E. Benefits of Greening Practices

In general, the respondents strongly agree that there are benefits derived from their greening initiatives. Of the identified benefits, ensuring compliance with government laws and regulations recorded the highest mean (M=4.55). This was followed by the benefits of boosting employee morale (M=4.53), improving brand image and company reputation (both M=4.46), improving employee/ customer health (M=4.41), and attracting more customers (M=4.40). The respondents generally consider the environmental laws, the health of their stakeholders, and the image of the company and its products. Other benefits identified by the respondents include ensuring that there is a clean and healthy environment and encouraging others to adopt or implement greening practices in their operations.

Table 7.

Benefits of Greening Practices

	Particulars	**Mean**	**SD**	**Verbal Description** (Practices at all times)
1.	Attracts more customers	4.40	0.57	Strongly Agree
2.	Increases competitive advantage	4.35	0.55	Strongly Agree
3.	Improves brand image	4.46	0.50	Strongly Agree
4.	Improves company reputation	4.46	0.50	Strongly Agree
5.	Cost savings	4.36	0.56	Strongly Agree
6.	Boosts company productivity	4.35	0.53	Strongly Agree

7.	Boosts employee morale	4.53	0.50	Strongly Agree
8.	Improves employee/ customer health	4.41	0.50	Strongly Agree
9.	Ensures compliance to government laws and regulations	4.55	0.50	Strongly Agree
	OVERALL	**4.43**	**0.39**	**Strongly Agree**

Legend: 4.20-5.00 Strongly Agree: Practices at all times/ always
3.40-4.19 Agree: Practices often or in some cases
2.60-3.39 Neither Agree or Disagree: Practices sometimes
1.80-2.59 Disagree: Practice rarely
1.00-1.79 Strongly Disagree: Never practices

Various literature supports the endless opportunities for adopting green practices among MSMEs. Omowole et al. (2024) highlight that green practices reduce the environmental footprints of businesses while enhancing their operational efficiency and competitiveness. Other long-term benefits include cost savings, improved market positioning, and compliance with evolving regulatory demands, among others (Omowole et al., 2024), including financial returns, risk reduction, and improved brand image (Cara et al., 2025). The importance of green practices is also vital for developing satisfaction and different customer behaviors such as loyalty, word-of-mouth, and willingness to pay more (Gonzalez-Viralta et al., 2023).

F. Challenges in Adopting or Implementing Greening Practices

As to the challenges noted, the lack of budget or additional financial resources was considered the top challenge in adopting and/ or implementing greening practices, with 19 respondents (24.36%), followed by awareness with 14 respondents (17.95%).

It was noted earlier that the respondents do not always conduct training or information sharing. Lastly, the respondents relayed the challenge of implementation, with 7 small manufacturers or 8.97 percent of the respondents. Awareness and implementation are notably related to the main challenge of a lack of budget or financial resources that hinders the small manufacturers in Nueva Ecija from fully implementing greening practices beyond compliance with existing environmental laws and regulations in the country. These concerns are backed by Omowole et al. (2024), noting that resource constraints and limited access to sustainable technologies remain significant obstacles among MSMEs.

Table 8.
Challenges in Adopting or Implementing Greening Practices

Particulars	Frequency (n=78)	Percentage (%)
Awareness	14	17.95
Implementation	7	8.97
Lack of Budget	19	24.36
Garbage collectors	2	2.56
Misconception	3	3.85
Waste Management	2	2.56
Others	5	6.41

G. Support Needed in Adopting or Implementing Greening Practices

The role of government and regulatory framework is crucial in supporting MSMEs' transition to green practices (Omowole et al., 2024). The researchers underscore the importance of policy support, financial incentives, and collaborative networks, particularly in facilitating the transition toward greener operations.

Noting the challenges of small manufacturers in Nueva Ecija, seminars and training sessions ranked highest in the support needed to increase awareness of employees and other stakeholders. This recorded 29 responses at 37.18 percent. It was followed by support in terms of the provision of machinery and equipment that are necessary in the continued adoption and/or implementation of greening practices in business operations. Ranked third are additional funds and cheaper products of materials, with 6 respondents each (7.69%).

Table 9.
Support Needed in Adopting or Implementing Greening Practices

Particulars	Frequency (n=78)	Percentage (%)
Seminars and Training	29	37.18
Cheaper Products of Materials	6	7.69
Additional Funds	6	7.69
Machinery and Equipment	7	8.97
Implementation	4	5.13
Support of Government	5	6.41
Encouragement	2	2.56
Capacity Building	2	2.56
Others	5	6.41

H. Relationship between the Profile and Greening Practices

The analysis revealed that only Business and Environment Laws (Cramer's V = 0.786, p = 0.000) exhibited a strong and statistically significant association with the sex of the owner. This indicates that perceptions of business and environmental regulations differ by sex, with female owners demonstrating comparatively higher levels of awareness and agreement. All other variables produced p-values greater than 0.05, signifying no statistically significant relationship with sex.

In terms of ownership type, significant associations were observed for Business and Environment Laws, Wastewater Management, Energy Efficiency, and the Benefits of Greening Practices. These results suggest that ownership structure influences respondents' environmental perceptions, with sole proprietors reporting higher levels of agreement across these dimensions. No other variables showed significant relationships with ownership type.

Spearman's rho analysis further indicated that years in business had a statistically significant relationship with perceptions of Business and Environment Laws, Wastewater Management, Energy Efficiency, and the Benefits of Greening Practices. This suggests

that the length of business operation shapes environmental perceptions, wherein firms with fewer years of operation tend to exhibit lower levels of awareness and engagement in greening initiatives.

Lastly, the number of employees showed significant associations with perceptions related to Business and Environment Laws, Natural Resources Management, Solid and Toxic Waste Management, and Transport Management. Manufacturers with larger workforces tended to report higher levels of perception in these domains. All remaining variables demonstrated no significant relationship with firm size.

Table 10 presents the correlation of the demographic profile of small manufacturers namely the sex of the owner, type of ownership, years in business, and number of employees and their green business practices.

Table 10.
Correlation of Profile and Green Business Practices of Small Manufacturers

Particulars	Value	P-value	Interpretation
SEX OF OWNER			
Business and the Environment Laws	0.786	0.000*	Significant
Natural Resource Management	0.299	0.137	Not Significant
Waste Water Management	0.279	0.194	Not Significant
Energy Efficiency Management	0.290	0.362	Not Significant
Solid and Toxic Waste Management	0.345	0.159	Not Significant
Transport Management	0.247	0.191	Not Significant
Local Supplies Management	0.114	0.907	Not Significant
Raw Materials	0.174	0.670	Not Significant
Environmental Awareness among Stakeholders	0.324	0.697	Not Significant
Benefits of Greening Practices	0.325	0.690	Not Significant
TYPE OF OWNERSHIP			
Business and the Environment Laws	0.706	0.000*	Significant
Natural Resource Management	0.216	0.556	Not Significant
Waste Water Management	0.351	0.001*	Significant
Energy Efficiency Management	0.371	0.010*	Significant
Solid and Toxic Waste Management	0.266	0.573	Not Significant
Transport Management	0.195	0.715	Not Significant
Local Supplies Management	0.287	0.057	Not Significant
Raw Materials	0.214	0.581	Not Significant
Environmental Awareness among Stakeholders	0.391	0.233	Not Significant
Benefits of Greening Practices	0.504	0.001*	Significant
YEARS IN BUSINESS			
Business and the Environment Laws	-0.163	0.154	Significant
Natural Resource Management	-0.024	0.838	Not Significant
Waste Water Management	-0.192	0.092	Significant
Energy Efficiency Management	-0.099	0.389	Significant
Solid and Toxic Waste Management	-0.038	0.740	Not Significant

Transport Management	0.035	0.763	Not Significant
Local Supplies Management	-0.198	0.082	Not Significant
Raw Materials	-0.067	0.658	Not Significant
Environmental Awareness among Stakeholders	-0.201	0.078	Not Significant
Benefits of Greening Practices	-0.051	0.658	Significant
NUMBER OF EMPLOYEES			
Business and the Environment Laws	0.777	0.000*	Significant
Natural Resource Management	0.376	0.005*	Significant
Waste Water Management	0.190	0.689	Not Significant
Energy Efficiency Management	0.171	0.971	Not Significant
Solid and Toxic Waste Management	0.419	0.007*	Significant
Transport Management	0.321	0.014*	Significant
Local Supplies Management	0.170	0.811	Not Significant
Raw Materials	0.146	0.912	Not Significant
Environmental Awareness among Stakeholders	0.334	0.742	Not Significant
Benefits of Greening Practices	0.390	0.363	Not Significant

IV. CONCLUSION AND RECOMMENDATIONS

The study found that small manufacturers in Nueva Ecija, Philippines, are generally practicing greening initiatives in their business operations. In particular, small manufacturers displayed consistency in their sustainable practices across the seven environmental hotspots, including natural resources management, energy efficiency management, solid and toxic waste management, transport management, local supplies management, and raw materials management.

The motivations underlying the adoption of greening practices among businesses are anchored in the principles of corporate environmental responsibility and sustainable development. These practices are recognized as instrumental in ensuring compliance with relevant environmental laws and regulations, protecting stakeholder health, and enhancing corporate reputation, brand equity, and competitive advantage. Nevertheless, small manufacturers encounter significant barriers to the adoption and implementation of these practices, including constrained financial resources, limited employee awareness, and inadequate organizational mechanisms for effective execution.

In understanding the intricacies of implementing greening practices among businesses, the government would be able to determine appropriate support initiatives. Noting the challenges of small manufacturers, support may be extended by the Department of Trade and Industry-Nueva Ecija (DTI-NE) or the Nueva Ecija- MSME Development Council in terms of the following:

a) The Nueva Ecija MSME Development Council may consider developing and implementing capacity-building modules that emphasize the enhancement of awareness regarding greening practices, as well as strategies that enable businesses to adopt more environmentally responsive and sustainable operational frameworks. Further, the Council members may institutionalize greening awareness by integrating relevant concepts into their ongoing programs and initiatives. These measures are expected to strengthen the knowledge base and

deepen the understanding of small manufacturers and their stakeholders concerning the long-term benefits of greening and the promotion of sustainable economic development.

b) DTI-Nueva Ecija may consider embedding within its strategic directions the pursuit of additional funding or the development of alternative financing facilities (i.e., loans or grants) in coordination with relevant government agencies such as the Small Business Corporation to facilitate the manufacturing sector's transition toward sustainable operational practices. This provision of such financial support is critical in ensuring the systematic integration of greening initiatives into business planning processes, performance measurement, and financial decision-making. These interventions contribute to the long-term continuity and institutionalization of environmentally sustainable practices within the sector.

c) DTI-Nueva Ecija may facilitate access to advanced and innovative tools essential for fostering sustainability. The availability of appropriate machinery and equipment enables businesses to adopt greener technologies, improve operational efficiency, and reduce their ecological footprints. These support transition toward sustainable production systems and strengthen the overall capacity of small manufacturers for innovation and long-term environmental stewardship.

V. DISCLOSURE STATEMENT

The authors declare no conflicts of interest regarding the publication of this paper.

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