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AN EVALUATION OF ENVIRONMENTAL IMPACTS OF REAL ESTATE PROJECTS

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ABSTRACT
The negative environmental implications of real estate projects are one of the industry's largest challenges. During construction, environmental consequences occur. Many threats to the ecosystem are human- made, such as the ones occurring due to construction projects. That's why this study's purpose is to determine the country's biggest environmental impacts. An examination of the literature discovered 28 environmental consequences of real estate construction which are subdivided into three fundamental types of repercussions was cross-sectional surveyed. A total of 48 building specialists were picked at random for questioning. Based on these experts response, the most serious environmental concerns were ranked. The relative importance index was used for ranking the discovered impacts (RII).The study concluded that real estate projects causes dust, social disruption, noise pollution, and energy usage. Construction workers were more prone to lung and organ cancer, hypertension, irritability, and insomnia, as well as other heart-related concerns. Some of the remedial measures to overcome these issues might include requiring institutions to complete environmental impact assessments (EIA). Results of the study can assist decision-makers in identifying significant environmental implications of construction and developing environmentally friendly building plans early on.

KEYWORDS: ***Environment, Construction, Ecosystem, Pollution, Public Impact***

1. INTRODUCTION

Environmental protection is a significant concern in both developed and developing nations (Estate et al. 2001). Construction emits more pollutants than any other business (Shen et al. 2005). Construction is not an inherently environmentally friendly activity (X. Li, Zhu, and Zhang 2010). The construction and operation of structures have a significant influence on the environment, both directly and indirectly (Shen et al. 2005). According to published study (X. Li, Zhu, and Zhang 2010), the construction industry uses a large amount of natural resources and contributes significantly to pollution. Construction pollution consists of a variety of elements, including harmful noise, gases, solid, liquid, and dust waste. These contaminants are referred to by some authors as "water pollutants," "air pollutants," "liquid and solid waste," "noise," "dust," and "harmful gases" (Morledge 2021), (Ball 2002), (Chen, Li, and Hong 2004), (Lam et al. 2011), (Nourbakhsh et al. 2012). Construction projects have a huge impact on the environment, the economy, and society (Chang, Ries, and Wang 2011). Only a small percentage of contractors and developers are concerned with the environment and recycling construction materials (Lam et al. 2011). According to Chang, Ries and Wang, 2011, contractors and developers may have acted in this manner because they placed a higher premium on speed than on environmental issues. Numerous construction workers have attempted to minimize the repercussions of their work via the use of environmental management systems (Lam et al. 2011). According to Nourbakhsh et al. 2012, this will aid in identifying the most effective environmental management methods. Regrettably, a scarcity of scientific data on the environmental implications of construction materials and technology restricts everyone from making knowledgeable decisions (Kaur and Arora 2012).

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1.1 Impact of Real Estate Construction Activities on Environment

The identification of important environmental concerns will aid in the consideration of a variety of on-site mitigation methods. Across construction operations, environmental impacts include ecosystems, natural resources, and public impact (X. Li, Zhu, and Zhang 2010).

1.1.1 Ecosystem impact

People and ecosystems are harmed as a result of the cumulative effects of environmental damage (Chen, Li, and Hong 2004). Due to the large number of development projects now underway, environmental impact has become a serious and worrisome concern (Nourbakhsh et al. 2012). In addition to causing environmental harm, these activities may also contribute to air pollution, noise, dust, foul odors, and land use change. Solid waste, toxic production, pollution of the air, water, and land are all examples of negative environmental consequences. In addition to car emissions and construction-related dust, construction-related air pollution is increased (Emmanuel 2016). Sulfur dioxide, carbon dioxide, and nitrogen dioxide are just a few of the many pollutants that fall under this category (X. Li, Zhu, and Zhang 2010), (Kaur and Arora 2012), (Emmanuel 2016). Construction equipment, vehicles, and air compressors are all known sources of noise pollution in the workplace. Garbage may be found in many areas including construction sites, labour camps, sewage treatment facilities, and more. During the execution phase, biodegradable, recyclable, inert/recyclable, and hazardous solid waste is created. There would be 50% biodegradable trash, 20% recyclable waste, 30% inert waste, and 0.3 percent hazardous waste in all of the garbage that is generated (Emmanuel 2016).

1.1.2 Natural resources

In order to create a typical building, several natural resources are used (Shen et al. 2005). Several construction equipment procedures need the use of renewable energy sources like hydropower and/or heavy oil. The extraction and transportation of raw materials by the construction industry consumes a lot of natural resources and pollutes the environment considerably (X. Li, Zhu, and Zhang 2010), (Morledge 2021). The building industry has a tremendous impact on the environment across the globe. Furthermore, it explains more than half of the overall energy consumption in high-income nations, as well as the bulk of global greenhouse gas emissions in developing areas (Tam, Tam, and Tsui 2004).

1.1.3 Public impact

The vast majority of construction sites are situated in locations with a high density of human activity. People who live on or around construction sites might suffer from health issues as a result of the vibration, noise, and dust produced by building activities including pile driving and excavation(X. Li, Zhu, and Zhang 2010). Construction noise and dust are two of the most detrimental elements to worker safety and well-being when a construction project is in progress(Ijigah et al. 2013).

Based on the above issues, the following are listed as the objectives of the study:

- Identifying and categorizing the numerous environmental consequences associated with real estate development initiatives.
- To ascertain the degree of comprehension and knowledge of people directly engaged in construction operations in order to elicit the most relevant and suitable replies.

2. LITERATURE REVIEW

According to the results of a survey conducted by (Ijigah et al. 2013) of stakeholders in the Nigerian building construction business, building development activities contribute to waste and desertification. Additionally, the research recommended that the most critical strategies for building protection be waste management, pollution control, and ecological preservation. The report advises players in the building construction industry to fully embrace EIA documents and other environmental regulations in order to minimize environmental impact. Authorities should educate the public about proper environmental management practices and hold individuals who violate such practices accountable. According to (C. Z. Li, Zhao, and Xu 2019), the top three dust respirable exposure sources are cement mixing, concrete breaking, and manual demolition, while grinding and rock breaking are the two highest quartz exposure sources. Analytical data indicate that the standard respiratory protection used on construction sites is often inadequate to prevent against exposures. This study used a large dataset to identify the

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most important characteristics for forecasting dust exposure and evaluating current dust control systems. This knowledge aided in the enhancement of dust control practices. (Xing et al., 2015)conducted a research to reduce construction-related air pollution. The study investigated China's present construction dust prevention and control techniques via a mix of document analysis, on-site observation, Questionnaire surveys, and interviews with experienced experts. There were 11 regulations in all, and they were all thoroughly explained and examined, and the key causes of construction dust creation were identified. A case study was added to highlight the current approach of dust management measures on building sites. R recommendations were suggested which included specialized laws, a functional charging scheme, a functional monitoring system, and increased training and distribution initiatives.

3. RESEARCH METHODOLOGY AND DATA ANALYSIS

The research was systematic in nature, with quantifiable data acquired and analyzed using statistical, mathematical, and computational methodologies. In a summary, the study used a quantitative survey. The research methodology used for this investigation is shown in Figure 1.

The questionnaire was constructed in such a way that it yielded responses pertinent to the study's aims. The questionnaire was constructed on the basis of 28 environmental consequences of real estate development. There were 28 criteria in all, and they were divided into three categories: ecosystem, natural resources, and public impact. A five-point Likert scale was used to gauge participants' reactions, with 1 being very low, 2 being low, 3 being neutral, 4 being a strong effect, and 5 being very powerful. It was easier for the respondent when a Likert scale was used, since they had more alternatives to pick from. The technique utilized in this research was meant to analyze and rate the environmental effects of real estate project development in terms of their severity of repercussions. The relative ordering of attributes is based on the Relative Importance Index (RII). The RII is calculated using the formula shown in Eq.1

$$Relative\ Importance\ index\ (RII) = \frac{\Sigma\omega}{(A\ X\ N)} \quad \textbf{(1)}$$

Where w denotes the respondent's weighting of each factor, which ranges from 1 to 5, with 1 denoting the least strong influence and 5 denoting the most powerful impact, A is the maximum weight, which in this instance is 5, and N denotes the total number of data points. The value of the relative relevance index varies from 0 to 1. The score for each risk was calculated by adding the scores provided to it by respondents. As a result, the respondents' degree of severity was utilized to establish the relative relevance of each consequence. To calculate the rankings of various effects measured in this research, the previously described rating scale of 1 to 5 was translated to relative significance indices for each element using Eq. (1). To assess the relative ranking on the effect of developing real estate projects, all of the scores obtained for different risks were translated to relative significance indices. The investigation drew on both primary and secondary sources of data such as surveys and literature studies, as well as observational cheek lists and flows and group discussion guides. This research relied on open-ended and closed-ended survey questions, while secondary data was acquired through reviewing relevant documents. A Google form was created and sent to a large number of organizations and individuals involved in real estate developments in India. The form had questions generated from published work as well as site visits and physical observation. The questions posed in the Google form were simple to read and comprehend, and the language used in the questions was straightforward. This assists the responder in comprehending the question and determining whether it is significant or not. 48 individuals responded to the distributed Google forms.

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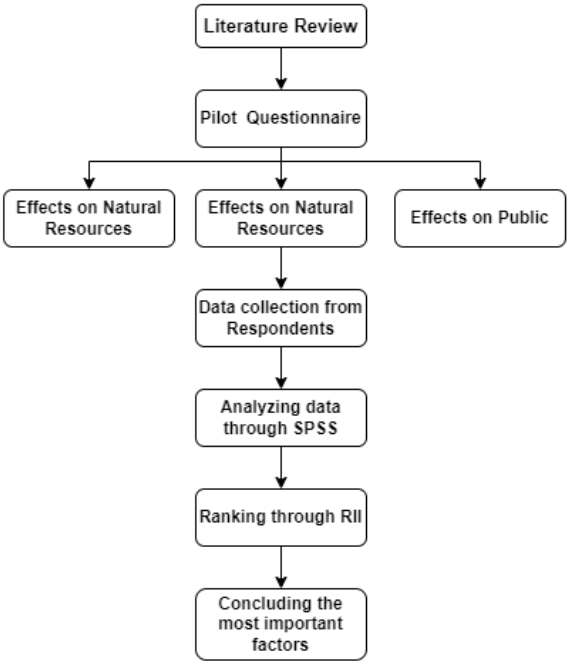

Fig 1. Research Methodology adopted in this study

Table 1. Questionnaire circulated, responses obtained and its Analysis

	Environmental Impacts	Effects in terms of severity					Total respond	Standard deviation	Weight	RII	Rank in the group	Overall Combined Rank
		5	4	3	2	1						
Effects on Eco-System	Dust generation with construction machinery.	6	15	15	7	5	48	4.454	154	0.64	11	22
	Noise Pollution	14	19	9	4	2	48	6.280	183	0.76	2	4
		8	13	18	6	3	48	5.314	161	0.67	9	
	Air pollution.	11	17	12	4	4	48	5.004	171	0.71	3	12
	Land use.	9	16	13	9	1	48	5.044	167	0.70	5	14
	Generation of inert waste	12	11	13	9	3	48	3.555	164	0.68	7	17
	Water pollution	9	10	15	8	6	48	3.007	152	0.63	12	23
	Dust generation	14	20	11	2	1	48	7.228	188	0.78	1	2
	Landscape alteration	7	12	16	7	6	48	3.826	151	0.63	13	24
	Greenhouse gas emission	7	9	14	12	6	48	3.007	143	0.60	15	27
	Climate change	5	17	11	8	7	48	4.176	149	0.62	14	26
	CO2, So2, Co emissions	6	8	15	12	7	48	3.382	138	0.58	16	28
	suspended particles	4	20	12	8	4	48	5.987	156	0.65	10	21
	Vibrations	10	16	11	8	3	48	4.224	166	0.69	6	15
	Water dumping	11	18	6	10	3	48	5.083	168	0.70	4	13
	Underground pipe failures	12	13	10	7	6	48	2.728	162	0.68	8	19

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Effects on Natural Resources	Transportation resources	9	13	18	7	1	48	5.713	166	0.69	6	15
	Use of water resources	12	20	9	6	1	48	6.344	180	0.75	3	6
	Extraction of raw materials	12	17	13	4	2	48	5.678	177	0.74	4	7
	Energy consumption	15	16	9	8	0	48	5.748	182	0.76	2	5
	Raw material Consumption	16	18	10	4	0	48	6.859	190	0.79	1	1
	Resource deterioration	10	17	14	5	2	48	5.535	172	0.72	5	10
Effects on Public	Electric consumption	11	16	13	7	1	48	5.200	173	0.72	3	9
	Site hygiene condition	13	15	13	4	3	48	5.044	175	0.73	2	8
	Public health effects	12	13	16	5	2	48	5.238	172	0.72	4	10
	Causalities	6	13	18	4	7	48	5.161	151	0.63	6	24
	Public safety	7	17	16	5	3	48	5.783	164	0.68	5	17
	Social disruption	17	14	10	6	1	48	5.678	184	0.77	1	3

The Statistical Package for Social Science 18.0 (SPSS) software was used to analyze the gathered data. Table 1, present the detailed report of questionnaire circulated and the analysis performed.

4. RESULTS AND DISCUSSIONS

The findings of the research show that construction workers and other employees are more susceptible to a number of health issues, including lung problems, liver illness, cancer, hearing loss, hypertension, irritability, insomnia, and other heart-related adverse effects. Environmental degradation is another consequence of construction activities, since these activities contaminate and pollute the environment, as well as inflict harm to property and assets and create hazardous working conditions. The utilization of raw materials was found to be the most harmful to the environment in the research. Dust generated by building operations came in second, according to the statistics. The third place was social disturbance. In the survey, noise pollution came in fourth position. Sand, gravel, clay, cement, water, aggregate, timber, iron, bitumen, aluminium, and fuels are only a few of the basic materials required for construction. As long as the real estate bubble remains, these vital resources are at danger of being depleted. As a consequence, the real estate market is in perilous shape, and resource use must be closely managed. Hazardous emissions from construction trucks, dust created by the discharge of solid and liquid wastes, volatile organic compounds, and other sources contribute to air pollution. The need of environmental preservation is plainly clear as a result of these studies.

5. RECOMMENDATIONS

As for potential measures to decrease the environmental implications of construction, "adopt the required protections to protect employees and communities living near construction sites" was put top on the list of possible solutions to reduce their environmental repercussions. Examples of this method include requiring institutions to do environmental impact assessments (EIAs) prior to the commencement of a project and promoting awareness of the environmental consequences of building. According to the findings of the study, "examine alternative possibilities" for constructing in order to counterbalance the negative environmental repercussions of construction was the most effective remedy for reducing construction's environmental impact. Due to the fact that dust seems to have the most negative influence on the environment, managers should urge contractors to use appropriate dust management technologies, such as wet systems, which utilize water sprays to prevent or confine airborne dust, in order to avoid or confine airborne dust. Vehicles leaving a construction site should have their wheels cleaned if they were transporting muck or other rubbish, in order to reduce the amount of silt that ends up on the asphalt. There must be more education provided to construction employees in regards to the environmental effects of their employment.

CONCLUSIONS

It is conceivable that the study's findings may educate project participants about the environmental

implications of construction. Additionally, the data may aid decision-makers in identifying key environmental effects and early-stage development of environmentally friendly construction practices. Professionals in architecture and construction may employ the data to develop more ecologically friendly and long-lasting structures.

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