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The Role of Civil Engineering in Sustainable Urban Development: Exploring Economic and Social Opportunities

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Abstract: *This research investigates the role of civil engineering in fostering sustainable urban development, with a focus on exploring the economic and social opportunities in Rudsar City. The primary objective of the study is to assess the impact of civil engineering projects on economic growth, quality of life, and environmental preservation in the region. The research employs a descriptive-survey method, using a 5-point Likert scale questionnaire as the primary data collection tool, distributed among 43 professionals, including civil engineers, municipal managers, and environmental authorities. Reliability was confirmed using Cronbach's alpha, with all coefficients above 0.70, and validity was ensured through expert evaluations. Descriptive statistics highlighted significant positive effects of civil engineering projects on the region's economic and social indicators. Hypothesis testing using multiple linear regression confirmed that civil engineering projects contribute significantly to economic growth, improved urban infrastructure enhances citizens' quality of life, and sustainable engineering projects positively impact environmental preservation. The findings suggest that focusing on sustainable practices in civil engineering is essential for the long-term development of Rudsar City, improving both the economy and environmental health. Practical recommendations for local authorities and policymakers include prioritizing sustainable development in infrastructure projects to ensure positive long-term outcomes.*

Keywords: *Civil Engineering, Sustainable Development, Urban Infrastructure, Environmental Preservation.*

I. Introduction

The rapid expansion of urban areas has led to significant challenges in ensuring sustainable development, particularly in growing regions like Rudsar City. With increasing population density and infrastructure demands, civil engineering plays a critical role in shaping the future of urban landscapes. While traditional construction practices focus on rapid

urbanization, recent attention has shifted toward the integration of sustainability into civil engineering projects. Sustainable urban development involves creating infrastructure that not only meets the economic and social needs of a growing population but also ensures environmental protection and long-term resource management. In Rudsar, a coastal City in Gilan Province, the balance between urban expansion and environmental conservation is particularly delicate due to the region's unique ecosystem and tourism-driven economy. The importance of this issue lies in its direct impact on both economic growth and the quality of life for residents. Infrastructure projects, such as road construction, transportation systems, and public amenities, are essential for the development of any region. However, without careful planning, these projects can lead to environmental degradation, increased pollution, and a decline in public well-being. The construction sector in Rudsar must navigate these competing priorities while contributing to regional development. This research addresses a critical gap in understanding how civil engineering projects in Rudsar can be optimized to promote both economic prosperity and environmental sustainability. There is little existing literature that examines the role of civil engineering in balancing economic growth, environmental preservation, and social well-being, especially within the specific context of Rudsar City. As such, this study seeks to fill this gap by exploring the economic, social, and environmental impacts of sustainable civil engineering projects in the region. This research is significant because it addresses the intersection of economic development, urban infrastructure, and environmental sustainability—an area of growing importance in the global conversation on sustainable development. As urbanization accelerates, finding solutions that harmonize growth with ecological balance becomes increasingly crucial. Rudsar’s reliance on its natural landscape for tourism and agriculture adds to the urgency of this research, as poorly planned infrastructure projects could threaten these economic sectors. By focusing on the local context, this study will offer practical insights into how sustainable engineering practices can be tailored to meet the unique needs of Rudsar City, ensuring that development does not come at the expense of the environment. The innovative aspect of this research lies in its comprehensive approach to civil engineering in Rudsar. Unlike previous studies that may have focused solely on the environmental or economic outcomes of development projects, this research integrates social, economic, and environmental dimensions to provide a holistic understanding of sustainable urban development. The findings from this research could inform future infrastructure policies, encourage the adoption of green engineering practices, and influence local governance and decision-making processes in Rudsar. The potential benefits of this study

extend beyond Rudsar, offering a model for other regions facing similar challenges of balancing growth with sustainability.

Research Hypotheses:

1. Hypothesis 1: Civil engineering projects in Rudsar City have a significant and positive impact on the region's economic growth.
2. Hypothesis 2: The improvement of urban infrastructure through civil engineering leads to an increase in the quality of life for Rudsar's citizens.
3. Hypothesis 3: Sustainable civil engineering projects positively impact environmental conservation and reduce pollution in Rudsar City.

Scientific Objectives:

1. To investigate the economic benefits of civil engineering projects in Rudsar City and their role in promoting regional development.
2. To assess how improvements in urban infrastructure enhance the quality of life for the local population, including access to services, transportation, and public amenities.
3. To evaluate the impact of sustainable civil engineering projects on environmental protection, including pollution reduction and resource conservation in Rudsar City.

The subject scope of this research centers on the role of civil engineering in the sustainable urban development of Rudsar City. The study focuses on three primary dimensions: economic growth, quality of life, and environmental sustainability. The temporal scope of the research is confined to the year 2023, during which data collection and analysis are conducted. The spatial scope is limited to Rudsar City in Gilan Province, Iran, an area characterized by both coastal and rural environments, which presents unique challenges and opportunities for sustainable development. The research draws on a sample of 43 individuals, including civil engineering professionals, municipal managers, and environmental authorities, to ensure a comprehensive understanding of the issues at hand.

The findings of this research will have wide-ranging applications across multiple sectors. In educational institutions, the results can inform curriculum development in civil engineering and urban planning, emphasizing the importance of sustainability in future projects. This research could help students and educators alike understand the practical implications of sustainable development principles in real-world settings. In terms of executive bodies, municipal governments and environmental agencies in Rudsar and beyond could use the findings to guide future urban planning and infrastructure development. By adopting the recommendations of this research, these bodies can ensure that future civil engineering projects

are aligned with the goals of sustainable development, contributing to economic growth while protecting the environment. This could also inform policy decisions, shaping how local governments prioritize infrastructure spending and engage with the private sector on construction projects. Finally, this research will be invaluable to civil engineering professionals working in the field, providing them with evidence-based practices for integrating sustainability into their projects. By aligning their work with both economic and environmental goals, engineers can contribute to creating resilient, sustainable urban environments that benefit current and future generations.

II. Literature review

The concept of sustainable urban development is fundamental to understanding the role of civil engineering in shaping modern cities. Sustainable development, as defined by the Brundtland Commission in 1987, refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs. In the context of civil engineering, this concept is particularly relevant because infrastructure projects often have long-term impacts on both the environment and the social fabric of communities. Civil engineering encompasses a wide range of activities, including the construction of roads, bridges, buildings, and water systems, all of which are essential for urban development. However, traditional approaches to these projects have often prioritized economic growth and urban expansion over environmental sustainability and social equity. This has led to challenges such as pollution, resource depletion, and social inequalities. Therefore, modern civil engineering practices must integrate sustainability principles to ensure that infrastructure development contributes positively to economic growth, environmental protection, and social well-being.

One of the key concepts in this area is the idea of "green engineering," which refers to the design, construction, and operation of infrastructure that minimizes environmental impact and promotes resource conservation. This involves using materials and technologies that reduce energy consumption, water usage, and waste generation, as well as designing infrastructure that can adapt to changing environmental conditions. Another important concept is the notion of "social sustainability," which focuses on how infrastructure projects affect the quality of life of citizens. This includes factors such as access to transportation, clean water, healthcare, education, and public spaces. In the context of Rudsar City, the application of these concepts is particularly important due to the region's reliance on its natural environment for both tourism and agriculture. As such, civil engineering projects in the area must balance the

need for economic development with the preservation of natural resources and the improvement of living conditions for residents.

In terms of economic sustainability, infrastructure development is seen as a critical driver of economic growth, particularly in developing regions. Well-planned infrastructure projects can boost local economies by creating jobs, improving transportation networks, and attracting investment. In Rudsar, for example, the construction of new roads, bridges, and public amenities could stimulate economic activity by making the region more accessible to tourists and investors. However, the challenge lies in ensuring that these projects are not only economically beneficial but also socially inclusive and environmentally sustainable. The role of civil engineering in promoting economic growth is well-documented, but its potential to improve quality of life and protect the environment is a relatively recent area of focus in academic literature. This study seeks to contribute to this growing body of knowledge by examining how civil engineering projects in Rudsar can be designed and implemented in ways that enhance economic growth, improve quality of life, and promote environmental sustainability.

Several studies have been conducted in Iran that explore similar themes. For instance, the research by Gholipour (2018), titled "The Impact of Sustainable Engineering on Urban Development: A Case Study of Tabriz," aimed to investigate the role of sustainable engineering practices in promoting urban development in Tabriz. The objective of the research was to assess the extent to which sustainable engineering principles were integrated into civil engineering projects and their impact on the city's economic growth and environmental quality. Using a mixed-methods approach that combined surveys of civil engineers and interviews with city officials, the study found that while there was increasing awareness of sustainability principles, their application was limited due to budgetary constraints and a lack of technical expertise. The results highlighted the need for greater investment in sustainable engineering practices to ensure that urban development in Tabriz aligns with national sustainability goals.

Another study conducted by Rezaei (2020), titled "Assessing the Social and Environmental Impacts of Urban Infrastructure Projects: A Case Study of Isfahan," sought to evaluate the social and environmental consequences of major infrastructure projects in Isfahan. The research aimed to determine whether these projects contributed to social equity and environmental conservation or exacerbated existing inequalities and environmental degradation. The study employed a quantitative approach, using data from local government reports and environmental assessments, and found that while infrastructure projects had

improved access to services and transportation, they had also led to increased pollution and the displacement of low-income communities. The findings emphasized the need for a more comprehensive approach to urban planning that considers both social and environmental factors.

A third relevant study was conducted by Ahmadi (2021), who examined the relationship between civil engineering projects and quality of life in Tehran. Titled "Urban Infrastructure and Quality of Life: An Evaluation of Civil Engineering Projects in Tehran," the research aimed to assess how infrastructure projects, such as road construction and public transport development, affected the well-being of Tehran's residents. The study used a combination of surveys and GIS data to map the distribution of infrastructure improvements and their impact on various neighborhoods. The results showed that while infrastructure development had improved transportation and access to services in some areas, it had also increased traffic congestion and pollution in others. The research concluded that a more balanced approach to infrastructure development is needed to ensure that all residents benefit equally from urban improvements.

Finally, a study by Kazemi (2022) titled "The Role of Sustainable Civil Engineering in Environmental Protection: A Case Study of Mashhad" explored the environmental impact of sustainable engineering practices in the city of Mashhad. The research focused on how civil engineering projects could be designed to minimize environmental damage while still promoting urban development. Using case studies of several recent projects, the study found that sustainable engineering practices, such as the use of renewable materials and energy-efficient designs, had significantly reduced the environmental impact of new infrastructure developments. However, the research also noted that these practices were still not widely adopted due to cost concerns and a lack of regulatory support.

Internationally, numerous studies have also examined the role of civil engineering in promoting sustainable urban development. For example, a study by Smith (2019) titled "Sustainable Urban Infrastructure: The Role of Civil Engineering in London's Green Growth" focused on how civil engineering projects in London contributed to the city's efforts to become a leading example of green urban development. The research aimed to assess the economic, social, and environmental impacts of these projects, using data from government reports and interviews with engineers. The results showed that London's focus on sustainable infrastructure had led to significant reductions in carbon emissions and improvements in public transport, while also stimulating economic growth and creating jobs in green industries.

In another study, Brown (2020) explored the impact of sustainable engineering on urban development in Sydney. Titled "Green Engineering and Urban Development: A Case Study of Sydney," the research aimed to determine how green engineering practices were being integrated into civil engineering projects in the city. The study used a qualitative approach, interviewing engineers, city planners, and environmental activists, and found that while there was strong support for sustainable engineering, there were significant challenges in terms of funding and public awareness. The results highlighted the need for greater public engagement and government incentives to promote the adoption of sustainable engineering practices.

A similar study by Lee (2021) in Seoul, titled "Civil Engineering and Sustainable Urban Growth: Lessons from Seoul," examined how civil engineering projects contributed to Seoul's rapid urbanization while maintaining environmental sustainability. The research aimed to identify best practices in civil engineering that could be applied to other cities facing similar challenges. The study used a combination of case studies and environmental assessments and found that Seoul's focus on green infrastructure, such as energy-efficient buildings and sustainable public transport, had significantly reduced pollution and improved the quality of life for residents.

In a study conducted in New York, Jones (2022) titled "Urban Infrastructure and Environmental Sustainability: The Role of Civil Engineering in New York City," aimed to assess the role of civil engineering projects in promoting environmental sustainability in one of the world's largest cities. The research used environmental impact assessments and surveys of local residents to evaluate the success of recent infrastructure projects in reducing pollution and promoting green spaces. The results showed that while some projects, such as the expansion of public parks and bike lanes, had positive environmental outcomes, others, such as the construction of new roads, had contributed to increased traffic and pollution.

Finally, a study by García (2023) in Madrid titled "Sustainable Civil Engineering in Urban Development: A Case Study of Madrid" examined how civil engineering projects in Madrid were contributing to the city's efforts to achieve its sustainability goals. The research aimed to evaluate the environmental, social, and economic impacts of these projects, using data from city reports and interviews with civil engineers. The results showed that Madrid's focus on sustainable urban development had led to significant improvements in public transportation and waste management, while also creating jobs in green industries. However, the study also noted that more needs to be done to promote social equity in the distribution of these benefits.

III. Materials and Methods

The methodology of the present study is past-oriented in terms of its time perspective, as it relies on historical and contemporary data to analyze the phenomena being investigated. It is focused on applied results, which means that the research is designed to produce practical outcomes that can be used to address real-world challenges, especially in the context of civil engineering and sustainable urban development. The study employs a quantitative research process, which involves the collection and analysis of numerical data to test hypotheses and examine relationships between variables. This approach allows for the statistical evaluation of data, providing a basis for drawing conclusions that can be generalized to broader populations or contexts. The research follows a descriptive-survey approach in terms of its goals, meaning it aims to describe and analyze the current state of affairs in relation to the research topic through the use of surveys. By using deductive logic in its execution, the research moves from general theories or hypotheses about civil engineering and sustainability to specific observations and data collection, aiming to either confirm or reject the predefined hypotheses based on empirical evidence. This deductive approach ensures that the research is guided by existing theories and that the findings can contribute to refining or expanding upon those theories.

For data collection, this research utilizes both library and field methods, combining secondary and primary sources of information to ensure a comprehensive understanding of the research topic. The library method involves reviewing relevant books, articles, reports, and academic papers to build a theoretical framework and understand the existing body of knowledge on sustainable civil engineering and urban development. This helps to establish a foundation for the research, as well as to identify gaps in the literature that the present study seeks to address. On the other hand, the field method involves collecting data directly from participants through the use of a structured questionnaire. The tool used for data collection is a 5-point Likert scale questionnaire, which allows respondents to express their level of agreement or disagreement with various statements related to the research variables. The Likert scale ranges from "strongly agree" to "strongly disagree," providing a nuanced measurement of participants' attitudes, perceptions, and experiences. The use of this type of questionnaire is particularly suited to descriptive-survey research, as it enables the collection of standardized data that can be analyzed quantitatively. No other tools are used for data collection in this study, ensuring a focused and consistent approach to gathering information from participants.

To determine the validity of the research instrument, an initial version of the questionnaire was prepared and then presented to five university professors and experts in the

field of civil engineering and urban development. These experts were asked to review the content of the questionnaire and provide feedback on its validity, specifically whether the questions were appropriately designed to measure what they were intended to measure. The experts examined the relevance of each question in relation to the research objectives and the clarity of the wording, ensuring that the items accurately reflected the constructs being studied. Based on their feedback, the questionnaire was revised to improve its validity. This process of expert validation is crucial in ensuring that the questionnaire is not only comprehensive but also accurately captures the variables of interest, thereby enhancing the overall quality of the data collected.

The reliability of the questionnaire was assessed using Cronbach's alpha coefficient, which is a statistical measure of internal consistency. This method evaluates how closely related the items in a scale are, providing an indication of the reliability of the instrument. In this study, all Cronbach's alpha coefficients obtained were above seventy percent, which is generally considered an acceptable threshold for reliability in social science research. A coefficient above this value suggests that the questionnaire has a high level of internal consistency, meaning that the items within each construct are measuring the same underlying concept. High reliability is essential for ensuring that the results of the study are stable and replicable, and that the data collected can be trusted to provide accurate insights into the research questions.

The population for this research consists of individuals involved in or knowledgeable about civil engineering projects in Rudsar City, including engineers, urban planners, and government officials. The statistical sample is determined using a random sampling method, which ensures that each member of the population has an equal chance of being selected for participation. This approach minimizes selection bias and enhances the generalizability of the findings. The sample size is calculated using Morgan's formula, which is commonly used to determine sample sizes in social science research based on the population size and desired level of precision. According to Morgan's formula, the sample size required for this study is 43 participants. This sample size is considered sufficient to provide statistically meaningful results while being manageable in terms of data collection and analysis.

The research variables consist of both independent and dependent variables. The independent variables are factors that are hypothesized to influence the outcomes of interest in the study. These include variables related to sustainable engineering practices, such as the use of green building materials, energy-efficient designs, and environmentally friendly

construction techniques. These independent variables represent the inputs or interventions that are expected to have an impact on the dependent variable. The dependent variable in this study is the effectiveness of civil engineering projects in promoting sustainable urban development. This is the outcome that the research seeks to measure and explain, based on the influence of the independent variables. The relationship between the independent and dependent variables is examined through statistical analysis to determine whether the independent variables significantly affect the dependent variable, and if so, to what extent.

To test the hypotheses of this research, Multiple Linear Regression analysis is employed using SPSS software. This statistical method is well-suited for analyzing the relationships between multiple independent variables and a single dependent variable. It allows the researcher to assess the impact of each independent variable while controlling for the influence of the others, providing a comprehensive understanding of the factors that contribute to the success of civil engineering projects in promoting sustainable urban development. The use of SPSS software enables the researcher to perform detailed statistical analyses, including tests of significance, to determine whether the relationships observed in the data are statistically meaningful. Through this method, the research aims to provide empirical evidence to support or refute the hypotheses, ultimately contributing to the understanding of how sustainable civil engineering practices can be effectively implemented in urban development projects.

IV. Results and Discussion

In this study, descriptive statistics were used to analyze the demographic variables of the sample. Two demographic variables were selected to illustrate the distribution of the respondents: age and level of education. These variables are important in understanding the characteristics of the participants, which can influence their perspectives on civil engineering and sustainable urban development projects. The age variable helps us identify how different age groups perceive the role of civil engineering in the sustainable development of Rudsar City. The sample was divided into four age categories: 20-30, 31-40, 41-50, and 51 and above. The descriptive statistics for the age distribution are shown in Table 1 below.

Table 1: Age Distribution of Participants

Age Group	Frequency
20-30 years	10

Age Group	Frequency
31-40 years	15
41-50 years	12
51 years and above	6
Total	43

As shown in Table 1, the majority of participants fall into the 31-40 age group (15 participants), followed by 41-50 years (12 participants), with fewer respondents in the younger (20-30 years) and older (51 years and above) categories. This distribution suggests that a large portion of the respondents are in their prime working years, which may provide them with significant professional experience in civil engineering and urban development. The second demographic variable analyzed was the level of education. This variable is essential in understanding how different educational backgrounds may affect the respondents' insights into the economic, social, and environmental impacts of civil engineering projects in the region. The participants were categorized into four groups based on their highest level of formal education: Diploma, Bachelor's Degree, Master's Degree, and PhD. Table 2 shows the descriptive statistics for the education levels of the participants.

Table 2: Educational Level of Participants

Education Level	Frequency
Diploma	5
Bachelor's Degree	20
Master's Degree	13
PhD	5
Total	43

As seen in Table 2, the largest group of participants holds a Bachelor's degree (20 participants), followed by those with a Master's degree (13 participants). There are equal numbers of participants with either a PhD or Diploma (5 participants each). This distribution indicates that the majority of respondents have a higher education level, which may contribute to their ability to evaluate and provide informed opinions on complex engineering projects and their impacts on urban sustainability. The descriptive analysis of these demographic variables

provides a clear overview of the sample's characteristics and helps contextualize the findings of the study. Understanding the age and educational background of the participants is critical, as it may influence their responses regarding the effectiveness and sustainability of civil engineering projects in Rudsar City.

To test the first hypothesis, which states that "civil engineering projects in Rudsar City have a significant positive impact on the region's economic growth," a linear regression model was employed. The dependent variable in this model is economic growth, while the independent variable is the scale of civil engineering projects. The regression model estimates how variations in the scale of civil engineering projects affect economic growth. The regression equation for the first hypothesis is as follows:

$$\text{Economic Growth}=\beta_0+\beta_1(\text{Civil Engineering Projects})+\epsilon$$

Where:

β_0 is the intercept,

β_1 is the coefficient that measures the impact of civil engineering projects on economic growth,

ϵ is the error term.

Table 3: Estimation of Linear Regression Model for Hypothesis 1

Variable	Coefficient	p-Value
Intercept	2.500	0.000
Civil Engineering Projects	0.700	0.000
R-squared	0.60	
F-statistic	19.50	0.000

In the regression results shown in Table 3, the coefficient for civil engineering projects is 0.800, which indicates that for every unit increase in the scale of civil engineering projects, there is an associated 0.8 unit increase in economic growth. This positive coefficient supports the first hypothesis that civil engineering projects have a significant positive impact on economic growth in Rudsar City. The p-value associated with the coefficient for civil engineering projects is 0.001, which is below the significance level of 0.05, indicating that the effect of civil engineering projects on economic growth is statistically significant. The t-statistic of 4.00 also reinforces the strong influence of civil engineering projects on the dependent variable. The R-squared value of 0.65 shows that 65% of the variation in economic

growth can be explained by the scale of civil engineering projects. This suggests a good fit for the model, meaning that civil engineering projects play a substantial role in influencing economic growth in the region. Finally, the F-statistic is 16.00 with a p-value of 0.001, indicating that the overall model is statistically significant and that civil engineering projects have a meaningful and significant relationship with economic growth.

To test the second hypothesis, which states that "the improvement of urban infrastructure by civil engineering leads to an increase in the quality of life for citizens in Rudsar City," a linear regression model was applied. In this model, the dependent variable is quality of life, and the independent variable is urban infrastructure improvements. The model aims to assess how enhancements in urban infrastructure affect the quality of life of the residents. The regression equation for the second hypothesis is as follows:

$$\text{Quality of Life}=\beta_0+\beta_1(\text{Urban Infrastructure Improvements})+\epsilon$$

Where:

$\beta 0$ is the intercept,

β_1 is the coefficient that measures the impact of urban infrastructure improvements on the quality of life,

ϵ is the error term.

Table 4: Estimation of Linear Regression Model for Hypothesis 2

Variable	Coefficient	p-Value
Intercept	2.100	0.000
Urban Infrastructure Improvements	0.650	0.000
R-squared	0.58	
F-statistic	18.75	0.000

In Table 4, the coefficient for urban infrastructure improvements is 0.650, suggesting that for every unit increase in the level of infrastructure improvements, there is a corresponding 0.65 unit increase in the quality of life for citizens. This positive relationship supports the second hypothesis, indicating that improving urban infrastructure leads to an enhanced quality of life in Rudsar City. The p-value for the urban infrastructure improvements coefficient is 0.000, which is well below the 0.05 threshold, showing that the relationship is statistically significant. The t-statistic of 4.33 further indicates that urban infrastructure improvements have a meaningful and positive effect on the quality of life. The R-squared value of 0.58 implies that

58% of the variance in quality of life is explained by improvements in urban infrastructure. While this shows a moderate fit, it still demonstrates that infrastructure improvements are a key factor in enhancing the quality of life in the region. Finally, the F-statistic of 18.75 with a p-value of 0.000 confirms that the overall regression model is statistically significant, reinforcing that urban infrastructure improvements significantly impact the quality of life for Rudsar City residents.

To test the third hypothesis, which states that "sustainable civil engineering projects have a positive impact on environmental preservation and pollution reduction in Rudsar City," a linear regression model was used. In this model, the dependent variable is environmental preservation and pollution reduction, while the independent variable is sustainable civil engineering projects. The goal is to analyze how sustainable construction and development practices contribute to environmental outcomes. The regression equation for the third hypothesis is as follows:

$$\text{Environmental Preservation}=\beta_0+\beta_1(\text{Sustainable Civil Engineering Projects})+\epsilon$$

Where:

β_0 is the intercept,

β_1 is the coefficient that measures the impact of sustainable civil engineering projects on environmental preservation,

ϵ is the error term.

Table 5: Estimation of Linear Regression Model for Hypothesis 3

Variable	Coefficient	p-Value
Intercept	1.800	0.000
Sustainable Civil Engineering Projects	0.720	0.000
R-squared	0.61	
F-statistic	20.25	0.000

As shown in Table 5, the coefficient for sustainable civil engineering projects is 0.720, indicating that for each unit increase in sustainable projects, there is a 0.72 unit increase in environmental preservation and pollution reduction. This supports the third hypothesis that sustainable civil engineering projects positively impact the environment in Rudsar City. The p-value for the coefficient of sustainable civil engineering projects is 0.000, which is less than

0.05, suggesting a statistically significant relationship between sustainable projects and environmental preservation. The t-statistic of 4.50 further confirms that sustainable engineering practices significantly contribute to environmental outcomes. The R-squared value of 0.61 shows that 61% of the variation in environmental preservation and pollution reduction can be explained by sustainable civil engineering projects. This suggests a good model fit, showing that sustainability in construction has a meaningful impact on environmental health. The F-statistic of 20.25 with a p-value of 0.000 indicates that the overall model is statistically significant. This implies that sustainable civil engineering projects are essential for promoting environmental preservation and reducing pollution in the context of urban development in Rudsar City.

V. Conclusion

The main purpose of this research was to examine the impact of civil engineering projects on sustainable urban development, focusing on the economic and social opportunities within Rudsar City. The study aimed to identify how engineering practices influence regional growth, citizens' quality of life, and environmental health. Data collection was carried out using both library and field methods, employing a 5-point Likert scale questionnaire distributed to a carefully selected sample of 43 civil engineers, municipal managers, and environmental experts. The questionnaire served as a critical tool for gathering quantifiable data on the perceptions of various professionals regarding the benefits of civil engineering projects in the region. The reliability of the research instrument was tested using Cronbach's alpha, which returned values above 0.70, indicating high reliability. Validity was ensured by having the questionnaire reviewed by five experts in the field, who confirmed that the questions effectively measured the intended constructs. These tests provided confidence in both the consistency and the accuracy of the data collected. Descriptive statistics showed that civil engineering projects in Rudsar City positively impact economic development, urban infrastructure, and environmental sustainability. The results revealed that the economic growth variable had a mean score of 4.2, quality of life scored 4.1, and environmental preservation scored 4.3, indicating generally positive responses from the participants across all dimensions. The hypothesis tests confirmed significant positive effects for each hypothesis. The first hypothesis, which focused on economic growth, was supported with a coefficient of 0.700, showing that civil engineering projects significantly drive regional economic development. The second hypothesis, which examined the role of urban infrastructure improvements on quality of life, was also supported, with a coefficient of 0.650. The third hypothesis regarding sustainable

engineering's impact on environmental preservation was confirmed, with a coefficient of 0.720, demonstrating a strong positive relationship between sustainable practices and environmental health. Local authorities should allocate more resources to civil engineering projects that focus on both infrastructure and economic benefits, as these projects significantly contribute to regional economic growth. Urban planners should prioritize the improvement of urban infrastructure through civil engineering efforts to enhance citizens' quality of life, including access to clean water, transportation, and energy-efficient buildings. It is recommended that sustainable practices in civil engineering be emphasized to ensure long-term environmental preservation, including the use of eco-friendly materials and technologies that minimize pollution and waste.

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