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The role of sustainability strategies for climate adaptation in enhancing institutional performance for colleges and universities is a case analysis of higher education institution development

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Abstract: This research aims to study the effects that sustainability strategies (SUST) have on the institutional performance of higher education institutions (INPE) in an era characterized by a rapidly changing climate. It examines sustainability strategy's environmental, economic, social, and technological dimensions and how they affect university performance stability. Now that I've clearly stated my methodological approach, let us get into it in more detail. Two hundred sixty questionnaires were distributed to faculty members at the University of Kufa, of which two hundred forty-five were returned and deemed valid for analysis. The author used advanced statistical methods to gauge sustainability strategies' impact on institutional performance. In addition, a literature review examined best global practices in sustainability policy at colleges and universities worldwide. Turning to research findings, the use of sustainability strategies contributed more than 62% towards improving institutional performance through resource efficiency, an absolute reduction in operating costs, and a structure that links various sections of the university together socially. Environmental sustainability equally accounts for 59.3% of lowering damage done to the university campus by natural disasters. Economic sustainability supports financial stability for this city by 57.8%. Furthermore, making full use of the digital environment helps teaching efficiency to sit at 60.5% due to the integration of modern technology in educational and administrative work. Whereas universities could gain many benefits from sustainability strategies, research also discovered that this still faces many challenges in execution and hasn't fully aroused the consciousness of universities as a whole—such as institutional finance, heavy public opposition to innovation, or low understanding levels of WhatsApp. Be it resolved that higher education institutions leave out something necessary, and institutional sustainability is important under present climate change conditions. By integrating a long-term and short-term model of development for institutions, everything becomes possible: colleges and universities will emerge equipped with new life from higher education and begin towards fitness for their second career.

Keywords: *Climate conditions, Higher education institutions, Institutional performance, Sustainability strategies.*

1. Introduction

The larger ambient conditions under which higher education institutions function is marked by rapid climate changes that are uniquely unprecedented in terms of the nature of the challenges these changes pose for sustainability and institutional efficiency. In addition to extreme environmental events like increases in temperature, resource depletion and changing climates, it affects university facilities, educational policy, research agendas, and sustainable funding [1]. Thus, implementing effective sustainability strategies has become crucial for these institutions to continue delivering their academic and societal mission whilst reducing their environmental footprint and increasing their contribution towards sustainable development [2].

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Integrating sustainability strategies is one of the key factors that aims to enhance the patency of higher education institutions, increase resource efficiency, reduce operational costs, and increase competitiveness through investments in green technology and sustainability initiatives [3]. In addition, this incorporation infuses a consciousness among students and researchers about the different environmental issues that society faces, thus equipping them with the knowledge they need to create new forms of knowledge to mitigate the climate problems that we must contend with Feinstein and Mach [4]. Furthermore, by adopting sustainability initiatives, universities can build strategic alliances with industry and government with the potential for funding and supporting research in renewable energy, green technologies, and sustainable urban development [5].

Strong evidence recently suggests that holistic sustainability strategies can contribute to improving educational institutions' long-term viability by reducing carbon emissions of the institution's associated infrastructure, providing quality infrastructure, and increasing faculty and student satisfaction levels [6]. Green building, waste management, and energy-saving investment directly feed into delivering the United Nations sustainable development goals [7]. Thus, the role of sustainability strategies in institutional performance is an area in which research is necessary to provide new solutions that ensure the sustainability of these institutions and provide agile responses to rapid climatic, economic, and social changes [8].

Based on the challenges faced by Higher education institutions in implementing sustainable environmental policies and exploring global best practices that are opportunities for gap analysis in this field, this study aims to investigate the effect of sustainability strategies on institutional performance. We aimed to provide a strategic framework for educational institutions to create improved sustainability policies, in the interest of achieving integrated operational and academic sustainability [9]. Higher education institutions from both developing and developed world can learn from successful experiences some advanced sustainability models, frameworks, and tactics these experiences will increase institutional excellence and sharpen the role of higher education institutions in sustaining the green economy and sustainable society [10].

It is a substantial scientific contribution to the sustainability of institutions and reviews the link between sustainability and institutional performance in higher education. It emphasizes how institutions tackle climate change strategically and presents the potential roles of universities in creating a sustainable society based on research with implications for many sectors (renewable energy, environmental resource planning, and education for sustainable development) and innovation, both in the economic and social realms [11]. In the face of these global challenges, higher education institutions need to develop flexible and regenerative systems so that they can reach their educational and research ends while ensuring their ecological and economic viability in the long-term [12].

2. Literature Review

2.1. Sustainable Practices in Universities

The concept of sustainability has turned out to be a building block in higher education institutions, as universities are attempting to embed the environmental, economic, and social dimensions of sustainability into their academic and administrative processes. The strategies for sustainability adopted in higher education are discussed in this review, where several authors are cited in the documents supporting those strategies [13].

2.1.1. Sustainability in Higher Education

Higher education sustainability is the broad term used to describe the responsibility of higher education systems and institutions to incorporate environmental, social, and economic principles into all aspects of their operations and activities as holistic entities. Research Zwein and Taher [14] argues that sustainable strategic planning plays a vital role in the quality assurance and operational sustainability of academic institutions within the HE sectors.

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2.1.2. Sustainability Strategies in Higher Education Institutions

To become sustainable, higher education institutions pursue different strategies; these strategies can be classified into three main dimensions:

2.1.2.1. Environmental Sustainability

Environmental Resource Management: Universities are working to reduce the negative environmental consequences of their operations by increasing resource efficiency and reducing waste. A longitudinal nine-year case study conducted at the University of Minho reveals an overarching approach and multi-faceted program that, adopted through all levels of the institution, can facilitate the transition toward sustainable culture within the institution [15].

2.1.2.2. Economic Sustainability

Funding source diversification: To enhance the resource efficiency of financial means and effectuate sustainability, universities are seeking to develop funding source diversification. The policy paper on higher education funding in Egypt highlighted the need to diversify funding sources whilst ensuring the best use of public expenditure on higher education in an efficient and equitable manner [16].

2.1.2.3. Social Sustainability

Improving Social Responsibility Universities contribute to sustainable development with social responsibility. Research Sulila [17] indicates that universities make a meaningful contribution to sustainable development by engaging their communities and facilitating social projects that will help their local context develop sustainably.

2.1.3. Difficulties That Sustainability Strategies Encounter

Why Universities Still Struggle to Implement Sustainability Strategies, Even with Good Data Almost everything about the climate crisis is big and complicated: the volume and scale of greenhouse gas emissions, the complexity of social and economic systems, and the multi-faceted nature of adaptation. This complexity poses a massive challenge to the translation of good data into forward-looking action, no matter if the data is made freely and openly accessible, as is mostly the case with climate and sustainability data. Yet climate action is built through thousands of local-level initiatives taken or not taken twice a day, every hour, and every day of the year, thriving or fading with local conditions. For instance, even as climate-related data outlets spanning multiple disciplines increasingly provide freely accessible, transparent, and comparative data (as the key to promoting action) on sustainability strategies among universities for instance, by comparing energy use, emissions, and sustainability-oriented initiatives among campus settings universities still struggle to implement sustainability strategies at the local level

Financial Burden: Certain sustainability initiatives come with high price tags, which can hinder financially challenged institutions [14].

Changing Mindset: When some institutions start implementing new strategies, they experience resistance among the faculty and the students as they are unaware of the significance of sustainability [13].

2.1.4. Best Global Practices

Diponegoro University (UNDIP) in Indonesia: The university has worked to sustainably improve higher education by enacting green policies and conducting research in support of sustainable development [18].

Strategies of sustainability in higher educational institutions demonstrate the will of universities in terms of implementing the development that is able to satisfy the needs of the present without compromising the ability of future generations to meet their own needs. Universities can be shining

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examples in the higher education sector through their curricula, resource efficiency, and efforts to improve community alertness.

2.1.5. Sustainability Strategy Fields in Higher Education Institutions

Higher education institutions aim to embed sustainability in their policies and strategies to reach sustainable development in responding to changes that are social, environmental, and economic. The role of higher education has shifted away from knowledge transfer, as it is now viewed as a critical vehicle to support sustainable development by training professionals who will be responsible for the future and providing innovative solutions for a more sustainable society [19].

2.1.5.1. Environmental Dimension

This dimension encourages institutions to strive for long-term sustainable development by focusing on natural resource management and waste reduction practices. As Abdulghaffar and Williams [15] suggest, "More holistic and integrated approach to sustainability in universities can create a culture of sustainability in their campuses with the increasing energy and water efficiency and pollution reductions.

2.1.5.2. Economic Dimension

The economic component is Hdesigned to improve the economic viability of higher education institutions by diversifying funding streams, curtailing costs, and creating long-term plans to sustain education. As evidenced by Abad-Segura and González-Zamar [16] Flexible and sustainable financial plans allow universities to avoid the problem of financial shortfalls not only without cutting off academic budgets but also without undermining the quality of education and scientific research.

2.1.5.3. Social Dimension

This dimension focuses on bolstering the social responsibility of educational institutions, including contributing to community development, social justice, etc. The findings of the study also indicate that sustainable development in higher education institutions can be achieved by enhancing the role of higher education institutions as community engagement [17] and conducting academic programs and initiatives that promote equal opportunities for all students.

2.1.5.4. Technological Dimension

Digital transformation has also been cited as an essential component of sustainability strategies, as it not only minimizes paper usage but also allows for optimization in the functioning of educational institutions the first place, universities spending on modern technology, including e-learning and digital administration, tend to have a lower environmental footprint compared to others and to support sustainability in education at large,

This dimension entails involving technology in making higher education sustainable, such as digitization of academic processes and minimizing the use of paper on campuses. According to Daniela, et al. [20] it claims that at lower environmental cost and operational efficiency, e-learning and digital management is often the best choice.

2.2. Institutional Performance in Higher Education Institutions

With growing environmental and climate challenges, institutional performance is of utmost importance in securing sustainable development in higher education institutions, also say that climatic conditions affect education quality directly and indirectly and have consequences on the sustainability of infrastructure and the flexibility of institutional policy [21]. Hence, the approach to working toward the sustainable development of higher education institutions needs to be flexible and sustainable enough to align according to the rapid climatic changes.

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Institutional performance means that educational institutions, through increased quality, efficiency, and financial sustainability, can strategically achieve their goals [22]. Administrative, instructional, institutional, and community support work with governance, long-range planning, and resource allocation being keys to institutional effectiveness [23].

2.2.1. Institutional Performance Enhancing Strategies for Climate Change Mitigation

Climate Change has an ever-growing impact on the infrastructure of higher education institutions, which is why the implementation of environmental sustainability policies is crucial to building resilience and alleviating risks [24]. The quarterly relentlessness of education cycles can be immediately and deleteriously impacted by studies also showing that developing temperatures and increasing natural disasters have consequences on the continuity of education and students [25, 26].

Strategies for sustainability and climate adaptation initiatives of many higher education institutions. Such measures include energy use efficiency, potential improvements to climate science, and the establishment of environmental sustainability curricula [27]. Universities with flexible plans are more able to respond to the challenges of climate change [28].

As climate change is accelerating, paying attention to building the performance of higher education institutions is one of the most important steps in sustainability, especially through the opportunity continuity of the educational process. These challenges can be tackled by higher education institutions with flexible strategies, good governance, and sustainable environmental policies. Hence, it is advised to conduct further investigations on the larger climate adaption by institutions to achieve sustainability in education.

2.2.2. Metrics of Institutional Effectiveness in Higher Education

In higher education institutions, the extent to which institutions achieve academic and administrative goals is referred to as institutional performance. Based on new studies of institutional performance, a few of the factors have been identified:

2.2.2.1. Work Systems

Refers to the Process, policies, and procedures that enable the implementation of the strategy, the achievement of efficient and effective institutional performance in terms of various aspects including effective work system [29].

2.2.2.2. Management Style

Refers to the type of leadership embraced by the institution, management style impacts both satisfaction and overall performance of employees [30].

2.2.2.3. Employee Skills

Encompasses the competencies and capabilities of employees, Developing employees' skills has a significant impact on enhancing institutional performance [31].

2.2.2.4. Strategic Leadership

This relates to the competency of the heads to steer the academic institution towards its strategic goals. Strategic leadership is one of the most recommended factors for institutional excellence and sustainability, effective strategic leadership is the most important factor influencing the institutional performance of universities [32].

Together, these dimensions highlight the need for institutional performance, which promotes better education quality, improves efficiency in administration, and enhances the reputation of the institution at local and global levels.

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2.3. Sustainability Strategies and Institutional Performance in Higher Education

It has been suggested that sustainability strategies need to be a core part of increasing the performance of all higher education institutions. It seeks to incorporate environmental, social, and economic commons into the design of institutional operations in order to be sustainable over the long term.

A sustainable strategic planning type is essential for enhancing the value of higher education in the world by creating a common vision for the future in institutions and developing the commitment of institutions to their mission. Such planning also increases the capacity of institutions to respond to the challenges ahead as well as to remain functional [33].

This paper aims to gain insight into the effects of strategic planning on institutional performance based on a field study at Al-Saeed University in Yemen, where it was found that there is a statistically significant relationship between strategic planning and institutional performance. The findings showed that the mean ratings of strategic planning and institutional performance were high and that the strategic planning dimensions together explained a large amount of the variance (45%) of institutional performance. This implies that the efficient sustainability strategies by educational institutions reflect to improve on the ground level [34].

Related: Not About Rosh Hashanah: A Theoretical Study on Institutional Performance and Evaluation Strategies A theoretical study on institutional performance and evaluation strategies also noted the importance of designing good strategies for assessing and improving performance in order to improve efficiency and sustainability. Setting inclusive assessment tools leads to sustainable and more effective performance for the institution [35].

These results suggest that sustainability strategies enhance the education, operational, and resource sustainability performance in higher education institutions, leading to improvements in their institutional performance in a significant way.

3. Model and Hypothesis

This study investigates the link between sustainability strategy variables and institutional performance variables due to climate change to continuity the educational process in higher education institutions such as the University of Kufa. Even if various approaches can be adopted to ensure the sustainability of higher education institutions, agreement on what they do to achieve sustainability in higher education institutions is also needed. This is due to the fact that sustainability relies on the success of collective action.

The present study is a hypothetical model that provides a simple, clear, and theoretical presentation of facts surrounding the phenomena under investigation while acting as a core intellectual framework. The independent variable sustainability strategies (SUST) is measured using four dimensions: environmental (EN), economic (EC), social (SO), and technological (TE) [36-38]. Thus, for the dependent variable institutional performance (INPE), can be measured through four dimensions: work systems (WS), management style (MS), employee skills (ES), and strategic leadership (SL) [39].

Within mind the following will be the main hypothesis that the study will be based on:

- Institutional performance and sustainability strategies have a positive connection.
- The effects of sustainability strategies on institutional performance are significantly positive.

The sprawling sub-hypotheses that stem from this main hypothesis are:
The environmental dimension positively influenced institutional performance.

- Institutional economic dimension rides as well as a qualitative improving performance.
- This dimension of society also has positive impacts on institutional performance.
- The techno-structural aspect has a strong influence on the performance of the institution.

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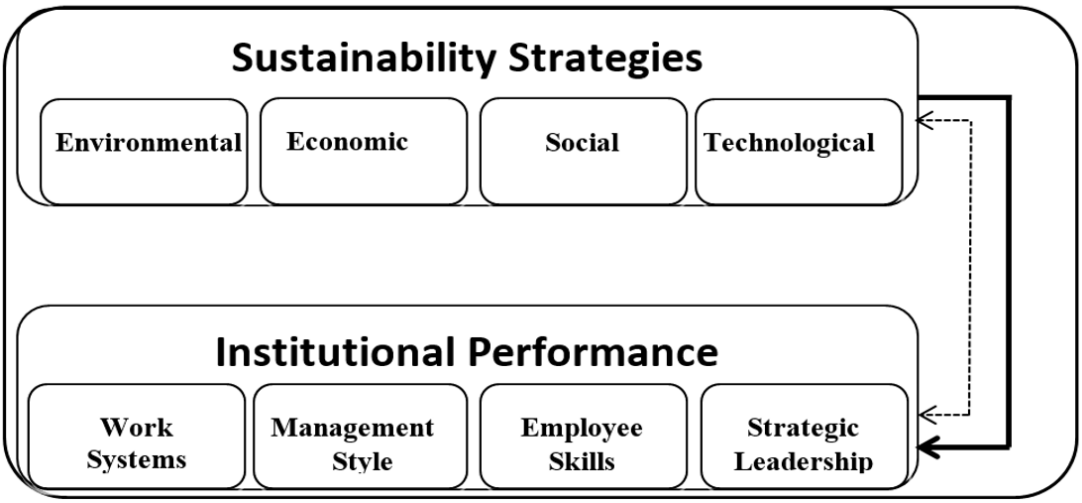

Figure 1.
The Research Theoretical Model.

When the estimated sample size needs to be determined using the impact of Sustainability Strategy Dimensions on Institutional Performance, the statistical table [40] was used, which was applied to the study population of 800 faculty members. From this, the optimal sample size was found to be 260 faculty members. Out of the 260 questionnaires, 13 were not returned, and 3 were incomplete. As a result, 245 valid questionnaires were deemed valid using the three questions, and the response rate was 94%.

4. Tests and Results

4.1. Descriptive Analysis of Study Variables and Dimensions

In order to confirm the comprehension of the points of view of the respondents in relation to the current study variables, a descriptive analysis test was applied by means of the calculations of the measures of central tendency, namely mean, standard deviation, and variance. The arithmetic mean was calculated to find out the distribution level of the dimensions of study variables.

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Table 1.
Descriptive Statistics.

	N	Mean	Std. Deviation	Variance
EN1	245	4.5306	0.80729	0.652
EN2	245	4.5918	0.67503	0.456
EN3	245	4.5306	0.83720	0.701
EN4	245	4.5306	0.80729	0.652
EN5	245	4.2286	0.67508	0.456
EC1	245	4.0612	0.43458	0.189
EC2	245	4.1224	0.48892	0.239
EC3	245	4.1184	0.54158	0.293
EC4	245	3.8816	0.87208	0.761
EC5	245	4.3878	0.92365	0.853
SO1	245	4.1347	0.48988	0.240
SO2	245	4.5755	0.54266	0.294
SO3	245	3.7918	0.84053	0.706
SO4	245	3.8571	0.82482	0.680
SO5	245	4.6122	0.67800	0.460
TE1	245	4.0939	0.45647	0.208
TE2	245	3.8000	0.83764	0.702
TE3	245	3.8449	0.84472	0.714
TE4	245	3.8612	0.84272	0.710
TE5	245	4.5918	0.63757	0.406
WS1	245	4.1469	0.49053	0.241
WS2	245	4.1306	0.50335	0.253
WS3	245	3.7878	0.84194	0.709
WS4	245	3.9714	0.74328	0.552
WS5	245	4.6082	0.66030	0.436
MS1	245	3.8898	0.64663	0.418
MS2	245	3.8694	0.74057	0.548
MS3	245	3.6327	0.89383	0.799
MS4	245	4.4408	0.74215	0.551
MS5	245	3.8122	0.79796	0.637
ES1	245	4.5918	0.49250	0.243
ES2	245	3.6531	0.98245	0.965
ES3	245	3.5102	0.96076	0.923
ES4	245	4.3837	0.78910	0.623
ES5	245	3.5102	0.90812	0.825
SL1	245	4.9429	0.23259	0.054
SL2	245	3.9265	0.89781	0.806
SL3	245	4.0163	0.75730	0.574
SL4	245	4.1469	0.77542	0.601
SL5	245	4.6898	0.58121	0.338
Valid N (listwise)	245			

Table 1 results reveal the degree to which the sustainability strategies influence the institutional performance among the sample of faculties. The study found that the mean scores for all dimensions and variables of the study were higher than (3), which was the hypothetical mean of the five-point Likert scale. The majority of means were above (4) (above average), indicating a favorable tendency among the subjects to accept the indicators and dimensions of the study.

The slightly lower value of standard deviation in the variables indicates some difference in responses but is not significant enough to prove the difference, meaning the sample is homogenous. The consistency of responses indicates that the study variables and dimensions are widely used in the institution based on respondents' perspectives.

These results further imply that faculty were highly aware of the research variables and that positive responses to the study questionnaire were unattended. This emphasizes the usefulness and

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relevance of the institution within the institution and the value of sustainability strategies in impacting institutional performance.

4.2. The Validity and Reliability Assessment of the Sustainability Strategies

The minimum level of acceptance for Cronbach's Alpha of (0.70) Coefficient of reliability as stated by Robinson, et al. [41]. This limit can be diminished in exploratory research (0.60), such as it happens with indicators used in the sense of statistics. The validity and reliability assessment of the dimensions of the independent variable (the sustainability strategies measure) employed in this study are shown in Table 2 below:

Table 2.
Item-Total Statistics.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Cronbach's Alpha if Item Deleted
EN1	79.6163	92.311	0.944
EN2	79.5551	95.691	0.946
EN3	79.6163	92.549	0.945
EN4	79.6163	92.311	0.944
EN5	79.9184	95.961	0.946
EC1	80.0857	99.628	0.948
EC2	80.0245	98.368	0.947
EC3	80.0286	97.323	0.946
EC4	80.2653	90.794	0.944
EC5	79.7592	92.356	0.947
SO1	80.0122	99.397	0.948
SO2	79.5714	97.59	0.947
SO3	80.3551	93.025	0.946
SO4	80.2898	92.289	0.945
SO5	79.5347	95.192	0.946
TE1	80.0531	98.878	0.947
TE2	80.3469	92.711	0.945
TE3	80.302	91.999	0.945
TE4	80.2857	91.803	0.944
TE5	79.5551	95.674	0.946

Table 2 above, concerning the variable of sustainability strategies, which includes the four dimensions of sustainability animals (environmental, economic, social, and technological), and the current study questionnaire consists of twenty items, constitutes the results showing that the reliability of all scale items is as high as Cronbach alpha over 6, and the internal consistency for each item in the questionnaire. All the Cronbach's Alpha coefficient values are above 0.70, as seen in Table (3).

Table 3.
Cronbach's alpha coefficient of Sustainability Strategies.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.948	0.95	20

As shown in Table 3 all the items used in the questionnaire are characterized by excellent reliability, which indicates that the questions are internally consistent and strongly reflect the same research concept.

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4.3. Validity and Reliability Assessment of the Institutional Performance Measure

Table 4.
Item-Total Statistics.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Cronbach's Alpha if Item Deleted
WS1	77.5143	77.079	0.907
WS2	77.5306	76.848	0.907
WS3	77.8735	71.996	0.903
WS4	77.6898	73.256	0.904
WS5	77.0531	73.936	0.903
MS1	77.7714	75.390	0.906
MS2	77.7918	74.157	0.905
MS3	78.0286	71.864	0.904
MS4	77.2204	74.066	0.905
MS5	77.8490	74.284	0.907
ES1	77.0694	77.073	0.907
ES2	78.0082	69.205	0.901
ES3	78.1510	70.014	0.902
ES4	77.2776	73.119	0.904
ES5	78.1510	71.686	0.904
SL1	76.7184	79.629	0.909
SL2	77.7347	73.155	0.907
SL3	77.6449	74.082	0.906
SL4	77.5143	73.185	0.904
SL5	76.9714	75.462	0.905

Table 4 above shows the results regarding the variable of institutional performance, which includes four dimensions including work systems, management style, employee skills, and strategic leadership in the current study questionnaire in addition to its (20) items on the scale, all of the scale items (20) have high levels of reliability and indicates the internal consistency of the tool of this study(paragraph) Table (5) demonstrates that Cronbach's Alpha coefficient values were equal or more than 0.70.

Table 5.
Cronbach's alpha coefficient of Institutional performance.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.909	0.913	20

As can be noticed in Table 5, all the items used have been used in a relatively good way in the present study, based on valuable tools with a high degree of reliability.

4.4. Main Correlation Relationship Test

The hypothesis that correlates mainly with the present analysis is that there is a significant correlation in the aggregate between sustainability strategies and institutional performance.

Table 7.
Correlation between Sustainability Strategies and the Institution Performance.

Correlations			
		SUST	**TEPE**
SUST	Pearson Correlation	1	0.793**
	Sig. (2-tailed)		0.000
	N	245	245
INPE	Pearson Correlation	0.793**	1
	Sig. (2-tailed)	0.000	
	N	245	245

Note: **. Correlation is significant at the 0.01 level (2-tailed).

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Table 6 Results of the Pearson correlation analysis show that the variable item correlation coefficient values are positive. Further, correlation coefficient value for study variables is 0.793 is more than 0.50 and the correlation values are significant at $p < 0.01$ level.
This outcome substantiates that there is a positive relationship between independent variable Sustainability Strategies and dependent variable Institutional Performance.

4.5. Examining the Effect Relationship Hypothesis between the Variables of Study

Objective The purpose of this study is to test the relationships of impact between the independent variable (Sustainability Strategies) consisting of four dimensions: environmental, economic, social, and technological and functional dependent variable (Institutional Performance) operationalized by scale for four dimensions: work systems, management style, employee skills, and strategic leadership.

The influence of these variables was analyzed on accepting or rejecting the hypothesis as given using the SPSS. 24 statistical software as follows:

Table 7.
Main Impact Hypothesis Test.

					Change Statistics				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**R Square Change**	**F Change**	**df1**	**df2**	**Sig. F Change**
1	0.793[a]	0.629	0.628	0.28148	0.629	412.462	1	243	0.000

Note: a. Predictors: (Constant), SUST

The values of the variables in the regression analysis are shown in Table (7) and the correlation coefficient value (R) = (0.793), that indicating a strong relationship between the independent variable Sustainability strategies (SUST)and dependent variable Institutional performance (INPE) Since a value in the range of (1) is relatively higher, this implies that the relationship between the two variables is a strong one, not just strong, but also a positive one.

R Square used are coefficient of determination is 0.629 How much sustainability strategies can explain the variance of institutional performance (62.9%) This indicates that the changes in the dependent variable are largely explained by the independent variable. Conversely the rest (37.1%) unaccounted variations associated with other factors out of the model. The coefficient of determination, R Square is (0.641), while the coefficient of determination is the percentage of the variance in the dependent variable explained by the predictors, and adjusted for the number of variables in the model and called Adjusted R Square here (0.628) The difference between R Square and the adjusted R Square is minimal implies that independent variable that has been included helps to explain the variance without greater risk of overfitting.

Those really mean the standard error of the estimate (the amount that the predicted values vary from the actual values, (0.28148)) This means a lower standard error, implying that the model is a more accurate prediction of the dependent variable. Notice also the R Square change statistic (0.629) indicating that inclusion of sustainability strategies accounts for (62.9%) in the variation of institutional performance.

This value (412.462) is the F Change and is the output of the ANOVA test which determines if the statistical significance of the model. The greater the value of F Change, the more beneficial the model becomes. df1 = 1 and df2 = 243 represent the degrees of freedom used for the test.

Level of statistical significance (Sig. F Change is (0.000). The significance of this value (0.05) is, as such, less says, so it proves the relationship between the independent and dependent variables the independently variable independently variable independently variable independently variable is highly statically neglected. This means that the effect of sustainability strategies on institutional performance is not random, but in fact a significant and true finding inside the model.

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Table 8.
Examination of the Effect of Sustainability Strategies on Institutional Performance.

			Sum of Squares	df	Mean Square	F	Sig.
INPE * SUST	Between Groups	(Combined)	40.627	48	0.846	14.674	0.000
		Linearity	32.680	1	32.680	566.551	0.000
		Deviation from Linearity	7.948	47	0.169	2.932	0.000
	Within Groups		11.306	196	0.058		
	Total		51.933	244			

This is evident from Table (8), which indicates that the relationship between sustainability strategies and institutional performance is linear and highly significant (Sig. = 0.000). The model was very strong on the basis of the quite high F value (566.551)

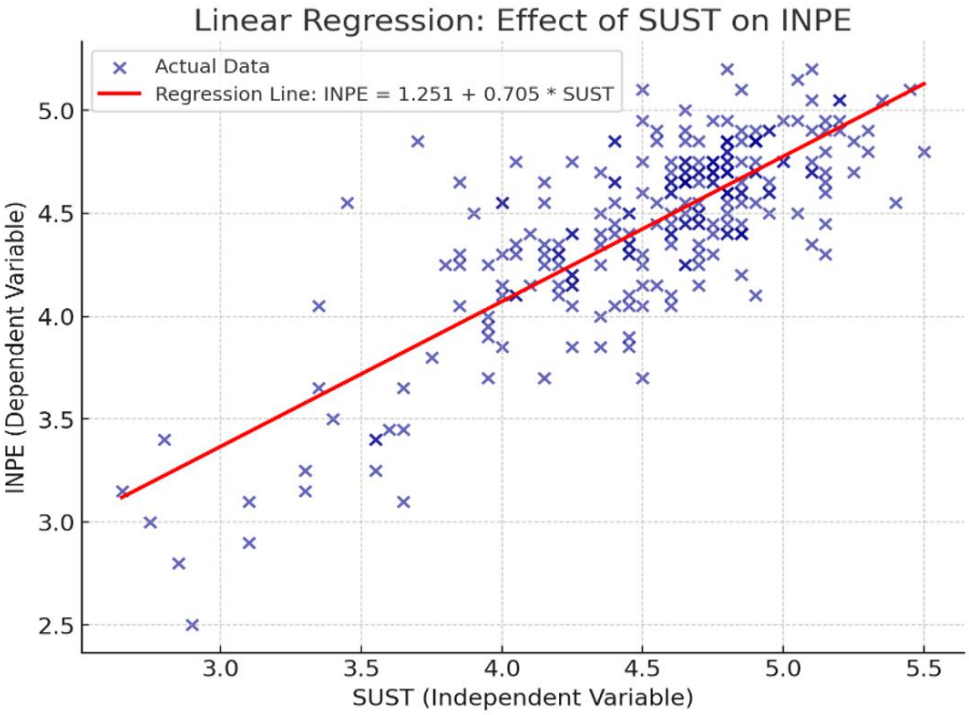

Figure 2.
The impact (SUST) on (INPE) and the correlation relationship.

The scatter plot shows the association of sustainability strategies tied independent variable (SUST) against the dependent variable (institutional performance INPE) as assumed by the linear regression equation:

$$INPE = 1.251 + 0.705 \times SUST$$

The blue dots of the plot are the values extracted from the dataset, where for different levels of SUST, INPE values vary. Regression line INPE = 460.07 + 0.69 SUST where, smallest squares estimate of the parameters with 95% confidence region in red and box (bottom right) Now this line gives you a straightforward trend explaining the reference between the two.

The slope of 0.705 is positively, meaning the SUST and INPE correlated positively. INPE also increases as SUST rise so appear to having a strongly positive relationship. This means that the points in the scatter plot are close to the regression line, indicating that SUST is an important predictor of

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INPE. There is a but of variation, however, and a handful of points lie a little away from the line, suggesting that beyond SUST other qualities might sometimes affect INPE too.

Strength of evidence, Final conclusion that higher SUST values yield higher INPE values. The regression line very well follows the overall trend in the data, and represents a good model to relate the two. Nevertheless, even though this model explains a large part of the variance in INPE, it is still not a perfect model, and other variables may account for more variation of the dependent variable.

5. Conclusions

This paper is meant to be a scientific contribution to sustainability in institutions. It focuses on the linking sustainability strategies and institutional performance between higher education institutions in the face of the urgency of climate change. There are a number of important conclusions that can be drawn by way of statistical analysis and field studies.

Results reveal a statistically significant positive effect of sustainability strategies on performance at the institutional level. This mechanism has played a significant role in helping universities to get sustainable, economic, and managerial and to improve the quality of academic and administrative services, while motivating universities in the process of developing and achieving their strategic goals.

The environmental dimension of sustainability strategies, including increasing energy efficiency, controlling environmental resources, and waste reduction, both directly reduce the environmental impact of higher education institutions, but also contribute towards higher education institutions' resilience in terms of accommodating climate alterations and brings them towards a more sustainable future.

The study found that diversification of revenue sources, spending efficiencies, and proper use of resources are critical for higher education institutions to attain economic sustainability. Financial crisis: Strategies for economic sustainability provide a robust financial framework that allows universities to withstand financial crises while continuing to provide educational or research services.

The findings suggest that integrating social sustainability approaches in higher education institutions via inclusive educational programs and community partnerships will facilitate higher levels of student and faculty satisfaction and bolster the role of universities in advancing sustainable development for the benefit of society.

The researchers confirmed that digital transformation contributes to sustainability. Implementing sophisticated e-learning, smart management, and modern-day digitalization aid in lowering old-fashioned resource consumption and increasing effectiveness in management and academic processes in the higher education system.

The study also found that various barriers prevented many universities from more widespread uptake of sustainability strategies including cost-effective challenges between the current model and the pioneering culture of sustainability the capital funding of infrastructure needed is high, and some people within the academic community exhibit resistance to change, as well as a difference of perception of sustainability by institutions

The results of Pearson correlation analysis showed a strong positive relationship between sustainability strategies and institutional performance. It is shown that institutions with more integrated and comprehensive sustainability policies tend to experience greater overall organizational efficiencies, sustainable improvements in education quality and better direct responsiveness to environments, economies, and societies that change. (palgrave.com)

The results of the study demonstrate that many universities around the world have successfully implemented effective sustainability strategies. Such experiences can help higher education institutions in developing countries in devising well-grounded sustainability policies in accordance with local environment, thus strengthening their academic and research competitiveness.

The outline advised that governments ought to offer monetary incentives to better schooling institutions to adopt sustainability strategies and to set regulatory guidelines, and stimulus to undertake

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clinical research on sustainability, to encompass sustainability both in the establishments and in their regional improvement policies.

The results of the study revealed that strategic leadership plays a critical role in the guidance towards sustainable mechanisms. But leaders who believe in sustainability can leverage change that ultimately makes academic institutions more sustainable and stronger in their capacity to be hyper-adaptive bodies capable of fulfilling their teaching, research, and community service missions for decades into the future.

The results showed that the impact rate of sustainability strategies on institutional performance is (62.9%) and there is a strong correlation (0.793) between the two variables; this means sustainability strategies directly enhance academic institutional performance. Furthermore, sustainability, environmental, economic, social, and technological sustainability is crucial for the quality of education and its continuity, with the rate of effectiveness varying between 57.8 and 64.2%.

The outcomes justified the need for effective implementation mechanisms of sustainability strategies apart from strengthening strategic leadership for continuous academic and environmental sustainability.

6. Recommendations

This study indicates that sustainability strategies are important for of higher education institutions' success. As such, the following recommendations will help maintain and ensure sustainability in the longer term, enabling universities to be able and prepared to tackle the future effectively and flexibly.

Sustainability must be addressed in long-term university strategic plans to protect institutional performance and enable academic and administrative efficiency.

institutionalize environmental governance systems that track the application of sustainability strategy as well as efficient resource usage on campus possibly with some in house support.

Expand funding sources and deepen strategic partnerships with the public and private sectors to secure the long-term financial stability of academic institutions.

Fund scientific research with sustainability themes by awarding research grants to sustainable environmental, economic, and social development projects.

Broaden digital transformation by ramping up e-learning as well as smart management systems to decrease conventional resource consumption.

Promoting social responsibility by designing community-oriented educational programs and increasing the involvement of universities in sustainable development.

Enhance strategic leadership through training university leaders to enhance their competency in embedding institutional sustainability principles;

Formulate climate change response policies that can sustain the continuity of the educational process as environmental conditions change.

Integrate sustainability in curricula so that students understand the importance of sustainable environmental, social, and economic practices.

International collaboration between universities for exchanging knowledge on best practices for implementation of sustainability strategies.

Transparency:

The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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