Journal of Civil Aspects and Structural Engineering

www.case.reapress.com

J. Civ. Asp. Struct. Eng. Vol. 2, No. 1 (2025) 50–66.

Paper Type: Original Article

Environmental Sustainability Assessment of Large Construction Projects: A Case Study of the Chabahar Port Development Plan Project and Analysis of Approaches Used to Reduce Environmental Impacts

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Citation:

Received: 17 May 2024 *Revised: 01 July 2024* *Accepted: 13 October 2024*	Mollazade, I. (2025). Environmental sustainability assessment of large construction projects: A case study of the Chabahar Port development plan project and analysis of approaches used to reduce environmental impacts. *Journal of civil aspects and structural engineering*, *2*(1), 50-66.

Abstract

This study seeks to evaluate the environmental sustainability of significant construction projects, focusing on the Chabahar Port Development Plan and examining strategies employed to mitigate environmental impacts. The research has an applied purpose, quantitative characteristics, and employs a descriptive survey method for data collection. The study's statistical population consists of 260 employees involved in a large construction project at Chabahar Port. Utilizing a random sampling method based on the Krejci-Morgan table, a sample of 152 individuals was selected. The Bashiri Standard Questionnaire [1] served as the data collection instrument, with its validity and reliability substantiated by expert opinions and Cronbach's alpha, respectively. Data analysis was performed using SPSS software along with regression tests. The results indicated that all research hypotheses were supported. Consequently, measures for reducing energy consumption, conserving water, improving mobility and accessibility satisfaction, enhancing walking appeal, addressing noise pollution, mitigating traffic annoyance, reducing noise dissatisfaction, evaluating place quality, and analyzing air pollutants and their health impacts, as well as identifying environmental challenges, all contribute to the environmental sustainability of large construction projects at Chabahar Port. Finally, recommendations were proposed regarding the research title and its components.

Keywords: Environmental sustainability, Construction projects, Chabahar Port.

1 | Introduction

The construction industry is a key sector of the global economy, significantly contributing to developing urban and rural infrastructure. Large-scale construction projects, such as bridges, tunnels, highways, dams,

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10.48314/jcase.v2i1.51

and high-rise buildings, are important in facilitating transportation, increasing energy generation capacity, and upgrading residential and commercial infrastructure. However, these projects usually have significant negative environmental impacts due to their large scale and extensive use of natural resources. Expanding China's construction industry has led to significant Gross Domestic Product (GDP) growth and economic benefits for local governments. However, China's environmental problems have raised great concerns from experts and policymakers, as large-scale construction projects are associated with high resource consumption, construction waste pollution, carbon emissions, and unsustainable building materials [2], [3].

Previous survey results have shown that production in China's construction industry accounts for more than 27.8% of China's annual energy consumption, which can lead to massive CO_2 emissions [4–6].

In addition, 40% of total waste is generated by construction activities due to insufficient environmental standards and environmental laws and regulations in China [7–9].

Furthermore, the unbridled development of the construction industry without fully considering sustainable approaches will inevitably accelerate environmental degradation [10], [11].

In the face of these obstacles, governments in many countries have become more aware of their responsibility to ensure the sustainability of the construction industry, at least locally. A breakthrough in the development of precise criteria and a framework for rating sustainable construction occurred in the United Kingdom in 1989, where a set of objectives was proposed: Building energy performance, indoor environmental quality, sustainable building materials, environmental impact, and contribution to the health of the ecological system [12], [13]. Sustainable Construction Projects (SCPs) represent the outcome of a sustainable construction delivery or procurement process and involve the sustainable construction process throughout its life cycle, with buildings or structures as the target output. SCPs have a specific cost and a specific process, are completed within a specific time, and meet quality requirements [14–17].

However, the current framework for construction project management has a major limitation. Current frameworks for construction projects do not effectively address social and environmental issues. Labuschagne and Burnett [18] suggested that developing actionable assessment indicators for decision-making would ensure that construction projects are based on empirical projects and are reasonable for sustainable development.

Therefore, the current framework for construction project management should include many sustainable elements, such as a sustainable project plan and strategy and the environment and biodiversity [19]. Although existing studies on sustainability theory and practice have been extensive, covering topics including social sustainability indicators [20], stakeholder assessment [21], sustainable development criteria [22], sustainable building materials [23], planning and design of SCPs [24], cost-benefit analysis of sustainable development [25], and energy consumption and carbon emissions in buildings [26], little attention has been paid to its practices in construction projects. These SCPs play an important role in rapid urbanization by optimizing land use and providing essential life services. Therefore, implementing SCPs is necessary and meaningful to promote the sustainable development of the construction industry and society.

Obito et al. [27]: The challenges and opportunities of integrating sustainability into HVAC project management include technological barriers, high upfront costs, and organizational resistance to opportunities such as technological advancement, renewable energy, and green building standards.

Dang et al. [28]: Assessing the compliance of LCSA studies in the construction industry with life cycle principles, transparency, and completeness of the most compliant was challenging, as were the key stakeholder principles and product desirability.

Hussain and Hussain [29]: Developing a fuzzy approach for assessing construction sustainability, showing that higher sustainability is more costly and decision makers can consider cost-sustainability trade-offs in projects.

Saleh et al. [30]: This paper provides a framework for assessing the sustainability of construction projects using multi-criteria decision-making methods. It verifies the accuracy of the model and its applicability in the construction industry.

Peterli et al. [31]: Investigated the impact of sustainable practices on construction project management using factor analysis and regression, which showed that some factors have a greater impact on different dimensions of sustainability.

Al-Saleh et al. [32]: Analyzing the impact of geothermal energy on reducing CO_2 emissions in European Union countries, it was confirmed that the growth of geothermal energy helps reduce carbon dioxide emissions, while economic and demographic factors can increase it.

This research examines the impact of various factors, including energy consumption reduction, water resource conservation, mobility and accessibility indicators, walking attractiveness, noise pollution, traffic, place quality, air pollutants, and environmental challenges, on the environmental sustainability of Chabahar Port development.

2 | Research Methodology

1.2 | Population and Statistical Sample

A population is a group or class of individuals, objects, variables, concepts, or phenomena that share at least one characteristic or attribute.

This study's population comprises 260 employees participating in a large construction project in Chabahar Port. Based on the Krejci-Morgan table, 152 people were selected as a statistical sample using a random sampling method.

2.2 | Data Collection Tools

The library method and documentary studies are used to collect theoretical foundations of information in relation to the explanation of the literature on the subject of the research. One of the main methods of data collection in this study is the library method in such a way that the theoretical topics required for the study are collected from relevant sources, including articles, books, and theses, as well as from resources available in university libraries, databases, and higher education institutions. The tool used in this research is a questionnaire. The questionnaire includes several questions about the variables to be measured from the research community, which are collected as information files using Excel software.

In addition, the measurement tool must have the necessary validity and reliability so that the researcher can collect data appropriate to the research and answer the research questions by analyzing the data. Scaled and standardized measurement tools have appropriate validity and reliability. Therefore, the researcher can use them with confidence. However, researcher-made tools lack this confidence, and the researcher must be sure of their validity and reliability [33]. Information is collected in the theoretical discussion through the library method and by using books, articles, and reputable Internet sites.

The method of collecting data in the practical part is fieldwork, and the questionnaire is distributed in the research field. The data collection tool in this research in the practical part is a questionnaire [34], which is distributed in the research field and then collected and prepared for statistical tests. The data collection tool is done through questionnaires, forms, and databases.

Table 1. Research questionnaire.

Row	Questions Energy Consumption Reduction Measures	Very Little	Low	To Some Extent	A Lot	Too Much
1	I do not turn on the lights when it is not necessary.					
2	I unplug electrical appliances that I am not using.					
3	I use air conditioning moderately in the summer.					
4	I reduce the temperature of heating appliances when leaving the house in the winter.					
5	I use the terrace for air conditioning.					
6	I use natural light during the day.					
Row	**Questions Water Consumption Conservation Measures**	**Very Little**	**Low**	**To Some Extent**	**A Lot**	**Too Much**
7	To what extent do you spend less time washing in the bathroom in your home?					
8	To what extent do you turn off the tap when brushing your teeth, washing dishes, etc., in your home?					
9	To what extent do you not use drinking water to irrigate green spaces and wash cars and vehicles in your home?					
Row	**Questions About Satisfaction with the Mobility and Accessibility Index**	**Very little**	**Low**	**To some extent**	**A lot**	**Too much**
10	Attention to streets and passages in terms of the quality of flooring and paving for bicycles and pedestrians.					
11	Suitability of passages for physically disabled people, older people, and children.					
12	Quality of passage access to shopping centers and local markets.					
13	Possibility of walking or cycling to work.					
14	Access to educational and recreational centers on foot and by bicycle.					
15	Possibility of using walking, cycling instead of private cars.					
16	How are alleys connected to the main road and street.					
Row	**Questions about the Attractiveness of Walking**	**Very little**	**Low**	**To some extent**	**A lot**	**Too much**
17	Can the reconstruction and improvement of sidewalks make walking in this neighborhood attractive?					
18	Can increasing pedestrian-oriented green paths make walking in this neighborhood attractive to you?					
19	Would placing benches and urban furniture make walking in this neighborhood more attractive?					
20	Could creating a modern commercial complex make walking in this neighborhood more attractive?					
21	Could creating local markets make walking in this neighborhood more attractive for you?					
22	Could painting and decorating walls and walkways make walking in this neighborhood more attractive?					
23	Could creating a neighborhood park make walking in this neighborhood more attractive for you?					

Table 1. Continued.

Row	Questions on Noise Pollution	Very little	Low	To some extent	A lot	Too much
24	To what extent do you think noise pollution caused by cars and honking in the neighborhood affects you?					
25	To what extent do you think noise pollution caused by motorbikes and honking in the neighborhood affects you?					
26	To what extent do you think noise pollution caused by excavation and urban development operations affect you?					
27	To what extent do you think noise pollution caused by neighbors' voices affects you?					
28	To what extent do you think noise pollution caused by heavy vehicles and honking in the neighborhood affects you?					
29	To what extent do you think noise pollution caused by workshops and industrial centers affects you?					
Row	**Questions on Annoyance Caused by Traffic**	**Very little**	**Low**	**To some extent**	**A lot**	**Too much**
30	Do you get headaches and dizziness when exposed to traffic noise?					
31	Do you get angry when exposed to traffic noise?					
32	Do you have trouble sleeping when exposed to traffic noise?					
33	Does traffic noise interfere with your ability to listen to radio and television?					
34	Does traffic noise interfere with your ability to converse?					
35	Does traffic noise interfere with your ability to concentrate?					
Row	**Questions About Dissatisfaction with Noise**	**Very little**	**Low**	**To some extent**	**A lot**	**Too much**
36	Do you feel the most dissatisfaction with noise in the morning?					
37	Do you feel the most dissatisfaction with noise in the afternoon?					
38	Do you feel the most dissatisfaction with noise in the evening?					
39	Do you feel the most dissatisfaction with noise at night?					
40	Do you feel the most dissatisfaction with night and morning noise?					
41	Do you feel the most dissatisfaction with evening and morning noise?					
42	Do you feel the most dissatisfaction with noise at any time of the day or night?					
Row	**Place Quality Questions**	**Very Weak**	**Weak**	**Medium**	**Good**	**Very Good**
43	Physical texture, including the layout of streets, building forms, and blocks.					
44	The existence of trash cans at appropriate intervals on paths and passages.					

Table 1. Continued.

Row	Air Pollutant Questions	Very Little	Low	To Some Extent	A Lot	Too Much
45	Condition of exterior facades of buildings on main and secondary streets.					
46	Quality of vegetation and trees on passages and the existence of local parks and green spaces.					
47	Quality of cleanliness of passages and open spaces.					
48	Absence of construction debris and waste and garbage at the neighborhood level and in the watercourse.					
49	Absence of waste water taps on the street and sidewalk.					
50	Status of lighting on streets and neighborhood sidewalks.					
51	Status of neighborhood sewage disposal system.					
52	Washing and cleaning of passages and tables.					
53	Is construction a source of air pollutants in your neighborhood?					
54	Are motorized vehicles (Including cars, motorcycles, and public transportation) a source of air pollutants in your neighborhood?					
55	Is fuel combustion from heating and cooking a source of air pollutants in your neighborhood?					
56	Is using heating and air conditioning devices (Air conditioners and packages) a source of air pollutants in your neighborhood?					
57	Is population growth in your neighborhood a source of air pollutants?					
58	Is tobacco use (Cigarettes, etc.) a source of air pollutants in your neighborhood?					
Row	**Air Pollution Questions and Its Impact on Health Indicators**	**Very little**	**Low**	**To some extent**	**A lot**	**Too much**
59	What are the effects of air pollution on shortness of breath/respiratory problems at the neighborhood level?					
60	What are the effects of air pollution on skin irritation at the neighborhood level?					
61	What are the effects of air pollution on feelings of depression at the neighborhood level?					
62	What are the effects of air pollution on inflammation of the eyes, nose, and throat at the neighborhood level?					
63	How does air pollution affect kidney and heart problems at the neighborhood level?					
64	What are the effects of air pollution on the incidence of asthma at the neighborhood level?					
65	What are the effects of air pollution on poor vision at the neighborhood level?					
66	What are the effects of air pollution on concerns about the living environment of children in the neighborhood at the neighborhood level?					

Table 1. Continued.

Row	Environmental Challenge Questions	Very Little	Low	To Some Extent	A Lot	Too Much
67	The most important environmental challenge that the neighborhood faces is the quality of the air in the neighborhood.					
68	The most important environmental challenge that the neighborhood faces is the quality of the neighborhood's drinking water.					
69	The most important environmental challenge that the neighborhood faces is the presence of non-compliant users at the neighborhood level.					
70	The most important environmental challenge that the neighborhood faces is the amount of energy consumption at the neighborhood level.					
71	The most important environmental challenge facing the neighborhood is the presence of noise pollution at the neighborhood level.					

3.2|Questionnaire Reliability

Reliability refers to the stability of the measuring instrument. The measuring instrument is reliable if a test is repeated several times and the results are the same [35]. In this study, the reliability of the research measurement instrument (Questionnaire) will be calculated using Cronbach's alpha formula. The Cronbach's alpha coefficient was calculated for the questionnaires, and its value was greater than 70 percent, which indicates the questionnaire's high reliability.

Table 2. Reliability of the questionnaire.

Row	Variable	Questions	Cronbach's Alpha Coefficient
1	Energy consumption reduction measures	6-1	0.868
2	Water consumption conservation measures	9-7	0.769
3	Satisfaction with mobility and accessibility index	16-10	0.878
4	Walking attractiveness	23-17	0.895
5	Noise pollution	29-24	0.871
6	Traffic annoyance	35-30	0.829
7	Noise dissatisfaction	42-36	0.906
8	Place quality	52-43	0.930
9	Air pollutants	58-53	0.904
10	Air pollution and its impact on health indicators	66-59	0.848
11	Environmental challenges	71-67	0.836
12	Environmental sustainability	71-1	0.988

4.2|Descriptive Statistics

4.2.1|Demographic variables

In this section, we will discuss descriptive statistics, i.e., presenting frequency tables and statistical charts to examine the distribution of the statistical sample of gender, age, and level of education variables.

Examining the gender of respondents

As the table below shows, men are the largest gender group.

Table 3. Frequency distribution of respondents by gender.

Gender	Abundance	Percentage
1 Man	148	97.4
2 Woman	4	2.6
Total	152	100%

The table above shows that 97.4% of people are men, and 2.6% are women.

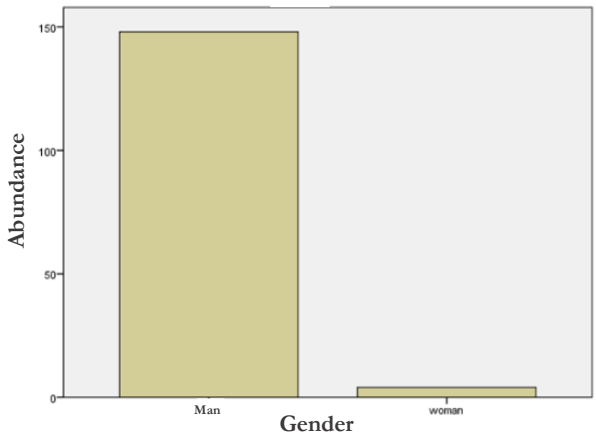

Fig. Frequency distribution chart of respondents by gender.

As shown in the graph above, men have the highest frequency.

Analysis of the age of respondents

The table below shows that people aged 26 to 33 are the largest age group.

Table 4. Frequency distribution of respondents by age.

Age	Abundance	Percentage
1 18-25	8	5.3
2 26-33	60	39.5
3 34-41	57	37.5
4 41-48	23	15.1
5 Over 49 years old	4	2.6
Total	152	100%

As can be seen in the table above, the 26 to 33-year-old age group has the highest frequency, with 39.5 percent, and the over-49 age group has the lowest frequency, with 2.6 percent.

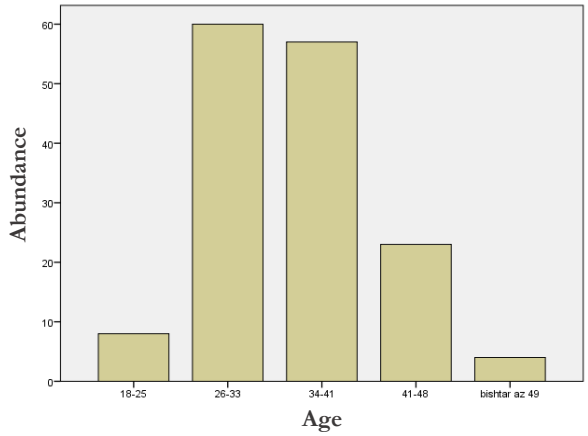

Fig. 2. Frequency distribution chart of respondents by age.

Table 5. Frequency distribution of respondents according to educational status.

Educational status	Abundance	Percentage
1 Diploma and Post-Diploma	10	6.6
2 Bachelor	84	55.3
3 Master and Doctorate	58	38.2
Total	152	100%

As shown in the table above, the highest frequency is for the undergraduate group, with 55.3 percent, and the lowest is for the diploma and postgraduate groups, with 6.6 percent.

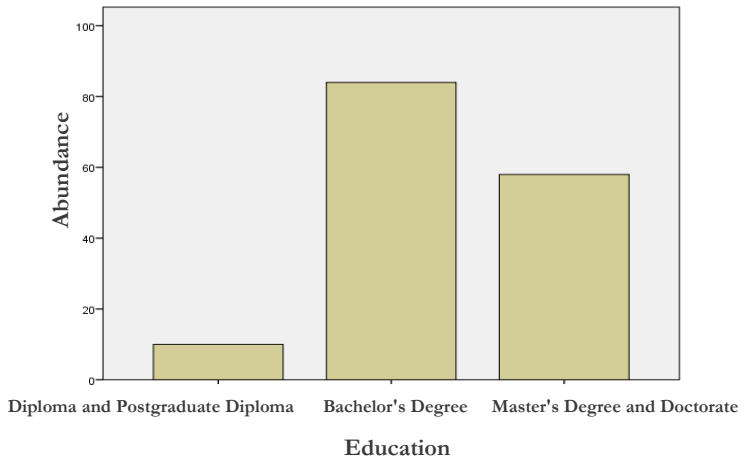

Fig. 3. Frequency distribution chart of respondents according to educational status.

4.2.2 | Conceptual model variables

With the data collected from the questionnaire, for each of the research variables, which include 1) energy consumption reduction measures, 2) water consumption conservation measures, 3) satisfaction with the mobility and accessibility index, 4) walking attractiveness, 5) noise pollution and 6) traffic annoyance, 7) noise dissatisfaction, 8) place quality, 9) air pollutants, 10) air pollution and its impact on health indicators, 11) environmental challenges, 12) environmental sustainability, we present numerical statistics such as mean, standard deviation, variance, minimum, maximum, skewness and elasticity in the following table:

Table 6. Table of descriptive statistics of research variables.

Indicator	Energy Reduction Actions	Water Reduction Actions	Mobility Index & Accessibility	Walkability Attractiveness	Noise Pollution	Traffic Annoyance	Noise Dissatisfaction	Place Quality	Air Pollutants	Air Pollution & Health Indicators	Environmental Challenges	Environmental Sustainability
Count	152	152	152	152	152	152	152	152	152	152	152	152
Missing Data	0	0	0	0	0	0	0	0	0	0	0	0
Mean	3.8827	3.8333	3.8968	3.8756	3.8822	3.8125	3.8421	3.8461	3.8114	3.8339	3.8461	3.852
Std. Error of Mean	0.04868	0.05132	0.04823	0.04872	0.04947	0.04451	0.04851	0.04831	0.051	0.04226	0.04791	0.04577
Median	3.8333	3.6667	3.8571	3.8571	4.0	3.8333	3.8571	3.9	3.6667	3.875	3.8	3.8732
Mode	3.83	3.67	4.00	3.86	4.00	4.00	4.00	4.00	4.00	3.88	4.00	3.62
Std. Deviation	0.60011	0.63269	0.59457	0.60066	0.60989	0.5487	0.59805	0.59556	0.6288	0.52103	0.59064	0.56428
Variance	0.36	0.4	0.354	0.361	0.372	0.301	0.358	0.355	0.395	0.271	0.349	0.318
Skewness	-0.326	0.003	-0.452	-0.297	-0.339	-0.072	-0.098	-0.201	-0.007	-0.117	-0.217	-0.202
Kurtosis	-0.241	-0.345	-0.126	-0.221	-0.219	-0.517	-0.43	-0.304	-0.385	-0.573	-0.251	-0.423
Range	2.5	2.67	2.57	2.57	2.67	2.5	2.71	2.8	2.67	2.25	2.8	2.48
Minimum	2.5	2.33	2.43	2.43	2.33	2.5	2.29	2.2	2.33	2.63	2.2	2.45
Maximum	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.88	5.0	4.93
Sum	590.17	582.67	592.31	589.1	590.1	579.5	584.0	584.6	579.33	582.75	584.6	585.5

As seen in the table above, the variables all have an acceptable value for the mean index. It should be noted that the acceptable value for the mean is greater than 3. If the variable is in this range, it has a favorable status in the statistical community.

5.2 | Inferential Statistics

5.2.1 | Reliability test

According to the rules of statistics, if Cronbach's alpha coefficient of a questionnaire is greater than 70%, the questionnaire is reliable and ready for analysis and inference for the community. In the table below, the reliability of the questionnaire factors was tested.

Table 7. Reliability of questionnaire questions.

Variable	Questions	Number of Respondents	Cronbach's Alpha
Energy consumption reduction measures	6-1	152	0.868
Water consumption conservation measures	9-7	152	0.769
Satisfaction with mobility and accessibility index	16-10	152	0.878
Walking attractiveness	23-17	152	0.895
Noise pollution	29-24	152	0.871
Traffic annoyance	35-30	152	0.829
Noise dissatisfaction	42-36	152	0.906
Place quality	52-43	152	0.930
Air pollutants	58-53	152	0.904
Air pollution and its impact on health indicators	66-59	152	0.848
Environmental challenges	71-67	152	0.836
Environmental sustainability	71-1	152	0.988

As can be seen, all components are stable, which indicates the homogeneity of the questionnaire components.

2.5.2 | Kolmogorov-Smirnov test

The normality of the variables is first examined to test the research hypotheses. Therefore, this condition is initially examined for the research variables.

Given that the significance level of the test in the above table for all research variables was not less than 0.05, the distribution of the variables mentioned above does not differ significantly from the normal distribution. Therefore, the data distribution is normal, and parametric tests should be used for inferential testing.

Table 8. Kolmogorov-Smirnov test for normality of research variables.

	Energy Consumption	Water Consumption	Accessibility Index	Walking	Noise Pollution	Traffic	Dissatisfaction with the Voice	Quality of Place	Air Pollutant	Health Indicators	Environmental Challenge	Environmental Sustainability
Test Statistic	0.079	0.130	0.097	0.071	0.100	0.081	0.098	0.069	0.098	0.078	0.087	0.051
Asymp. Sig. (2-tailed)	0.021[c]	0.000[c]	0.001[c]	0.056[c]	0.001[c]	0.016[c]	0.001[c]	0.073[c]	0.001[c]	0.026[c]	0.006[c]	0.200[c,d]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

3|Conclusion

Hypothesis 1. Energy consumption reduction measures have a positive and significant effect on the environmental sustainability of Chabahar Port development. The multiple correlation is 0.983, which means there is a strong correlation. The multiple determination coefficient is 0.966, which means that the independent variable was able to explain the variance of the dependent variable by 96 percent. The value of the F statistic is 4206.679, and the significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. We conclude that energy consumption reduction measures have a positive and significant effect on the environmental sustainability of Chabahar Port development.

Hypothesis 2. Water consumption protection measures have a positive and significant effect on the environmental sustainability of Chabahar Port development. The multiple correlation is 0.969, which means there is a strong correlation. The multiple determination coefficient is 0.938, which means that the independent variable could explain the dependent variable's variance by 93 percent. The value of the F statistic is 2281.891, and the significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. We conclude that water consumption protection measures have a positive and significant effect on the environmental sustainability of the development of Chabahar Port.

Hypothesis 3. Satisfaction with the mobility and access index has a positive and significant effect on the environmental sustainability of Chabahar Port development. The multiple correlation is 0.919, which means there is a strong correlation. The multiple determination coefficient is 0.845, which means that the independent variable could explain 84 percent of the variance of the dependent variable. The value of the F statistic is 0.815. The significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. We conclude that satisfaction with the mobility and access index has a positive and significant effect on the environmental sustainability of Chabahar Port development.

Hypothesis 4. The attractiveness of walking has a positive and significant effect on the environmental sustainability of Chabahar Port development. The multiple correlation is 0.990, which means there is a strong correlation. The coefficient of multiple determination is 0.980, which means that the independent variable could explain 98% of the variance of the dependent variable. The value of the F-statistic is 0.7301. The significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. The attractiveness of walking has a positive and significant effect on the environmental sustainability of the development of Chabahar Port.

Hypothesis 5. Noise pollution has a positive and significant effect on the environmental sustainability of Chabahar Port development. The multiple correlation is 0.936, which means there is a strong correlation. The multiple determination coefficient is 0.876, which means that the independent variable was able to explain the variance of the dependent variable by 87 percent. The value of the F statistic is 1062.855, and the significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. So, noise pollution has a positive and significant effect on the environmental sustainability of the development of Chabahar Port.

Hypothesis 6. Traffic annoyance has a positive and significant effect on the environmental sustainability of Chabahar Port development. The multiple correlation is 0.856, which means there is a strong correlation. The multiple determination coefficient is 0.733, which means that the independent variable could explain 73 percent of the variance of the dependent variable. The value of the F-statistic is 244.412, and the significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of the utility is Sig<0.05, its beta statistic is significant. We conclude

that traffic annoyance has a positive and significant effect on the environmental sustainability of the development of Chabahar Port.

Hypothesis 7. Dissatisfaction with noise has a positive and significant effect on the environmental sustainability of the development of Chabahar Port. The multiple correlation is 0.980, which means there is a strong correlation. The multiple determination coefficient is 0.961, which means that the independent variable was able to explain the variance of the dependent variable by 96 percent. The value of the F statistic is 3659.018, and the significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. We conclude that dissatisfaction with noise has a positive and significant effect on the environmental sustainability of Chabahar Port development.

Hypothesis 8. The quality of the place has a positive and significant effect on the environmental sustainability of Chabahar Port development. The multiple correlation is 0.985, which means there is a strong correlation. The multiple determination coefficient is 0.970, which means that the independent variable could explain the dependent variable's variance by 97 percent. The value of the F-statistic is 266.4801, and the significance level is 0.000. Since the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of the utility is Sig<0.05, its beta statistic is significant. So, the quality of the place has a positive and significant effect on the environmental sustainability of the development of Chabahar Port.

Hypothesis 9. Air pollutants have a positive and significant effect on the environmental sustainability of the development of Chabahar Port. The multiple correlation is 0.972, meaning there is a strong correlation. The multiple determination coefficient is 0.946, which means that the independent variable was able to explain the variance of the dependent variable by 94 percent. In the table above, the value of the F-statistic is 2604.949, and the significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. So, we conclude that air pollutants have a positive and significant effect on the environmental sustainability of Chabahar Port development.

Hypothesis 10. Air pollution and its impact on health indicators positively and significantly affect the environmental sustainability of Chabahar Port development. The multiple correlation is 0.940, which means there is a strong correlation. The multiple determination coefficient is 0.883, which means that the independent variable was able to explain the variance of the dependent variable by 88 percent. The value of the F-statistic is 1132.911, and the significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. So, air pollution and its impact on health indicators have a positive and significant effect on the environmental sustainability of the development of Chabahar Port.

Hypothesis 11. Environmental challenges have a positive and significant effect on the environmental sustainability of Chabahar Port development. The multiple correlation is 0.982, which means there is a strong correlation. The multiple determination coefficient is 0.965, which means that the independent variable was able to explain the variance of the dependent variable by 96 percent. The value of the F statistic is 258.4088, and the significance level is 0.000. Because the significance level is less than 0.05, the regression model is significant and well-fitted. Given that the significance level of utility is Sig<0.05, its beta statistic is significant. We conclude that environmental challenges have a positive and significant effect on the environmental sustainability of Chabahar Port development.

Based on the findings of this study, all the hypotheses raised regarding the impact of various factors on the environmental sustainability of Chabahar Port development have been confirmed. The results of statistical analyses show that the variables of energy consumption reduction measures, water consumption conservation measures, satisfaction with the mobility and accessibility index, walking attractiveness, noise pollution, traffic annoyance, noise dissatisfaction, place quality, air pollutants, the impact of air pollution on health indicators,

and environmental challenges all have a positive and significant impact on the environmental sustainability of Chabahar Port development.

The high correlation coefficient and determination coefficient in all regression models indicate that the independent variables have been able to explain the variance of the dependent variable to a great extent. Also, a significance level of less than 0.05 in all tests indicates the significance of the relationships between the variables and the appropriate fit of the regression models.

These results indicate that paying attention to environmental measures in various areas, including reducing energy and water consumption, improving the quality of urban spaces, controlling noise and air pollutants, and managing traffic, can significantly promote the environmental sustainability of Chabahar Port development. Therefore, it is suggested that policymakers and urban managers implement effective programs in this area and consider the necessary measures to improve the environmental indicators of this strategic port.

Author Contribution

The author is responsible for all aspects of this research, including conceptualization, methodology, data collection, analysis, interpretation of results, writing, and finalizing the manuscript.

Funding

This research did not receive any specific funding from public, commercial, or not-for-profit sectors. The study was self-funded by the author.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Data access is subject to project confidentiality agreements.

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