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Research Article

Global Excellence in Environmental Regulations towards Economical Sustainable Building Design

Rashid Maqbool[1], Venkata Saidutt Kambhampati[2], Saleha Ashfaq[3]

Affiliation 1 Department of Civil Engineering and Management, The University of Manchester, Oxford Road, M13 9PL, Manchester, UK.
Affiliation 2 Faculty of Science and Environment, Northumbria University, NE1 8ST, Newcastle upon Tyne, UK.
Affiliation 3 Department of Civil Engineering and Management, The University of Manchester, Oxford Road, M13 9PL, Manchester, UK.
Correspondence: rashid.maqbool@manchester.ac.uk

Abstract

Sustainable building contributes to a healthy ecosystem while reducing carbon emissions and improving climate management. Sustainable construction improves resource management, operating systems, utility bills, and operational efficiency. Sustainable building construction improves energy efficiency and the environment by adding amenities and lowering energy use. By utilizing the UK based quantitative surveys, this research explores the interconnections and regularities in the environmental regulations and accessibility of resources towards sustainable development. The theoretical model was tested through hierarchical multiple regression and structural equation modelling (SEM) tests. The hierarchical multiple regression was utlised to explore whether financial constraints and lack of awareness have any moderating effect on the economic sustainability as well as use of sustainable design. The research further provides the mediation influences of waste reduction, social awareness, energy consumption, and environmental responsibility towards economic sustainability and sustainable design. The findings suggest solutions to enhance construction, sustainability, and the environment. The findings revealed that the sustainable designs have benefited the building industry and introduced sustainability to construction operations. Sustainability reviews reduce construction waste and enhance organisation. Sustainable expansion in the UK construction industry improves customer experiences and reduces greenhouse gas emissions. Sustainability in UK construction lowers environmental harm and enhances health. The construction industry is evolving towards net zero and sustainable services for targeted clientele, which may improve customer experiences. Thus, building industry concepts have improved workplace sustainability and helped in eliminating environmental issues.

Keywords: environmental regulations, accessibility of resources, waste reduction, social awareness, environmental responsibility, financial constraints and technology.

Highlights

- identify the effectiveness of global excellence in the construction industry for design sustainability.
- observe the factors of the environmental regulations for managing the sustainability design in the construction industry.
- analyse the effective sustainability design in the construction site to work appropriately.
- recommend the appropriate facility for maintaining the sustainable design by the environmental department.

1 Introduction

This proposal will present the outcome of global excellence based on the design by sustainability practices among the construction buildings. It has been stated that this particular exercise has been managed by costs and benefits in the construction site based on the factors of the economy by creating a solid network of centres of excellence by integrating a sustainable design for the construction business. On the other hand, Cristiano et al., (2021) stated that concentration centres have been focused on the factors of promoting adequate knowledge by providing teaching based on the practices of sustainable as well as low-carbon design techniques. Thus, it can depend on applying global excellence technologies to provide the "low-carbon construction industry". Zhang et al., (2019) identified that reducing "greenhouse gas emissions" by up to 80% by the year 2050, as well as energy consumption for creating the relevant factors based on the department of the Environment by 45% of emissions of CO2, by the greenhouse gas.

On the other hand, the construction industry has been playing an influential role in environmental regulations by maintaining various policy targets depending on the knowledge and skills by achieving dramatic reductions with insufficient to mitigate the challenge by Alawneh et al., (2019). After that, it can provide the appropriate recommendation for establishing a solid network networking system for managing excellence by integrated "sustainable building design" to support the construction industry through rapid changes and unprecedented change.

The problem statement of this research has been identified that reducing fossil fuel dependency and refurbished buildings in the construction industry for analysing the lack of sufficient resources based on the knowledge and skills necessary for evaluating the economy. As per the view of Darling et al., (2019), the environmental performance has been focused on the construction building for providing the help for built-in, without requirements for levelling the terms and conditions by maintaining the energy for operating. Thus, it can be broken down, as well as not fulfilling the need for replacement during the construction of the building for managing the sustainable design. After that, it can be focused on the construction industry for genuinely making the design for sustainable buildings by the durable parts of the construction building, for structuring as well as an envelope to working effectively for controlling the internal climate. As cited by Elmassah et al., (2022), it can be observed that creating construction buildings has been focused on the "low carbon economy". We are managing the aspects of sustainable design in the construction industry by continuing to experiment with the physical form and energy performance of construction buildings.

This research will focus on identifying effective practices of global excellence that have strengthened sustainability among construction buildings.

After that, it is evaluated by adapting the facility of carbon reduction, efficiency measures, and primary energy for appropriately managing the practices of the construction site. Thus, it can focus on the aspects of "expensive technological fixes" by reducing the cost by refurbishing buildings based on "low carbon", with the potential to reduce the investment required. Therefore, it can depend on the factors of additional infrastructure along with generation for enhancing the capacity by developing the growth by the trend for keeping the adequate existing power mentioned by Amiri et al., (2019). Thus, it can be achieved by the carbon reductions for building the Environment with significant reductions being achieved.

- To identify the effectiveness of global excellence in the construction industry for design sustainability.
- To observe the factors of the environmental regulations for managing the sustainability design in the construction industry.
- To analyse the effective sustainability design in the construction site to work appropriately.
- To recommend the appropriate facility for maintaining the sustainable design by the environmental department.

This research employs a framework gives an organised way of looking at a research topic, which aids in locating and assessing the literature, ideas, and concepts that will shape the study's design and methodology. Researchers ensure their study is relevant to the area and build on prior work by employing a framework to guide their investigation mentioned by Kumar (2018). This study's combination of qualitative and quantitative approaches might reveal hidden nuances and insights about the research topic suggests by Lin (2013). As per McDermott (2023), Researcher, may benefit from using qualitative techniques like case study learning to understand complicated events better, discover patterns, and formulate ideas that can be tested using quantitative data.

2 Literature Review

2.1 Critical Evaluation of the Building Construction and Environmental Issues

The massive generation of demolition and construction has led to an increase in the impacts on the Environment. As per the views of Tawalbeh et al., (2021), several issues are faced during construction, such as inadequate management of risk, poorly defined goals, the overruns of the cost, and several others. It has been noticed that the number of the mortality rate of people working in construction has been rising. The shortage of labour is another major issue that is related to construction. There are several issues, such as sometimes, the goals and objectives are unclear to the stakeholders of what the industry is aiming for, which causes problems for the stakeholder related to the construction industry. In the views of Sayed et al. (2021), the communication gap is also a major issue seen in the construction industry, resulting in problems with the time management of the project. Several construction industries were unable to use innovative technology within the industry, which complicates the task to complete on time, which makes the work unable to finish in the schedule.

The preservation of the Environment is another major issue faced during construction. The rate of pollution is gradually increasing, leading to harmful effects on the condition of the Environment. According to Habert et al., (2020), it is one of the major causes of the increase in air and water pollution. The construction industry also requires primary sources of natural raw materials, including limestone, wood products, water, and several others. There are multiple construction issues, such as demolishing building materials for renovating buildings, which can increase the rate of air pollutants that negatively impact the Environment. Air pollution is a significant negative impact that increases exposure to mould, asbestos, lead, and other respiratory irritants. Foster et al., (2020) has been found that the construction sector contributes to air pollution by 23%, 40% to water pollution, and 46% to landfill waste). Apart from this, isolation is also a common issue connected with the construction of buildings. Sustainable construction buildings are essential to mitigate the problems with a direct negative environmental impact.

As per the Clean Air Act 1993, acquiring and using "unauthorised fuel" in a smoke control area is an offence unless used in an 'exempt' appliance. As per designingbuildings.co.uk, (2023) regulation, the

construction industry must use smokeless fuels, such as gas, electricity, and anthracite, to reduce the burden of air pollution. On the other hand, the Environment Protection Act 1990, Part II has highlighted the regulations regarding the controlled disposal of household, industrial and commercial waste on land designingbuildings.co.uk (2023). Therefore, the construction industry is required to take duty to collect, treat and dispose of waste properly.

In the United States of America, the "Environmental Protection Agency (E.P.A.)" is the federal agency that enforces the laws and regulations related to environmental issues. This agency further shares the responsibility with other states and federal agencies under some specific "federal environmental laws". Apart from the "Clean Air Act", various other federal laws and regulations have been imposed in America to mitigate the issues that the Environment is affected. “National Environmental Policy Act (N.E.P.A.)" is one of them, which needs the federal agencies to measure the effects that the proposed actions have on the Environment before making the final decision by ceq.doe.gov, (2023). This specific law is in application to construction and the infrastructure projects related to it. This law forces construction companies to examine the environmental effects that their project actions may have before starting construction.

On the other hand, India has also enforced some laws and regulations regarding the environmental issues caused by the construction industry. "The Water (Prevention and Control of Pollution) Act, 1974"states the principle concerning controlling and preventing water pollution. This act was further enacted to maintain and restore the abundance of water in the industry according to Indiacode. Nic. in (2023). This is inflation to the "Stormwater management post-construction". It elaborates that the construction industry or companies operating in the industry should manage the waste dispersed during any construction project of building or infrastructure. The increase in pollution is also increasing the level of global warming. In the views of Foster et al. (2020), the use of technology in several construction industries is also playing a significant role in the increase in the environmental issues caused by the construction industry. It is decreasing the condition of water by polluting it with the presence of several dust particles.

2.2 Sustainable Designs of Construction Buildings

Sustainable design of construction buildings has the potential to create efficient building plans. Sustainable design of a construction building seeks to reduce negative impacts on the Environment and comfort of occupancy in the building. Zhao et al. (2019), proposed that fundamental objective of sustainable construction building is to minimise resource consumption, mitigate waste management issues, create a healthy environment, etc. He also stated that Various principles of sustainable building construction include s*ustainable design, durability, energy efficiency, waste reduction, water conservation, etc.* Among these principles, the most potent factor is creating sustainable designed building construction for a productive environment. These designs are effective for producing a stable structure.

2.2.1 Passive Sustainable Design

"Passive sustainable design" depends on strategies focusing on sun orientation and climate. It is the most significant aspect of Passive Sustainable Building Design, A thoughtful process for the Environment that can bring severe sustainability within the construction process of a building. This is the best design to manage energy consumption and reduce energy requirements for the building stated by Wu et al. (2019). In certain climates, thermal mass techniques are used to hold solar energy.

In such cases, thick wall construction in a building is required, and a "Passive sustainable design" can build this kind of building. Regarding the factor of certain climates, thick wall absorbs heat from the sun during daylight and releases the heat at night.

2.2.2 Green Building Designs

Willar et al., (2021), explained that green buildings should be a priority for every person in the world. This is a significant way of producing sustainable buildings. This design mainly focuses on environmental sustainability. Generally, construction buildings contain major issues that harm the Environment. Regarding this factor, it is worth mentioning that green building design primarily focuses on mitigating those issues that are harmful to the Environment. Green construction is considered the most effective design that can positively impact nature and not provide any negative influences. Finishing materials such as carpets and furnishings are used in green building-designed construction. On the other hand, waste management is a vital part of this design that generates good environmental sustainability.

2.2.3 Active Sustainable Design

The use of Modern equipment focuses on building sustainability in construction projects through "Active sustainable design". The mechanical and engineering team plays a crucial role in giving ideas to the architecture of a sustainable building through active sustainable design. The mechanical person and engineers implement this design per the needs of the construction and local people. This design helps implement sustainability in building construction by Shehata et al., (2022). This is a significant way to implement high-efficiency plumbing, electrical, HVAC, and other systems. These are designed for environmental sustainability. This design especially helps to have little ecological footprints. Engineers implement this intending to create environmental sustainability.

2.3 Factors affecting Sustainability in Building Construction

The important keyword of the title "Sustainability" includes four significant factors such as "Human", "Social", "environmental", and "Economic". These factors play an essential role in creating sustainability in building construction. The sustainability of every building depends on these factors and determines building construction's efficiency and accuracy. On the other hand, another keyword, "Building construction", refers to some elements connected with the procedure of constructing a building smoothly stated by Goh et al. (2020). The environmental factors are closely related to the context of the research study as it deals with the effects caused by construction on the Environment. Additionally, the factors related to human, and society are also relevant as humans' lifestyle also gets affected due to any infrastructure construction.

As per the views of Ramos and Martinho (2021), the more effect construction does on the Environment; it indirectly affects the economy as well. This is to mitigate the already caused issues to the Environment. There is a need to investigate many finances which can be saved in the first place. On the other hand, Shehata et al., (2022) suggested that sustainable construction also requires other factors, such as using renewable and recyclable materials, reducing onsite waste, and reducing energy consumption. On the other hand, another keyword, "Building construction", refers to some factors connected with constructing a building smoothly. The aspects of building construction include "Durability", "Cost", "Handling of products", and "local availability of raw materials", etc. These are essential factors in selecting suitable construction materials.

A few factors connected with the sustainable development of the Environment primarily influence building construction. Input factors are associated with establishing sustainable building construction. In views of Fallahpour et al., (2020), Input factors that are related to building construction include "Environmental regulations", "Technology", "Operating and management cost", and "Equipment machines". While on the other hand, mediating factors include "Waste reduction", "Social awareness", "Energy consumption", and "Environmental responsibility". These moderating and mediating factors positively affect "economic stability" and "participation of the local community". The factors mentioned earlier are in close relation to the study content as all of them are in some way or the other related to construction and its sustainability. The construction industry should adhere to these factors to enhance its sustainability initiatives within its infrastructure-building process.

2.4 Development of the Framework

The framework provided in Figure 1, is based on the aforementioned literature review and underpinning theories (namely, Resource-based theory, and Accountability theory), indicates the Independent, Mediating, Moderating and Dependent factors.

Construction designs are providing a negative impact on the sustainability approach. On the other hand, monitoring the resources and the analysis of the take on the management of the resources are found to be mitigating the sources to be delivered. The management study for implementing Resource-based theory is provided an overview of the management of the available resources by Sony (2019). Along with that, the strategic analysis of the implementation of this theory has been provided in providing a concept that will contribute to elevating the standard of performance across the sustainability standards sector.

The implementation of this Accountability theory is said to provide an overview of the accountability theory's management regarding the sector's standard accountability management. The leadership of the deliverable standard for delegating the bar of accountability and measuring the strategic approach for effective monitoring will elevate the overall sustainability strategy suggested by Wieringa (2020). On the other hand, monitoring the capabilities and measures of accountability standards will overall contribute to the effective implementation of sustainability standards.

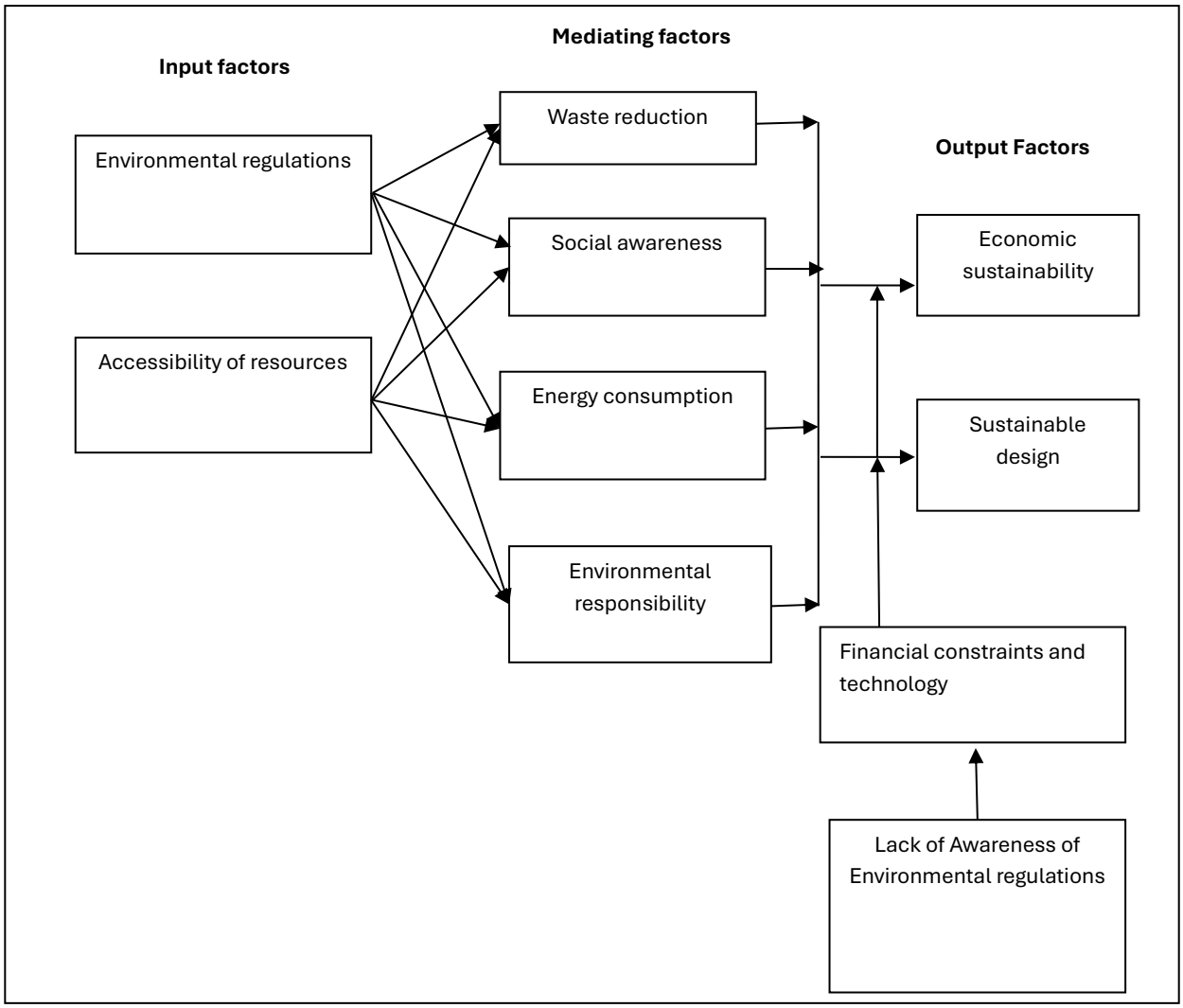

Figure 1. Framework with factors of construction project

Mediating factors support independent factors in deriving dependent variables. Whereas Moderating Factors oppose the independent factors in deriving output factors.

2.4.1 Input Factors Linkage with Mediating Factors

There are critical linkages between the input factors and the mediating factors. The organisation's sustainable operations can benefit environmental sustainability and operations. The management of the companies is essential for managing the construction works. Input factors such as environmental regulations and resource allocation are necessary for the whole governance process. Sustainable operations use several methods by linking with mediating elements by Oke et al., (2019). Accordingly, the distribution of resources is of immense importance for managing the challenges in operational management. The waste reduction process and social awareness effectively recognise the importance of environmental regulations. Social awareness regarding energy consumption plays a vital role in managing the changes in the management process. Waste management and recycling processes can be beneficial in managing energy consumption and applying energy resources into practices.

Sustainable design in the construction process helps to take a responsible approach towards preserving the Environment. Allocation of resources is significant for managing the mediating factors into operations—the management of resources done by taking up practical strategies towards social awareness and responsible environmental effects. The waste reduction process can be necessary for managing economic sustainability as well. According to Osobajo et al., (2022), applying a circular economy can help manage the cost reduction process in the whole operation. Energy consumption and responsible approaches towards environmental protection help improve social operations. Economical designs and proper planning can be beneficial in taking up practical strategies for operational management. The mediating factors are significant in managing the sustainable design of organisational leadership. These factors contribute to the growth of efficient economic operations and future scenarios of the company's construction operations by Tahmasebinia et al., (2020). Responsible functions towards sustainable development are necessary to maintain the company's operational management. The mediating factors can be linked to the input factors positively in making up effective outcomes. The proceedings of the organisational operations can be of immense importance in managing socially responsible functions.

2.4.2 Influence of Moderating Factors

The moderating factors of the operations are of immense importance to recognise at an early stage. Moderating factors can negatively influence the process. The management can manage the moderating factors to reduce their impact on the output. Financial constraints of the project can have a strong negative effect on the strategic implementation process. The collaborative skills of project management are necessary for the growth of performative analysis suggested by Li et al., (2019). Financial issues of the project lead to the ineffective management of the operations, which negatively impacts organisational functions as well. Environmental regulations can be crucial for managing the functionality of the organisation. Financial constraints can hamper the sustainable design of the processes.

Lack of adequate maintenance and operation can be fruitful by taking up essential process changes. Operation and management often lead to better results for project management. According to Goh et al., (2020) However, several constraints, such as financial, communication and leadership, are responsible for the lack of organisational management regarding sustainable development. In the contemporary scenario, many ordinary people are unaware of environmental sustainability. Therefore, a lack of awareness can lead to severe consequences for organisational management. It is necessary to manage the changes following the upcoming challenges. The risks can be recognised to mitigate them before impacting their operations. Social awareness can be required to address the challenges regarding sustainable operations designs. Several issues regarding operational difficulties can be necessary in the long run. In a challenging contemporary scenario, the moderating factors can affect the output factors in a significant manner.

Environmental responsibility and social regulation are needed for the further effectiveness of the organisation's operational activities. According to the views of Hossain *et al.*, (2019), these factors generally affect the overall proceedings of the construction project. It further helps the construction organisation gain deep insight into the experimental process, which can be accumulated within the construction project. Identifying these factors aids the business leader and manager in gaining knowledge about the overall construction project's external and internal conditions.

3 Methodology

3.1 Research Method

The research aspect is to check the environmental drives and initiatives to make the changes in the construction tools, strategies, and design to support development by keeping the Environment unaffected. Emphasis has been given to the sustainability factors like reduction of wastes in the construction, minimising resource acquisition, adaptation of vehicles and machinery run with electrical energy, building designs sustainable for the Environment and others. Analysing the aspects, including innovative designs and profitability measures, it is essential to select the suitable methodology for ensuring success with net zero protocols, reducing the greenhouse effect and others.

3.2 Method Outline

Table 1. Questionnaire for Data Collection

Factor	Factor type	No. of Questions	Sources/ References
Environmental regulations	Independent	6	(Habert et al. 2020)
Accessibility of resources	Independent	6	(Zhao et al., 2019)
Waste Reduction	Mediating	5	(Shehata et al. 2022)
Social Awareness	Mediating	5	(Ramos and Martinho, 2021)
Energy consumption	Mediating	5	(Shehata et al. 2022)
Environmental Responsibility	Mediating	5	(Habert et al., 2020)
Financial constraints and technology	Moderating	5	(Goh et al., 2020)
Lack of awareness of environmental regulations	Moderating	4	(Wu et al., 2019)
Economic sustainability	Dependent	5	(Foster, 2020)
Sustainable Design	Dependent	5	(Sayed et al., 2021)

Table 1 demonstrates the number of questions and different factors used in this study to accumulate data for questionnaire from the proposed authors.

The Research Onion, provided by Saunders et al. (2012), is a framework for organising the process of planning and carrying out scientific investigations. It's predicated on the premise that doing research is a multi-step process with each step building on the one before it and necessitating a variety of considerations and choices along the way.

3.3 Research Philosophy

Practical interpretation of the designs, challenges on the path of imposing threats to environmental sustainability and ensuring optimised research usage are the key factors to lay importance. Therefore, "positivism philosophy" is the best-suited method to illustrate the contextual issues and critically assess the standpoints in a meaningful manner related to the sustainability drives in the construction industry by Li et al., (2020). "Positivism" emphasises practical, realistic and justified approaches based on the logical order. The challenging matters to incorporate in this study are the utilisation of reusable materials, implementation of green machinery like vehicles running on electrical power, reduction f waste of materials by the inclusion of digital tools, and virtual reality for designing and reducing water wastes.

3.4 Research Approach

The research has sustained the relations among environmental regulations, "operation" and the "management costs", "technology", "waste reduction", "social awareness" and other matters under a single shade by Velter et al., (2020). The interrelation of these factors with the reduction of stress on

green energy is the subjective interest. Critical justification for making changes, ensuring balance, and regulating operational directives with construction and engineering by retaining the participation of the local community have to be interlinked says Benzidia et al., (2021). To elaborate on these factors by emphasising case illustrations, participant opinion and practical approaches, "deductive approaches" are considered the most suitable to include in this case.

Responsibility of the organisations related to the construction projects, analysis of the business environment and creating an impact on the reduction of wastes by ensuring high efficiency could be critically deduced with theoretical interpretation in the study conducted by Sönnichsen and Clement (2020). Social awareness, the role of legal bodies in decision-making and their impact on sustaining a business environment are also subjectifies in this research systematically with the help of "deductive approaches".

3.5 Research Design

This research design has illustrated the factor of regulations ascertained the production values and environmental sustainability by including a descriptive illustration of the case examples presented by the study participants suggests Bag et al., (2020). The study has drawn information from different domains to symbolise participants' roles, consumption norms associated with sustainability, and strategies adopted to reduce environmental dilemmas. As per Khan et al., (2020) The research has focused on developing the organisational structure and the business environment to keep the productive goals of the construction to draw importance upon sustainability from five specific standpoints. These are "people", "planet", "prosperity", "peace", and "partnerships", respectively.

Therefore, the descriptive design that has been followed in this research effectively envisaged the relations of the participants with sustainable construction and the time of their participation. Analysis of the collected data based on different response percentages of the participants elaborated their interest in the uprising issues like population, resource exploitation and carbon emissions and others.

3.6 Research Strategy

Information collected for the research purpose has drawn information related to the materials used for construction. It also entertained the designs followed for sustainability, people's interest in retaining environmental stability, knowledge on climate change and global warming and carbon emissions and other issues, respectively by Umar et al., (2020). Collection of information, utilisation of the various resources, and dedication to outcomes are subjectified in this case with the help of survey results and related quantitative information. Questions are designed by aligning with the research parameters to cumulate the goals of the organisation and its regulated frameworks. These frameworks include input questions related to the positive roles of social awareness, business regulations and others, highlighting the environmental responsibility of the construction firms.

"Mediation factors" include the construction drives of the Environment to retain the social structure, energy usage and the impact on the supply chain due to sustainable derives in the construction projects. "Modelling factors" like drawing importance on profitability and restraining resource usage up to a specific limit, social and environmental impact are the operational matters incorporated in the development of the concept.

3.7 Data collection

"Quantitative primary studies" have taken place for this research to check the regulations practised for sustaining environmental protection during a construction project by including 500 participants. With the help of Google Forms, participants are asked several questions on the subject, including construction materials, techniques used for the construction, their impact on the resources and Environment, their contribution to carbon emission and others by Li et al., (2020). Aside from the information related to the construction materials, their role in green construction has been signified to sustain the positive outcomes from people's awareness and participation. The study includes the influences of the stakeholders on different national and international projects and the role of regulatory bodies in supervising the approaches for checking the construction projects sustaining environment-friendly actions.

4 Quantitative Analysis & Results

The analysis of data in the research sector relies heavily on the results of statistical tests. In this research, we used several statistical analyses to learn more about the interconnections and regularities present in our data. To get a complete picture of our sample population and the connections between our variables, we did demographic, reliability, descriptive, and bivariate correlation analyses. We next checked our data for factor analysis potential using KMO and Bartlett's research. We also conducted a moderation study using hierarchical multiple regression to investigate the possibility that any of our independent variables could be moderating our dependent one. Last but not least, we put our theoretical model to the test using confirmatory factor analysis and structural equation modelling using Amos tests. We hoped that by doing these statistical analyses, we would be able to make sense of the intricate connections between our data points.

4.1 Demographic Analysis

From the quantitative surveys, it was observed that, 34.3% of the 500 participants are female. 59.8% of men favour the idea. 1.3% of the 500 participants are non-binary and support environmental sustainability. The Education demographic showed that 4.4% of 500 bachelor's degree holders approved of the idea. However, 16.7% have G.C.S.C., and 14.3% have HNC degrees, encouraging sustainability. 31.7% have master's degrees, and 9.4% have PhDs. Degree promotes environmental sustainability Rajathi and Chandran (2019).

6.1% are academic researchers, 24.1% are civil engineers, 3.9% are logistic managers, and 20% are procurement managers. 19.6% of construction managers and 4.1% of QSEs supported environmental sustainability. Quantity Surveyors, site managers, and students assist in economic sustainability. The 18-24 age group has 26.9%, while the 25-34 age group has 40.2%. 18.3% are 35-44, and 9.1% are 45-54, promoting environmental sustainability. Experienced participants, 1-5 years, supported the notion at 36.1%. The 6-10-year experience group has 16.9%. They advocate environmental sustainability Arkkelin (2014).

4.2 Bivariate Correlations Analysis

The correlation analysis has effectively reflected that the values represented in this rarefied are higher than the average value of the 5-point Linkert scale and hence can be considered valid and reliable

according to Swank and Mullen (2017). This correlation standard from Table 2 has reflected that it has elevated the interrelation between the identified Dependent Variables and Independent Variables.

Table 2. Bivariate Correlations Analysis

S.no	Co-efficient	ER	AR	WR	S.A.	EC	ERY	FCT	LER	ES	SD
ER	Pearson correlation	1	0.668	0.617	0.591	0.611	0.607	0.566	0.605	0.582	0.55
AR	Pearson correlation	0.688	1	0.711	0.617	0.647	0.593	0.634	0.581	0.573	0.554
WR	Pearson correlation	0.617	0.711	1	0.693	0.632	0.615	0.570	0.612	0.571	0.570
SA	Pearson correlation	0.591	0.617	0.693	1	0.683	0.614	0.590	0.664	0.613	0.600
EC	Pearson correlation	0.611	0.647	0.632	0.683	1	0.662	0.657	0.662	0.650	0.625
ERY	Pearson correlation	0.607	0.593	0.615	0.614	0.662	1	0.624	0.650	0.644	0.638
FCT	Pearson correlation	0.566	0.634	0.570	0.590	0.657	0.624	1	0.689	0.639	0.666
LER	Pearson correlation	0.605	0.581	0.612	0.664	0.662	0.650	0.689	1	0.708	0.665
ES	Pearson correlation	0.582	0.573	0.571	0.613	0.650	0.644	0.639	0.708	1	0.717
SD	Pearson correlation	0.555	0.554	0.570	0.600	0.625	0.638	0.666	0.665	0.717	1

4.3 Moderation Analysis-Hierarchical Multiple Regression Analysis

In data analysis, multiple hierarchical regression is often used to explain and predict a dependent variable using a variety of independent predictor variables by Cohen et al., (2003). The standard of the regression analysis is established that the data reflecting a value lower than 0.05 are found to be contemplating a validity percentage of 95%. On the other hand, a value less than or equal to 0.10 reflects a validity percentage of 90%. Hence it signifies that the overall analysis represents relevance between the identified factors with the chosen Dependent Variables of environmental sustainability.

Table 3. Analysis by Considering Economic Sustainability as a Dependent Factor

S.no	Factors	Unstandardised Coefficients	Significance
Dependent on Independent variables			
1	Constant	1.177	<0.001
	Environmental Regulations	0.375	<0.001
	Accessibility of Resources	0.337	<0.001
Dependent on Independent and Moderating variables			
2	Constant	0.650	<0.001
	Environmental Regulations	0.149	<0.001
	Accessibility of Resources	0.106	0.013
	Financial Constraints and Technology	0.183	<0.001
	Lack of awareness of environmental regulations	0.407	<0.001
Dependent on Independent, Moderating and Interaction of Moderating and Independent factors			
3	Constant	2.067	<0.001
	Environmental Regulations	-0.622	0.011
	Accessibility of Resources	0.509	0.028
	Financial Constraints and Technology	0.275	0.201
	Lack of awareness of environmental regulations	-0.045	0.838
	FCTER	0.057	0.414
	LERER	0.139	0.042
	FCTAR	-0.085	0.187
	LERAR	-0.020	0.751

If the significance is less than 0.05, the data accumulated is 95% valid, and if it is less than or equal to 0.10, it is 90% accurate. Here in Table 3 the sign represents the accuracy of the data accumulated.

The features of the below Table 4 in columns 3 through 6 of the following indicate Sustainable Development (SD) as a dependent variable. In contrast, the values in columns 1 through 3 show the co-efficient values of economic sustainability. Regression Strong to moderate correlations between predictor variables is indicated by R and R Squared values between 0.6 and 0.8 and 0.6-0.35, respectively. The regression models are accurate to within 4% if one considers the standard error of the estimate values, which falls between 0.42 and 0.55.

Table 4. Co-efficient Of Determination

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.632	0.400	0.398	0.51049
2	0.756	0.571	0.568	0.43252
3	0.763	0.582	0.576	0.42820
4	0.607	0.368	0.366	0.54690
5	0.736	0.542	0.538	0.46668
6	0.740	0.548	0.541	0.46537

a. Predictors: (Constant), AR, ER
b. Predictors: (Constant), AR, ER, LER, FCT
c. Predictors: (Constant), AR, ER, LER, FCT, LERAR, FCTER, FCTAR, LERER

4.3.1 Economic Sustainability as Dependent Factor (2-way Linear Interaction's by Jeremy Dawson)

The analysis of a plot by Dawson sheds fresh light on the interaction of personal and environmental factors that affect employees' well-being, contentment, and productivity at work. Two-way linear interactions are often used in this field of statistics when looking at such linkages. I'm learning more about the moderating variables that affect the results.

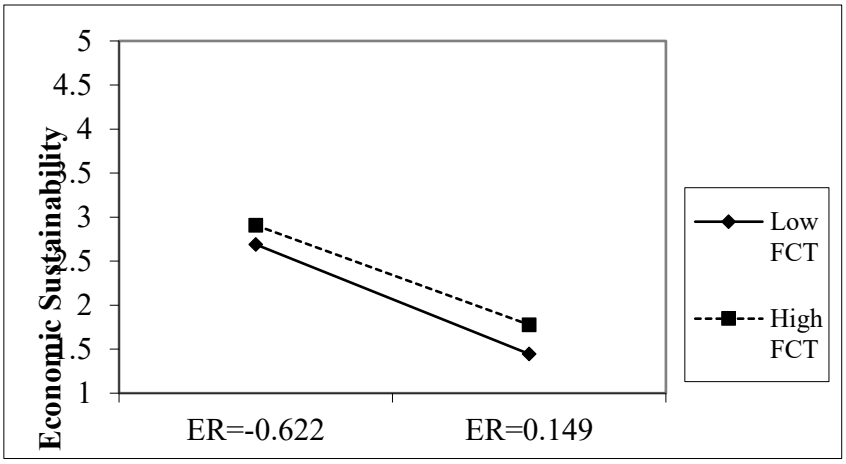

Figure 2. ER&FCT 2-way Linear Interaction

Figure 2 analysis reflects that the identified E.R. achieved a point of intersection across the mediator value between 2 and 2.5. It also reflects that one of the factors is degrading, whereas the other one is upgrading, and hence they are contemplating the wrong approach.

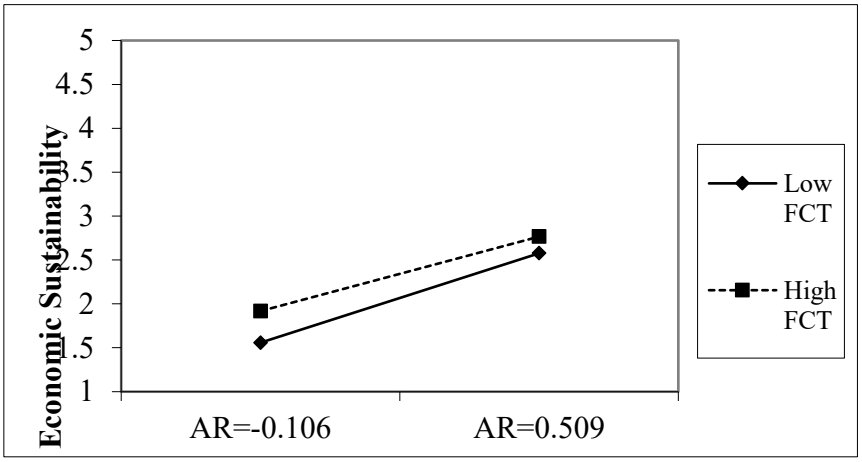

Figure 3. AR&FCT 2-way linear Interaction

The analysis of the Figure 3 graph represents a parallel interaction between the identified A.R. It will reflect an elevated approach and contribute to the overall monitoring of the sector.

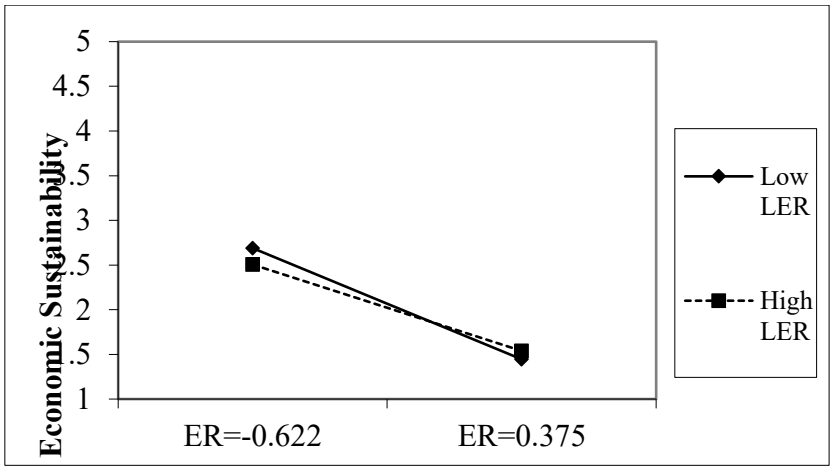

Figure 4. ER&LER 2-way linear Interaction

The analysis of the Figure 4 graph is said that E.R. and LER are found to have a parallel connection. Hence, they are considered to be dependent on the identified sustainability approach.

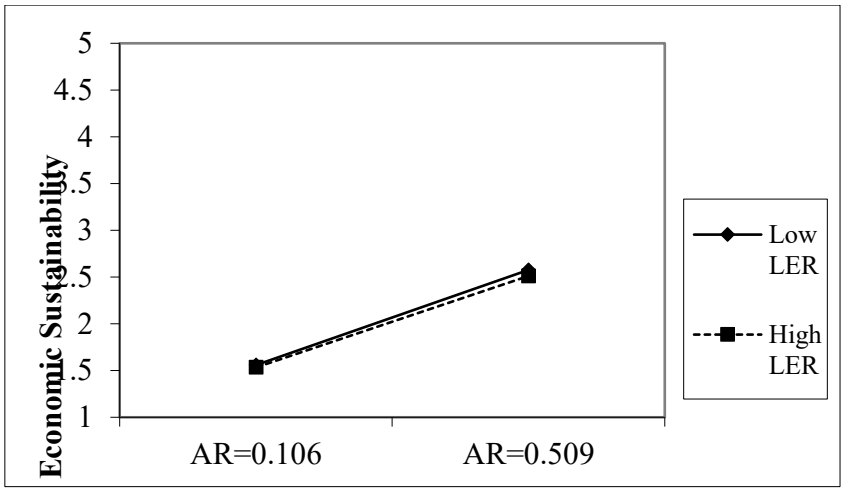

Figure 5. AR&LER 2-way linear Interaction

In Figure 5 the analysis of the A.R. and LER relation has reflected that it has contributed to the overall elevation of the sector by reflecting a valid and interdependent relationship with the inclusion of a parallel graph.

4.3.2 Sustainable Design as Dependent Factor (2-way Linear Interactions)

From Table 5 including the dependency standard is identified as a value of over 0.50 and reflects a validity ratio of 90%. On the other hand, a value less than 0.50 reflects a validity ratio of 95%.

Table 5. Analysis by Considering Sustainable Design as a Dependent Factor

S.no	Factors	Unstandardised Co-efficient's	Significance
Dependent to independent variables			
1	Constant	1.167	<0.001
	Environmental Regulations	0.363	<0.001
	Accessibility of Resources	0.351	<0.001
Dependent to Independent and Moderating variables			
2	Constant	0.627	<0.001
	Environmental Regulations	0.135	0.003
	Accessibility of Resources	0.083	0.072
	Financial Constraints and Technology	0.311	<0.001
	Lack of awareness of environmental regulations	0.321	<0.001
Dependent to Independent, Moderating and Interaction of Moderating and Independent factors			
3	Constant	1.679	0.003
	Environmental Regulations	0.088	0.741
	Accessibility of Resources	-0.143	0.567
	Financial Constraints and Technology	0.571	0.015
	Lack of awareness of environmental regulations	-0.212	0.378
	FCTER	-0.091	0.232
	LERER	0.104	0.163
	FCTAR	0.022	0.749
	LERAR	0.035	0.608

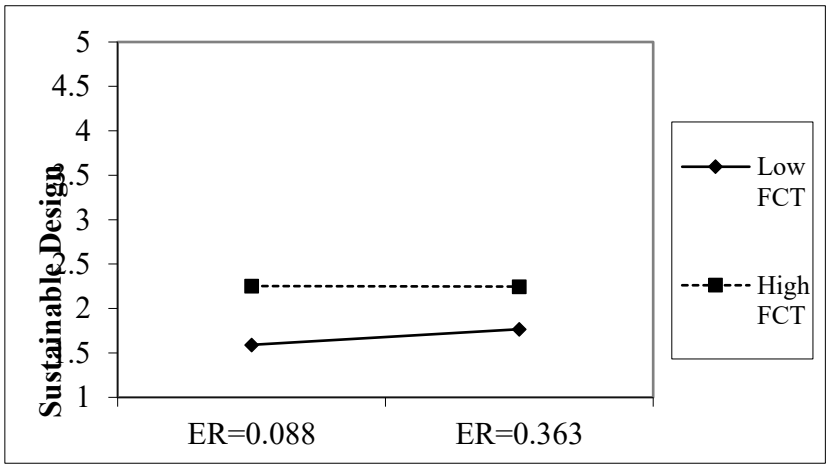

Figure 6. ER&FCT 2-way linear Interaction

In Figure 6 the parallel relationship between the E.R. and F.C.T. reflects a standard of dependency between these two and contributes to the overall successful approach of this analysis.

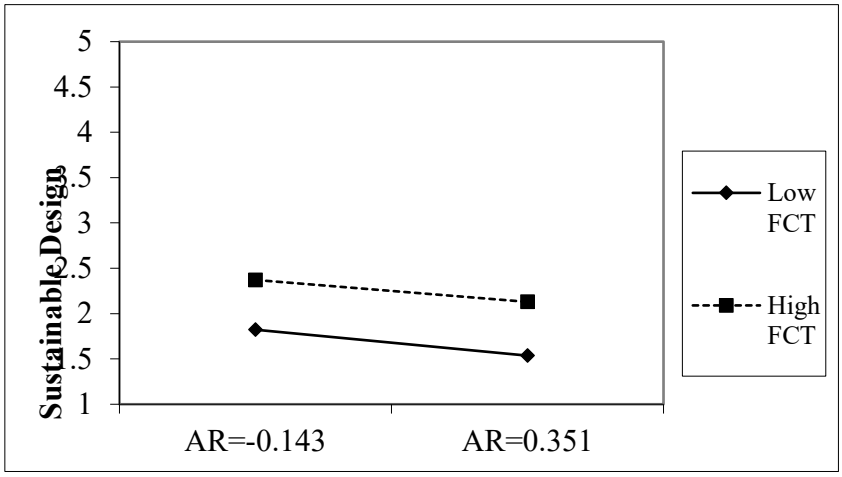

Figure 7. AR&FCT 2-way linear Interaction

In Figure 7 the parallel relationship between the A.R. and F.C.T. reflects a standard of dependency between these two and contributes to the overall successful approach of this analysis.

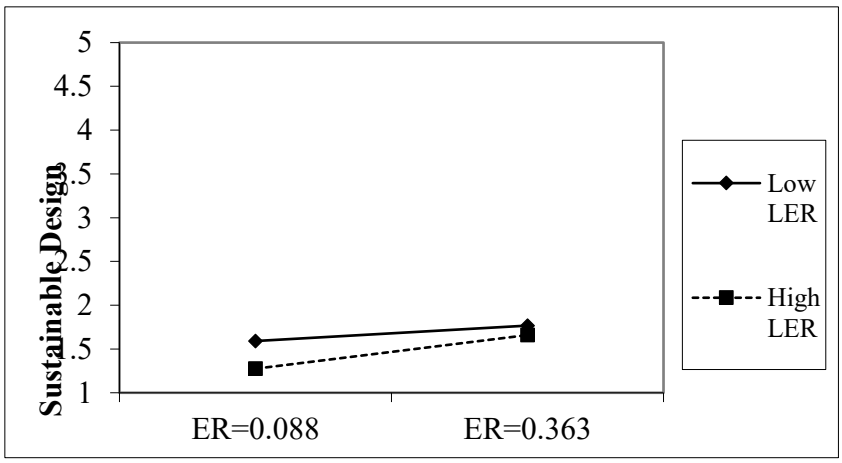

Figure 8. ER&LER 2-way linear Interaction

In Figure 8 the parallel relationship between the E.R. and F.C.T. reflects a standard of dependency between these two and contributes to the overall successful approach of this analysis.

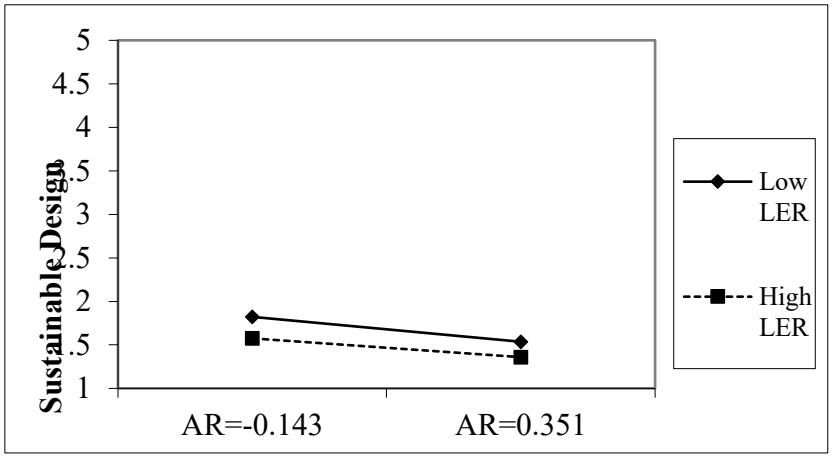

Figure 9. AR&LER 2-way linear Interaction

In Figure 9 the parallel graph for A.R. and LER reflects a high dependency value and demonstrates a standard's validity.

4.4 Confirmatory Factor Analysis

A statistical technique called confirmatory factor analysis (C.F.A.) examines how effectively your indicators capture your unobserved constructs and determines whether they are singularly distinct. An unobservable concept is frequently called a "factor" in a C.F.A. Thus, "factor" denotes an observable construct we are attempting to quantify. An unseen variable is symbolised in a diagram by a circle or oval in views of Mustafa et al., (2020). A single-headed arrow will lead from the unobserved construct to each indicator that measures the unseen variable.

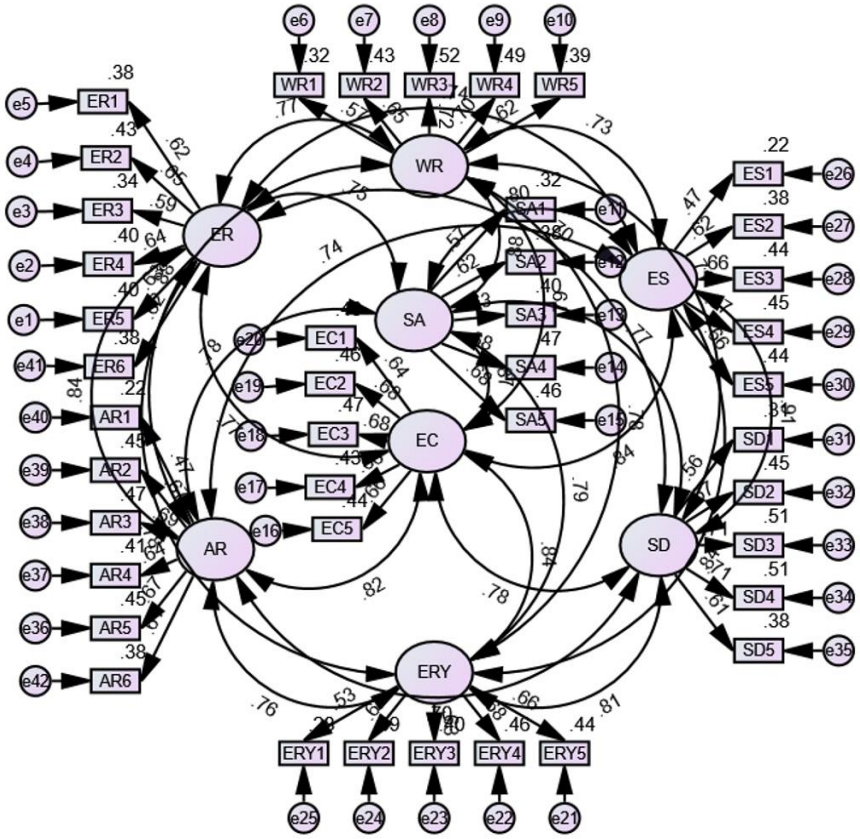

Figure 10. C.F.A. Initial and Final Model

Table 6. C.F.A. Model Fit

Tests	CMIN/DF	P	GFI	CFI	RMSEA	PCFI	Pclose
Initial & Final	2.028	0.00	0.875	0.910	0.044	0.836	1.000

The primary lookout points for the Figure 10 is S.A.F. The other interdependent factors relevant and closely related to this topic can be regarded as E.S.F., ERF, A.R.F., E.R.Y.F., S.D.F., E.C.F., and E.S.F. are found to be reflecting a graphical representation of interdependent factors. On the other hand, they monitor the element that the study has contributed to the independent factor. This standard has been affirmative because the terms can violate and elevate the primary factor According to Brown (2015). The values from Table 6 reflect a higher than 0.5 value and are said to demand a standard for relevance

with the identified Dependent Variables and Independent Variables. A higher than 0.5 score is displayed to be reflecting a relevant matter for explaining a criterion of significance and interdependence and is successful in elevating the standard. The value of 1.991 demonstrates a measure of C.M.I.N. value and has expressed the importance of independence and validity. The G.F.I. reflects a discount of 0.732, and this has enhanced the elevation of the standardized attribute, which on the other hand, will contribute to the monitoring of the validity standard. Baselines reflect the criteria for 0.948 values, which will elevate the validity standard and confirm the middle of interdependency according to Gatignon (2014). The P.A.M. measure reflects a coefficient of 0.808 for explaining the idol of relevance and validity. The NCP result has reflected a value of 369.598 for establishing a standard of significance. F.M.I.N.'s value will elevate to an average of reliability with a value of 1.104, reflecting the highest amount of reality. R.M.S.E.A. demonstrates a value of 0.991 and contemplates a matter of the high validity standard.

4.5 Structural Equation Modelling

The analysis of the below Figure 11 reflects that the identified factors are correlated and reflect a high dependency standard in monitoring the data performance approach and elevating the standard for establishing validity by Hayashi et al., (2007). Current research supports the direct technique for modelling missing values in a structural equation model. However, numerous circumstances exclude its beneficial use according to Brown (2014).

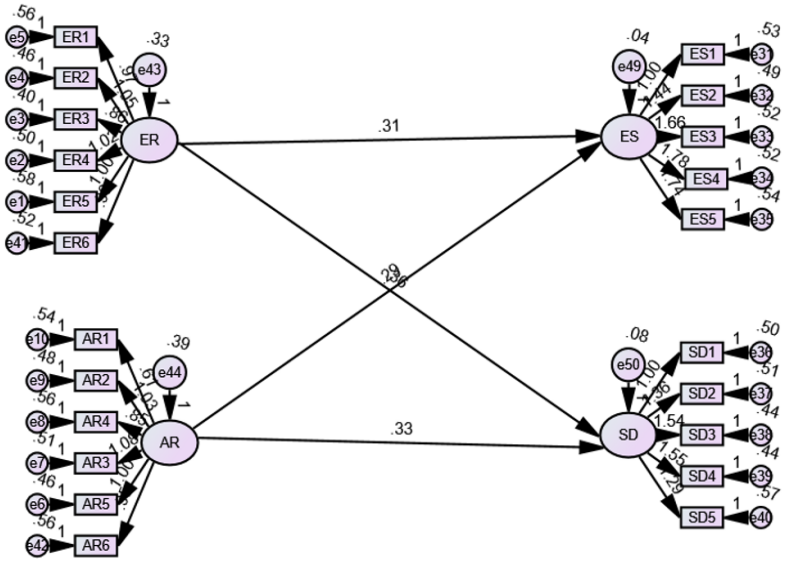

Figure 11. S.E.M. model for Independent to Dependent variables

Table 7. Direct Method Regression weights

Relations			Estimate	S.E.	C.R.	P
Economic Sustainability	<---	Environmental Regulations	.314	.047	6.721	***
Sustainable Design	<---	Environmental Regulations	.355	.049	7.308	***
Economic Sustainability	<---	Accessibility of Resources	.289	.042	6.929	***
Sustainable Design	<---	Accessibility of Resources	.335	.044	7.657	***

Both sustainable design and environmental legislation are demonstrated to have a favourable and statistically significant relationship with economic sustainability in the Table 7. Both economic and

design sustainability have a positive and statistically significant relationship with availability of resources.

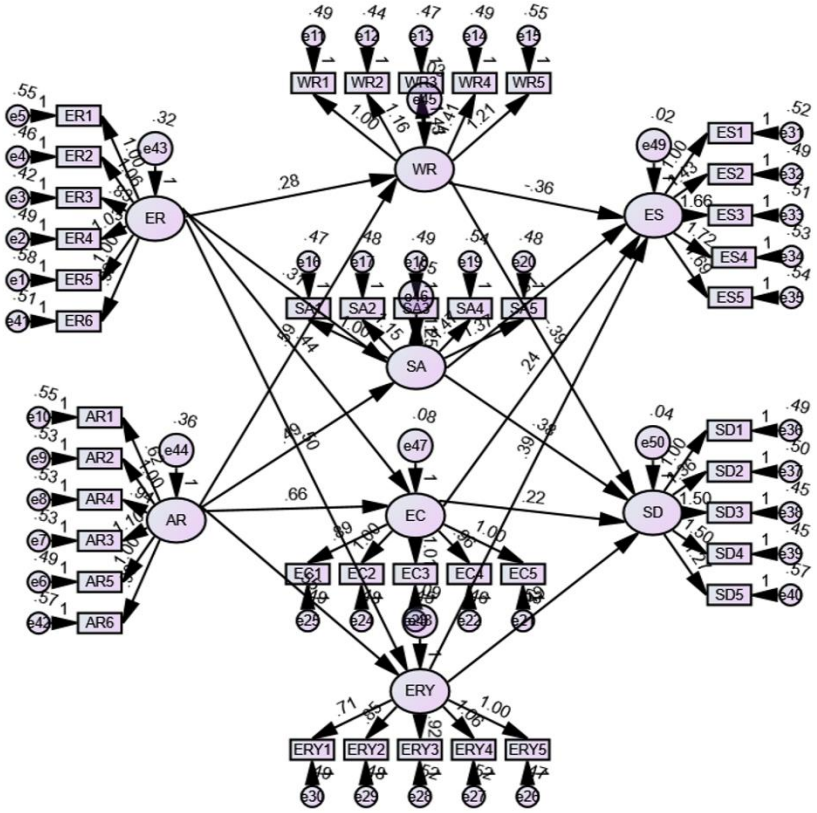

Figure 12. S.E.M. model for Independent, Mediating and Dependent variables

A group of statistical methods known as structural equation modelling (S.E.M.) are used to quantify and examine the connections between latent and observable variables. It explores linear causal links between variables while simultaneously correcting for measurement error, making it similar to but more potent than regression studies.

Table 8. Indirect Method Regression Weights

Relations			Estimate	S.E.	C.R.	P
Waste Reduction	<---	Environmental Regulations	.279	.039	7.078	***
Social Awareness	<---	Environmental Regulations	.309	.043	7.183	***
Energy Consumption	<---	Environmental Regulations	.436	.055	7.972	***
Environmental Responsibility	<---	Environmental Regulations	.497	.058	8.617	***
Waste Reduction	<---	Accessibility of Resources	.586	.059	9.887	***
Social Awareness	<---	Accessibility of Resources	.491	.053	9.197	***
Energy Consumption	<---	Accessibility of Resources	.656	.063	10.388	***
Environmental Responsibility	<---	Accessibility of Resources	.547	.056	9.733	***
Economic Sustainability	<---	Waste Reduction	-.355	.099	-3.588	***
Sustainable Design	<---	Waste Reduction	-.390	.113	-3.433	***
Economic Sustainability	<---	Social Awareness	.313	.092	3.393	***
Sustainable Design	<---	Social Awareness	.375	.110	3.425	***
Economic Sustainability	<---	Energy Consumption	.242	.067	3.634	***
Sustainable Design	<---	Energy Consumption	.217	.075	2.884	.004
Economic Sustainability	<---	Environmental Responsibility	.394	.072	5.452	***
Sustainable Design	<---	Environmental Responsibility	.493	.084	5.863	***

Table 8 is affirmative in addressing the inter-dependency standard among the identified Dependent Variables and Independent Variables.

The Figure 12 reflects a high standard of graphical representation reflecting a standardised approach of relevance among the identified DV and IV and has contributed to the overall elevation of the sector. These findings are well aligned with earlier research conducted by Hayashi et al., (2007)

5 Discussion

5.1 Critical Views of the Factors

There are different energy-efficient premises followed by managers of the construction industry to enhance their construction more valuable for the consumers and bring lots of positive changes effectively. Therefore, the construction industry is also working on adopting sustainable technologies to bring sustainability to their workplace management activities as per Cristino et al., (2021). After that, The optimisation of waste management activities with a correct implementation of technological devices. It will allow construction businesses to gain high agility in enhancing organisations' development and gaining advantages in improving supply chain activities. The construction industry managers needed to build strong connections with the suppliers and customers, which will assist in effectively achieving their targeted organisational goals. Therefore, creating sustainable and solid relationships with suppliers, customers, and other stakeholders will support construction businesses to gain effective outcomes and develop strong customer connections by França et al., (2017). Moreover, suitable theoretical adoptions are needed to empower business agility and achieve high sustainability for operating businesses in targeted markets.

5.2 An Exploration of Statistical and Structural Analysis Using SPSS and AMOS

Quantitative research examined how age, gender, education, and income affected participants' long-term environmental sustainability beliefs. Gender, education, occupation, and age significantly affect environmental sustainability outcomes. The study's variables and factor analysis were trustworthy and relevant to environmental sustainability, with a high Cronbach's alpha value and KMO score. Environmental sustainability requires certain traits, according to research. Correlation coefficients for all ER, AR, WR, SA, EC, ERY, FCT, LER, ES, and SD permutations are presented below. Closer to 1 has a higher beneficial connection. ER and SD correlate by 0.555, although ES and SD correlate by 0.717. A positive cumulative correlation between variables implies causality. Multiple regression tree long-term economic viability outcomes are below. Environmental regulations and resource availability affected economic viability in the first model. In the second model, environmental law and cutting-edge technology experts moderate. Every factor except technology and finance is statistically significant. The third model includes moderating-independent variable interaction terms. Environmental regulatory ignorance was the only significant predictor. Long-term Multiple-Hierarchy Analysis of ecological rules and resource availability are crucial. This section examines moderation and dependent variable independence. Environmental compliance involves regulations, resources, finance, and expertise according to Ong and Puteh (2017). Finally, the independent, moderating, and interfering variables are investigated with the dependent variable. The constant is 1.679, with a significance level of 0.003. Technology highly correlates with financial limits (0.015), although environmental regulations, resource availability, and ignorance of ecological standards show

negligible connections. FCTER is -0.091, LERER 0.104, FCTAR 0.022, and LERAR 0.035. Only LERER and FCTAR had non-significant p-values.

This section discusses AMOS CFA data and interpretation. S.A.F., E.S.F., ERF, A.R.F., E.R.Y.F., S.D.F., and E.C.F. are some factors. Use the information if your dependability score is above 0.5. A C.M.I.N. score of 1.991 and a G.F.I. discount of 0.732 indicate data dependability. The partial autocorrelation coefficient (0.808) and interdependence midpoint (0.948) differ substantially from 0.948. 1.104 is the most reliable FMIN. The high R.M.S.E.A. (0.991) shows validity. The direct and indirect regression weights show the relevance of environmental norms for environmentally and economically successful design. The synopsis may include this information Gallagher et al., (2008).

5.3 Theoretical Alignment

5.3.1 Contingency theory

The leaders of construction businesses must follow the steps or procedures of contingency theory, which will enhance leadership development and implement strategies relying on organisational values and situations. As per Otley (2016), The three stages are followed by businesses to empower organisational efficiency and optimise corporate growth effectively. Hence, the exemplary implementation of the contingency model has supported business leaders to enhance their leadership styles and provide practical guidance to executive employees. Moreover, there are three stages followed by project managers to strengthen project developments and bring sustainable advantages in maintaining healthy relationships effectively.

Leaders have to provide clear and realistic views to their organisational team to perform the management activities accordingly, which will support reducing negative impact in enhancing the development of the construction industry and providing more sustainable advantages to their organisational teams, which will allow them to bring the organisational effectiveness remove bias factors from their workplace activities. As per the view of Niemand et al. (2021), following this theoretical framework, leaders of businesses have to be situation-oriented and not be stereotyped, which will bring positive outcomes in organisational management. After that, the implication of creative and innovative ideas of leaders will assist leaders of construction businesses in empowering their team development and getting more advantages in reaching organisational goals.

5.3.2 Improving Interpersonal Competence and Communication Skills through Stakeholder Theory

The construction firm managers demonstrates management of healthy relationships with their stakeholders, allowing them to bring sustainability and make positive changes in organisational effectiveness. Construction businesses must maintain healthy relationships with suppliers, customers, investors, employees, media, trade unions, communities, and customers by Freeman et al., (2021). Moreover, this theoretical concept will give construction companies more advantages in motivating their stakeholders. On the other hand, applying this theoretical framework will allow construction businesses to enhance the motivation of their employees and achieve the organisational goals effectively.

In Conclusion, Construction managers should adopt a stakeholder orientation to improve staff social skills and communication. This strategy requires identifying and then interacting with all key stakeholders to understand their needs, desires, and concerns. Stakeholder management and

communication may increase a company's legitimacy, customer retention, and word-of-mouth. According to stakeholder theory, construction businesses should consider how their work will affect society and the environment and seek mutually beneficial results. Stakeholder theory may help construction businesses improve corporate social responsibility and sustainability. Their constituents may trust them more, leading to additional business opportunities. Stakeholder theory may also help construction businesses align their aims with their stakeholders. There are many efficiency and sustainability-related concerns that the construction industry is addressing. However, by using relevant strategies and pertinent theoretical frameworks, construction businesses may get over these obstacles and effectively complete their tasks. The contingency theory might aid CEOs in developing more flexible management strategies. Meanwhile, the stakeholder theory may help organisations improve their interpersonal and communication skills, build a trustworthy relationship with stakeholders, and generate advantages that are advantageous to everyone.

5.4 Standarised Ecological management practices

5.4.1 Innovation and adoption of EMP (Ecological Management practices)

It has been effectively established that including modernised concepts and the methodologies adopted across the U.K. and China is concentrated in waste management by Ramanathan et al., (2017). The inclusion of a waste management strategy and modernised systems for the overall elevation of the sector has been incorporated effectively in corporate height.

5.4.2 Determinants of Innovation

It has been identified that including the determinants and the standardised attributes responsible for the implementation of E.M.P. has contributed to the overall elevation of the sector and the adaptation made from the environmental perspective Ramanathan et al., (2017). This will elevate the performance standard of the companies and will contribute to overall elevation.

The individual factors, namely the creation of personal imitativeness and the overall implications of the E.M.P. in the waste management sectors, are intertwined. Moreover, the regulations regarding efficacy development and the managerial implications of reducing carbon footprints are used vigorously in views of Pekovic and Bouziri (2021). The crucial considerations seen in this context are the licensed agreements and the market correspondence of the individual variability evident in the case of customers' experiential analysis.

The sustainable design formulations for managing environmentally responsible technical efficacy development are the essential paradigms for developing data actualisations by Wang et al., (2022). Moreover, the collective initiations of the environmental awareness campaigning forums are crucial in developing the marketing logistics. The renewability and the biodegradability perspectives of the resource rarity and the immutability paradigms are managed through the measurement of environmental ethics. Moreover, economic sustainability is aligned with the case development of the reduction of debt and insolvency ratio measurements stated by Al Muhairi and Nobanee (2019). The financial transactions-oriented fluctuations and the symmetric re-distributions of the financial resiliencies-oriented pricing distributions are linked. The prominent verifications of the technical efficacy development are integrated through evaluating the environmental Protection regimes.

The critical implications of the emergences of waste management are interlinked into the case development of technical scepticism analytics. The resiliencies and the fluctuation evident in the case

of cross-cultural stakeholder engagement policy development are analysed through the actualisation of the innovative determinant selections according to Famiyeh et al., (2018). Clarifications regarding the waste management evaluations are intervened with the innovative entrepreneurship management of significant concerns.

This study demonstrates why it is essential to include determinants and standardised attributes into E.M.P. implementation in the waste management business to promote environmental sustainability. This study shows the synergistic effects of individual initiative, legislation, and institutional policy in the fight against pollution. Sustainable design formulations and environmental awareness campaigns are essential in developing marketing logistics, as is measuring environmental ethics for managing renewability and biodegradability perspectives. Metrics like the debt-to-equity and insolvency ratios are often used to assess a country's fiscal health. The study demonstrates the need to evaluate environmental protection regimes to ensure the development of technological effectiveness. It is essential to include the perspectives of a wide range of culturally diverse stakeholders when evaluating waste management projects. As the study confirms, implementing an E.M.P. strategy benefits both commercial output and environmental sustainability.

6 Conclusion

Sustainable adoption will support businesses to maximise the growth of their business capabilities and achieve higher sustainability in managing organisational activities effectively. Construction business managers must communicate effectively with their employees and stakeholders, which will support expanding the business faster and achieving higher sustainability in optimising corporate management.

Input and moderating factors are crucial for attaining sustainable design in organisational leadership and operations. Environmental regulations and resource allocation are input factors in governance, whereas waste reduction and social awareness are mediating factors in managing operational challenges. Integrating sustainable design in construction can facilitate environmental preservation, while efficient resource management is essential for incorporating mitigating factors into operations. Moderating factors such as financial constraints, maintenance and operation deficiencies, and insufficient awareness of environmental sustainability can hinder the process. Hence, it is essential to recognise and regulate these moderating variables to minimise their impact on the result. Construction firms can promote sustainable development by recognising risks and tackling challenges. This approach facilitates project stakeholders in obtaining an understanding of both the internal and external factors affecting the project, thereby enabling them to undertake requisite actions.

The waste management sectors in both the United Kingdom and China would benefit significantly from implementing environmental management practices (EMP). EMP implementation's underlying factors and standardised qualities have boosted the industry's overall environmental adaption and elevation. Personal imitation, enhanced effectiveness, management consequences, licencing agreements, and market correspondence are all part of the EMP conceptual framework. While economic sustainability is associated with debt and insolvency ratio analyses, sustainable design formulations and environmental awareness campaigns are essential for marketing logistics. Evaluating ecological protection regimes, elaborating on waste management assessments, and using creative entrepreneurship management are all part of verifying the growth of technological

effectiveness. Improvements in efficiency and effectiveness in the waste management industry cannot be achieved without including these elements.

The positive effects of construction managers who take the time to learn about their stakeholders' wants, requirements, and concerns. Trust, client loyalty, and positive word of mouth may all increase with this method. Corporate social responsibility and sustainability may benefit from stakeholder theory's call for businesses to think about social and environmental repercussions and seek win-win solutions. In addition to improving stakeholder engagement, the idea may also be used to increase sales. The line also suggests that CEOs study contingency theory and makes reference to the use of procedures and theoretical frameworks to solve efficiency and environmental challenges.

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Data Availability Statement
Data utilized for this research is available on a reasonable request.

Conflicts of Interest
The authors declare no conflict of interest.

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