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ASSESSING THE ENVIRONMENTAL, SOCIAL AND ECONOMIC DIMENSIONS OF THE CONSTRUCTION INDUSTRY IN SAMAR TOWARDS BUILDING A SUSTAINABLE FUTURE

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ABSTRACT

The construction industry is a major contributor to environmental degradation, necessitating a review to inform stakeholders on the impact of road construction in the First District of Samar. This study evaluated the effects of road construction on sustainability across economic, environmental, social, and technological dimensions. Using frequency counts, percentages, One Way ANOVA, and Pearson correlation, it analyzed the profiles and projects had sufficient funding (₱16-20 million). In addition, 33.33% of the owners have 11 or more years of experience. The responses of the construction owners and government representatives showed high alignment in environmental concerns. However, the views of the construction owners on sustainability were consistent regardless of their profiles. Recommendations include implementing sustainable supply chain management and adopting comprehensive equipment sustainability practices to enhance the industry's overall sustainability.

KEYWORDS: Road Construction, Sustainability, Economic Impact, Environmental Impact, Social Impact

INTRODUCTION

As the global population exceeds 8 billion and continues to grow, the demand for resources has intensified, leading to significant environmental challenges such as resource depletion, pollution, and species extinction (United Nations, 2023; Bansard & Schröder, 2021). Addressing these issues requires the adoption of sustainable practices, as defined by the United Nations Brundtland Report (1987), which emphasizes meeting present needs without compromising future generations. The construction industry plays a crucial role in economic and social development but is also a major contributor to environmental degradation, and is responsible for substantial waste, resource consumption, and pollution (Hussain et al., 2022; Paz et al., 2020). Sustainable construction practices, such as using recycled materials and renewable energy, can mitigate these impacts and improve efficiency (Cubukcuoglu, 2022). However, implementing these practices involves additional costs and planning complexities, necessitating solutions that balance environmental and economic benefits (Mavi et al., 2021).

The research is anchored on the conceptual framework that showed sustainable practices in the construction industry in the First District of Samar, considering economic, technological, social, and environmental dimensions. It suggests sustainable supply chain management and comprehensive equipment sustainability as inputs for sustainable future business.

This study examines the impact of road construction on sustainability in the First District of Samar, with the following research objectives: 1) Identify the status of construction firms using the variables: number of projects; number of reconstruction request; cost of construction and quality of projects; 2) Determine the sustainability of the construction companies in the First district of Samar; 3) Evaluate the level of assessment of the respondents on the impact of the construction industry on the following factors: Social; Economic; Environmental; Technological aspects of construction industry; 4) . Identify the significant relationship on the assessment of the stakeholders on the impact of road construction on the following dimension of sustainability: Economic, Technological, Environmental and social; 5) Ascertain differences on the assessment of the stakeholders on the impact of road construction in the First District of Samar in terms of the following dimensions: Economic and Technological, Social, and Environmental when grouped according to their personal variables; and 6) Be able to suggest inputs to build sustainable future for the construction industry.

Theoretical Framework

The study's theoretical framework is based on the Sustainable Development Goals (SDGs), particularly Goals 8, 11, and 12, as delineated in the UN Report (2023). Goal 8 focuses on equitable remuneration, secure labor conditions, and skill development to ensure productive employment and sustainable economic growth.

Goal 11 aims to create sustainable, inclusive, safe, and resilient urban areas, addressing global urbanization and ensuring accessibility and affordability.

Goal 12 emphasizes responsible production and consumption, advocating for resource efficiency and waste reduction through circular economy principles. The construction sector can achieve these goals by prioritizing worker safety, equitable pay, skill development, green building designs, and resilient infrastructure, thereby promoting social progress, economic growth, and environmental sustainability.

Economic Sustainability

People widely recognize improved road networks as catalysts for economic development. Studies such as those by Ruacorp.com (2023) and Villata (2023) emphasized the importance of road infrastructure in enhancing connectivity and fostering economic growth. However, significant financial commitments were required, as highlighted by Fernando et al. (2022), who also noted challenges like project delays and taxation issues. Dimaculangan (2023) pointed out that while the construction sector significantly contributed to economic growth, it also posed environmental risks due to excessive resource consumption. Castillo et al. (2021) discussed how road expansion can alleviate traffic but lead to economic losses due to delays in relocating utilities. Sackley et al. (2023) linked road infrastructure sustainability to reduced life-cycle costs, improved energy efficiency, and the creation of green jobs, all of which contributed to local economic development.

Social Sustainability

The social impacts of road infrastructure were less frequently addressed in the literature compared to economic and environmental aspects. However, Zhao & Ke et al. (2020) emphasized that sustainable road infrastructure promotes social inclusion by improving road safety, reducing traffic congestion, and enhancing accessibility. Gurmu et al. (2022) identified barriers to implementing social sustainability practices in the construction industry, while Sierra and Pellicer et al. (2017) emphasized the importance of employment opportunities, community

participation, and accessibility to a safe environment. Shooshtarian et al. (2020) and Reverte (2018) discussed how government policies in Australia and Spain, respectively, have promoted social sustainability through sustainable procurement practices.

Environmental Sustainability

The environmental dimension of road infrastructure sustainability is a significant concern, with studies such as those by Franco (2021) and Li et al. (2022) exploring the environmental impacts of construction activities. Franco (2021) focused on the challenges of promoting environmentally friendly construction practices in Metro Manila, while Li et al. (2022) highlighted the potential of 3D printing and other technologies that reduce waste and promote sustainability in the construction industry. Sierra (2022) and Nura Shehu Aliyu Yaro et al. (2023) discussed how sustainable road infrastructure can reduce greenhouse gas emissions, improve energy efficiency, and encourage the use of renewable energy sources. Oke et al. (2021) and Wijewantha (2020), who provided insights into reducing the environmental impact of road construction and maintenance, also emphasized the need for environmental assessments and the adoption of green building practices.

Sustainable Supply chain Management in Construction Industry and Comprehensive Equipment Sustainability

In the conceptual framework of the study (figure 1), it can be noted that the sustainable practices of the construction industry considering the Economic and Technological dimension, social, and environmental dimension when scrutinized will result in inputs for the sustainable future of the construction companies doing business in the First District of Samar. In this study, however, the economic, technological, environmental dimensions, and social dimension of sustainability was looked upon in terms of the impact of road constructions in the aforesaid areas as assessed by the stakeholders. Based on the results, sustainable supply chain management in construction industry and comprehensive equipment sustainability are the inputs for the construction company to maintain their sustainability.

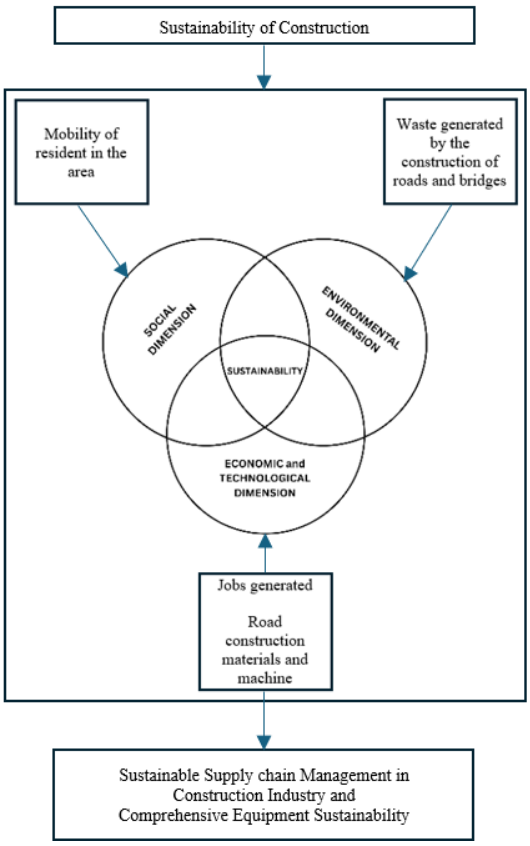

Figure 1. Conceptual Framework - Sustainability of Construction Companies

METHODOLOGY

Research Design

This study employed the Mixed Method of Research. This study employed both quantitative and qualitative methods. For the quantitative method, descriptive correlation was used, whereby it determined the relationship of two or more variables (Calmorin, 2012). The descriptive method was used in describing the construction owners of the study in terms of their variables: number of projects; number of reconstruction/repair projects; cost of construction; and quality of projects. Correlational research simultaneously examined two variables to identify patterns of relationships.

In this study, the researcher analyzed the relationship between the respondents' assessments of the impact of road construction on the economic, technological, environmental, and social dimensions of sustainability in the first district of Samar. The researcher also analyzed the variations in the respondents' responses to the various aspects of sustainability, taking into account the characteristics of the construction owners. For the qualitative part, the researcher conducted a focus group discussion with the following stakeholders: a representative from the COA, a representative from DPWH, and a sample of respondents from the road end users and barangay population.

Research Instrument

The researcher utilized a researcher-made questionnaire in determining the assessment of the respondents on the sustainability of the construction company in terms of efficiency in managing their resources and the impact of road construction on the economic, technological, environmental, and social dimensions of sustainability.

The questionnaire was developed by the researcher. Experts in the field validated it, and reliability testing yielded a Cronbach alpha of 0.95. The researcher employed the purposive sampling technique to select the study's respondents. An individual/company was chosen as part of the sample due to good evidence that he is representative of the total population (Calmorin, 2018).

The study's sample size consisted of 292 public or road users in Samar, 377 residents in the first district of Samar, and 8 government adjunct representatives from COA, DPWH, and DENR.

Statistical Treatment of Data

The frequency count and percentage were used in describing the profile of the construction owners, the Weighted Mean was used in analyzing the assessment of the respondents on the impact of road construction in the economic, environmental, technological, and social dimensions of sustainability, the One-Way analysis of variance (Kruskal Wallis), was used to establish the differences of the responses of the construction owners when group based on their profile while the Pearson r was utilized in analyzing the relationship of the responses of the different stakeholders on the impact of road construction to the economic, technological, environmental and social dimension of sustainability in the 1st district of Samar.

RESULTS AND FINDINGS

Table 1 suggests that a single construction company receives more project awards than the rest. Out of the six construction companies, one, representing 16.67 %, reconstructed 6-10 previously completed projects, while the remaining five, representing 83.33%, reconstructed 1–5 projects. This indicates that the same construction company reconstructed nearly 30% of previous projects. There were two, or 33.33%, whose project cost ranged from 21M. and over. Four projects, accounting for 66.67%, have a budget of between 16 and 20 million. Most of the project cost fell within the range of 16 million to 20 million. The project's cost indicated a sufficient budget for the projects under implementation. There were 2 or 33.33% of the owners who have been in the service for 11 years and over;

similarly, both 1 to 3 years and 7 to 10 years have 1 each respondent, or 16.67%. Most of the construction owners have been in the business for an average of 7 years. As a result, they could have already gained enough experience in implementing the projects they were awarded.

Table 1 Profile of the Construction Owners

Number of Construction Projects	Frequency	Percentage
16 and over	1	16.67
11 – 15	1	16.67
6 – 10	2	33.33
1 – 5	2	33.33
TOTAL	**6**	**100.00**
Number of Reconstruction Projects	**Frequency**	**Percentage**
16 and over	0	0
11 – 15	0	0
6 – 10	1	16.67
1 – 5	5	83.33
TOTAL	6	100.00
Project Cost	**Frequency**	**Percentage**
21 M and over	2	33.33
16 M to 20 M	4	66.67
10 M to 15 M	0	0
TOTAL	**6**	**100.00**
Length of Service	**Frequency**	**Percentage**
11 and over	2	33.33
7 – 10 years	1	16.67
4 – 6 years	2	33.33
1 – 3 years	1	16.67
TOTAL	**6**	**100.00**

The summary of the assessment of the three groups of respondents on the impact of road construction on the different dimensions of sustainability is reflected in Table 2. The table reflects that among the dimensions covered in this study, the respondents ranked the Social Dimension highest with a composite mean of 3.63, Rank 1, followed by the economic dimension (3.42, Rank 2), technological dimension, and environmental dimension, both ranked 3.5, respectively. The respondents are one in saying that road construction has a greater impact on the social dimension. This result aligns with Neri's (2024) findings, which indicate that the organization placed a higher priority on social and economic sustainability, with a moderate emphasis on environmental sustainability.

Table 2: Summary of Assessment of the Respondents on the Impact of Road Construction

Sustainability Dimension	Construction Owners (WM, VI)		Government Adjunct Representatives (WM, VI)		Road end Users / Local Residents (WM, VI)		Composite Mean	Rank
	WM	VI	WM	VI	WM	VI		
Economic Dimension	3.46	SA	3.37	SA	3.42	SA	3.42	2
Technological Dimension	3.52	SA	3.55	SA	3.21	SA	3.38	3.5
Environmental Dimension	3.50	SA	3.70	SA	3.17	SA	3.38	3.5
Social Dimension	3.52	SA	3.73	SA	3.61	SA	3.60	1

In the focus group discussion, Informant #3 mentioned that “road construction has helped sell farm products at affordable prices to neighbors and businesses in the area." While Construction Owner Informant #1 narrated that “road construction has contributed to the economy by opening avenues for businesses and reducing walking distances, thereby boosting income”.

For the social dimension, Informant #4 and Informant #2 expressed the benefits of improved roads in Samar, stating that “they now feel safer on the roads and can easily visit relatives”. Informant#1 (construction owner) also noted that roads “have made people more mobile, allowing them to explore and connect with their relatives in the upland barangay, and attend social gatherings”.

Table 3 reflects the relationship between the stakeholders’ responses on the impact of road construction on the Economic, technological, environmental, and social dimensions of sustainability. In the economic dimension, the computed r-values of.706 and 0.562 implied that there was a moderate relationship between the responses of the construction owners, government adjunct representatives, and road end users. Conversely, the computed r- value of.342 indicates a slight relationship between the responses of government adjunct representatives and road end users. Further, on the responses of the stakeholders on the technological dimension, results showed a computed r-value of 190, .037, and .060 for the construction owners and government adjunct workers, construction owners and road end users, and government adjunct representatives and road end users all have verbal interpretation of negligible relationship.

Table 3: Relationship of responses of stakeholders on the effect of road construction to the following dimension of sustainability: Economic, Technological, Environmental and Social

Sustainability Dimension	Relationship	SD	r-value	Interpretation
Economic Dimension	Construction Owners and Adjunct Representatives	0.268	0.706	Moderate Correlation
	Construction Owners and Road End Users	0.187	0.562	Moderate Correlation
	Government Adjunct Representatives and Road End Users	0.195	0.342	Slight Correlation
Technological Dimension	Construction Owners and Adjunct Representatives	0.122	0.150	Negligible Correlation
	Construction Owners and Road End Users	0.148	0.037	Negligible Correlation
	Government Adjunct Representatives and Road End Users	0.094	0.060	Negligible Correlation
Environmental Dimension	Construction Owners and Adjunct Representatives	0.206	0.917	Very High Correlation
	Construction Owners and Road End Users	0.154	0.660	Moderate Correlation
	Government Adjunct Representatives and Road End Users	0.082	0.565	Moderate Correlation
Social Dimension	Construction Owners and Adjunct Representatives	0.130	0.094	Negligible Correlation
	Construction Owners and Road End Users	0.167	0.045	Negligible Correlation
	Government Adjunct Representatives and Road End Users	0.105	0.036	Negligible Correlation

This implies that there was no correlation between these stakeholders' responses regarding the impact of road construction in the technological domain. In the environmental dimension, the relationship between the construction owners and the government adjunct representative was interpreted as highly significant, with an r value of .917. Results support the study of Neri (2024), where the author noted that a positive relationship exists between economic, environmental, and social sustainability.

The study yielded an r-value of .660 for the relationship between construction owners and road end users, and an r-value of .565 for both government adjunct representatives and road end users, indicating a moderate relationship. Finally, the stakeholders' responses in the social dimension yielded a computed r-value of .094, .045, and .036 for the relationship between construction owners and government adjunct representatives, the relationship between construction owners and road end users, and the relationship between government adjunct representatives and road end users respectively. The computed r values all indicate a negligible correlation. The results show that in the economic dimension, as the rating of construction owners increases, there is a tendency for the responses of government adjunct representatives to also increase, although not in a perfectly correlated manner.

Within the economic realm, both groups share similar viewpoints or evaluations of the economic aspects of the construction of road projects. Furthermore, the results regarding the technological impact of road construction indicate that the perspectives of construction owners and government representatives regarding the influence of technology on road construction matters are largely distinct from each other. This suggests that the opinions of construction owners and road end users on technological issues are independent of each other, and alterations in one group's reactions do not forecast alterations in the other group's reactions. As one group's reactions increase, the responses of the other group also increase in close correlation.

The environmental component of road construction implies that both construction owners and government adjunct representatives share closely aligned viewpoints or evaluations regarding the environmental aspects of road projects. The significant level of agreement demonstrates a robust consensus and shared priorities addressing environmental issues. Further, on the government adjunct representatives and the road end users, it is noted that there was an observable inclination for the responses of these two groups to align, but the correlation was not as robust as that between construction owners and government adjunct representatives. This indicated that although there is substantial consensus between construction owners and road end users about environmental issues, there were still certain divergences in their viewpoints.

Regarding the social impact of road construction, we can observe that the perspectives and assessments of construction owners and government representatives on social issues related to construction projects largely differ from each other. The negligible r-value indicated that there was a negligible linear correlation between the responses of these two groups. Lastly, the proximity to zero indicated a lack of significant linear correlation between the responses of government adjunct officials and road end users on the impact of road development on social issues. This indicated that their evaluations of social elements were mostly autonomous from one another. Neri (2024) opined that giving importance to economic growth, social inclusion, and environmental preservation enhanced a company's performance and contributed to its long-term sustainability.

Table 4: Differences of Respondents assessment on the impact of road construction to Economic, Technological, Environmental and Social Dimension

Personal Variables and Dimensions	dF	X	p	c.v.	Interpretation
Number of construction and Impact of road construction on Economic dimension responses	3	4.50	0.198	7.81	NS
Number of construction and Impact of road construction on Technological dimension responses	4	3.96	0.291	9.48	NS
Number of construction and Impact of road construction on environmental dimension responses	4	4.96	0.285	9.48	NS
Number of construction and Impact of road construction on environmental dimension responses	4	6.00	0.199	9.48	NS
Number of reconstruction and Impact of road construction on Economic dimension	4	4.50	0.212	5.99	NS
Number of reconstruction and Impact of road construction on Technological dimension	1	6.00	0.197	3.84	NS
Number of reconstruction and Impact of road construction on Environmental dimension	1	0.0909	0.763	3.84	NS
Number of reconstruction and Impact of road construction on social dimension	2	0.364	0.516	5.99	NS
Cost of project and Impact of road construction on Economic dimension	2	2.51	0.284	5.99	NS
Cost of project and Impact of road construction on Technological dimension	2	3.00	0.223	5.99	NS
Cost of project and Impact of road construction on environmental dimension	1	1.25	0.046	3.84	NS
Cost of project and Impact of road construction on social dimension	3	5.00	0.172	7.81	NS

Table 4 displays the differences in respondents' assessments regarding the impact of road construction on economic, technological, environmental, and social dimensions, as well as their variables and dimensions. The differences in the respondent's assessment of the impact of road construction on the different dimensions of sustainability and the personal variables of the construction owners are shown in Table 4.

As reflected in the table, all p values were greater than.01, thus the null hypothesis, which stated that there were no differences in the responses of the stakeholders on the impact of road construction on the dimensions, economic, technological, environmental, and social dimension when grouped into the profile of the construction owners is accepted. This implies that the respondents: the construction owners, government adjunct representatives, and road end users do not differ in their responses when grouped using the profile of construction owners. It was implied by this that there weren't any significant differences in the opinions of the stakeholders regarding these aspects, or that they are typically in agreement. It means that there was a shared agreement or consistency in how they view the effects of road-building projects, which can be advantageous for working together on planning and making decisions. Accepting the null hypothesis does not imply perfect agreement but rather indicates that any discrepancies seen were not statistically significant. Neri (2024) opined that giving importance to economic growth, social inclusion, and environmental preservation enhanced a company's performance and contributes to its long-term sustainability.

DISCUSSION

Upon examining the profile of the construction company, the study revealed that a single company received more project awards than the others, with 16.67% reconstructing 6-10 projects and 83.33% reconstructing 1-5 projects. Most of projects cost between 16M and 20M, indicating a sufficient budget for implementation. The majority of construction owners have been in the business for an average of 7 years, indicating they have gained experience in implementing projects assigned to them.

Neri's (2024) research, which prioritizes social and economic sustainability, aligns with the study's findings that road construction has a greater impact on the economic and social dimensions, while environmental sustainability receives moderate importance. Road construction in Samar has improved the economy by opening avenues for businesses, reducing walking distances, and boosting income. These findings concur with the results of Dimaculangan, E. (2023) when he noted that as of 2022, the Build! Build! Build! (BBB) initiative contributed to the 9.2% annual growth rate in the Philippines' construction industry. Road construction also made people feel safer, allowing them to visit relatives and attend social gatherings. Informant #3, construction owner, and others also noted its social benefits. Furthermore, the study found that while construction owners and road end users generally agree on environmental issues, they have divergent viewpoints on social matters related to road construction. Construction owners and government representatives' responses to social issues are independent of each other, meaning changes in one group's opinion do not predict changes in the other group's opinion. Similarly, government representatives and road end users also have independent evaluations of the impact of road development on social issues. Results concur with that of Neri 2023) where he noted that the importance of maintaining a delicate equilibrium between social inclusion, ensure long-term sustainability.

The study found that there were no significant differences in the responses of construction owners, government representatives, and road users when grouped based on their profiles as construction owners. This suggests that there is a shared agreement or consistency in their opinions regarding the effects of road-building projects. However, it is important to note that accepting the null hypothesis does not mean there is perfect

agreement, but rather that any differences observed were not statistically significant. Neri (2024) opined that giving importance to economic growth, social inclusion, and environmental preservation enhances a company's performance and contribute to its long-term sustainability.

CONCLUSION

The study determined the profile of the construction owners who are engaged in road construction in the first district of Samar. The study also pinpointed the sustainability of the construction company in terms of handling their materials and equipment; it analyzed the evaluations of various stakeholders, including the construction owners themselves, the government representative, the residents, and the road end users, and compared them based on their personal characteristics. Construction owners in Samar have extensive expertise and manage multiple projects, with a focus on reconstruction. The average expenditure for each project is around 15 million pesos. These owners have an average of seven years of experience in the construction sector, demonstrating skill and dedication. They use their experience and knowledge of road construction to complete projects to the satisfaction of constituents in Samar District 1. The construction owners are able to maintain the sustainability of their materials and equipment, completing projects within budget and displaying good financial management. This demonstrates that achieving social sustainability does not require financial compromise. The positive impacts of road construction align with the United Nations Sustainable Development Goals (SDGs), particularly SDG 9: Industry, Innovation, and Infrastructure. Stakeholder assessments of road construction projects reveal a strong to moderate relationship in the environmental dimension, a moderate to slight relationship in the economic dimension, and a negligible relationship in the technological and social dimensions. This complexity highlights the need for comprehensive impact studies to address stakeholder concerns. The construction company's profile does not have a significant impact on stakeholder assessments. Consistent social, environmental, and economic practices are important for fostering sustainability and aligning with the principles of people, planet, and profit. Construction firms support the UN SDGs and balance the three P's.

Construction owners can use this study to enhance their positive influence on the environmental and social dimensions of sustainability as an impact of road construction, while also refining their economic and environmental practices. The local government leaders may also take a look at the results in order to align their practices in terms of road construction. This research has demonstrated that aligning the practices of the construction company in the First District of Samar with sustainability dimensions can serve as a solid foundation for their continued business success.

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