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Drivers of Institutional Sustainability in Egyptian and Saudi Universities: A Comparative Mixed-Methods Analysis

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Abstract

Purpose: This study investigates the multifaceted dynamics of institutional sustainability (IS) within the higher education sectors of Saudi Arabia and Egypt. It examines the direct influence of cultural, technological, and economic factors, alongside change management techniques (CMT), on the sustainability of universities in these two nations. Methodology: Employing a comparative, mixed-methods approach, the research collected data from 427 university staff members across Saudi Arabia and Egypt. Structural Equation Modeling (PLS-SEM) was utilized for data analysis, complemented by Multiple Group Analysis (MGA) to explore variations across different demographics, including gender, geographical location, and institution type (public vs. private). Findings: The study reveals that Change Management Techniques (CMT), cultural norms, technological infrastructure, and economic factors all significantly and directly influence institutional sustainability. Effective CMT is crucial for successful technological integration and mitigating staff resistance. Cultural norms, particularly in high power distance and collectivist societies, profoundly impact the adoption of innovations. A robust technological infrastructure is foundational for operational efficiency and educational outcomes, while strategic economic planning and diversified funding streams are vital for long-term stability and growth. Originality: This research offers actionable insights for policymakers and academic leaders by providing a nuanced understanding of how to build resilient, sustainable, and technologically advanced educational institutions in the Middle East. It emphasizes the necessity of context-specific strategies that acknowledge the unique regional socio-cultural and economic realities of Saudi Arabia and Egypt, bridging the gap between global sustainability paradigms and local implementation challenges.

Keywords: institutional sustainability; Higher Education Institutions (HEIs); Change Management Techniques (CMT); cultural norms; technological infrastructure; economic factors

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1. Introduction

In the contemporary global landscape, higher education institutions (HEIs) are increasingly confronted with the dual challenge of rapid technological evolution and the imperative for long-term institutional sustainability. As universities strive to remain relevant and resilient, the integration of advanced technologies has emerged as a central strategy for enhancing educational outcomes and operational efficiency [1]. However, the transition toward a technologically driven sustainable model is not merely a technical

endeavor; it is a complex organizational process that is deeply embedded within specific socio-cultural, technological, and economic contexts [2].

Despite the growing body of literature on institutional sustainability in higher education, a critical problem persists: the dominant sustainability frameworks and empirical studies are largely anchored in Western institutional contexts, rendering them inadequate for explaining sustainability dynamics in the Arab world. Higher education institutions (HEIs) in Egypt and Saudi Arabia operate under markedly different socio-cultural, political, and economic conditions—conditions that profoundly shape how sustainability challenges manifest and how institutions respond to them. Yet, there remains a conspicuous absence of comparative, empirically grounded research that examines the simultaneous influence of cultural norms, technological infrastructure, economic constraints, and change management practices on institutional sustainability within these two distinct but regionally interconnected educational systems. This gap leaves policymakers and academic leaders without the context-sensitive evidence needed to design effective, sustainable institutional strategies.

The significance of this study lies in its timeliness and its deliberate effort to address what prior research has overlooked. The current moment is particularly critical: Saudi Arabia's Vision 2030 is actively restructuring the higher education sector through large-scale investment in technology and institutional reform, while Egyptian universities are simultaneously grappling with massification pressures, fiscal austerity, and the need to modernize under resource constraints. Prior studies have examined these issues in isolation—focusing either on technology adoption, or on funding challenges, or on cultural barriers to change—without accounting for the interplay among these dimensions, and almost never in a comparative cross-national framework within the Arab region. Furthermore, the role of change management techniques (CMT) as a catalyst for navigating these multifaceted challenges has been largely neglected in the sustainability literature specific to Middle Eastern HEIs. This study fills these gaps by offering a theoretically grounded, mixed-methods comparative analysis that captures the complexity of institutional sustainability across two nations with distinct yet overlapping higher education realities.

This study explores the multifaceted dynamics of institutional sustainability (IS) within the higher education sectors of Saudi Arabia and Egypt—two nations that are undergoing significant educational transformations but operate under distinct institutional frameworks. While Saudi Arabia's "Vision 2030" provides a centralized, resource-rich roadmap for modernization and technological integration, Egyptian universities navigate a more fragmented landscape characterized by resource constraints and adaptive, innovation-driven responses to massification pressures [3,4]. The study question can be described as what is the influence of Change Management Techniques (CMT), Cultural Norms (CN), Technological Infrastructure (TI), and Economic Factors (EF) on Institutional Sustainability (IS) in Saudi and Egyptian universities?

The research posits that the path to institutional sustainability is shaped by four critical pillars:

1. Change Management Techniques (CMT): The strategic processes used to manage the human and operational aspects of technological transitions and new practice adoption.
2. Cultural Norms (CN): The shared values and hierarchical structures that dictate how innovation is perceived and embraced within the Arab academic context.
3. Technological Infrastructure (TI): The physical and digital backbone—including hardware, software, and connectivity—that enables the delivery of modern education and supports institutional operations.

4. Economic Factors (EF): The financial resources and funding models that determine an institution's capacity for long-term investments and growth.

By employing a comparative, mixed-methods approach involving data from both public and private universities, this study seeks to bridge the gap between global sustainability paradigms and regional realities. It specifically examines how these variables interact across different demographics, including gender, geographical location, and institution type. Ultimately, the goal of this research is to provide actionable insights for policymakers and academic leaders, fostering a more nuanced understanding of how to build resilient, sustainable, and technologically advanced educational institutions in the Middle East.

2. Literature Review

2.1. Change Management Techniques (CMT) and Institutional Sustainability (IS)

Change management techniques (CMT) are critical for fostering institutional sustainability; CMT ensures that technological transitions are integrated smoothly, creating an environment that supports long-term operational resilience and adaptability [5,6]. The successful implementation of innovative practices, for instance, relies heavily on comprehensive change management approaches, including faculty training, engagement workshops, and adaptive leadership models. These strategies are vital for mitigating resistance among stakeholders and facilitating a cultural shift towards embracing innovations [5,7]. Research indicates that initiatives incorporating regular feedback and iterative learning practices contribute significantly to continuous improvements and the successful embedding of new methods within organizational processes [8].

CMT provides a platform for evaluating existing procedures and ensuring that new practices are seamlessly integrated without compromising the quality of operations. Such assessments often lead to optimized workflows and resource allocation, thereby improving overall educational outcomes and supporting sustainability efforts [9]. By embedding change management as a strategic element, educational institutions can enhance their resilience and maintain the momentum necessary for future innovations [10,11]. The effectiveness of CMT can vary by the type of institution (public vs. private) and location, as resource availability and institutional autonomy may influence the scope and depth of change initiatives. While the provided study does not explicitly detail gender-specific impacts of CMT, it is generally understood that inclusive change management practices that address diverse needs and perspectives are more likely to succeed across all demographic groups within an institution.

2.2. Cultural Norms and Institutional Sustainability (IS)

Cultural norms play a pivotal role in shaping the adoption and integration of new practices within educational institutions, thereby influencing institutional sustainability [12,13]. These norms, encompassing shared values, beliefs, and practices, dictate how innovation is perceived and embraced by faculty, students, and administrators [5,14]. In societies characterized by high power distance, such as Saudi Arabia and Egypt, the acceptance of new methodologies often depends on endorsements from top-level authorities and alignment with traditional teaching methodologies [15]. This hierarchical structure can either facilitate rapid adoption if leaders champion the change or lead to significant resistance if faculty members perceive innovations as challenging established norms [5,16].

Collectivist cultures, prevalent in many Arab nations, may exhibit greater openness to practices that support collaborative learning environments, such as group projects [17]. Conversely, cultures with high uncertainty avoidance might resist changes due to a preference for stability and a fear of the unknown [18,19]. Therefore, effective integration of new practices and the enhancement of institutional sustainability require extensive training

and clear communication strategies that are culturally sensitive. The attached study highlights that cultural norms have a direct influence on sustainability [5,20]. Supplementary research further emphasizes that cultural values in both Saudi Arabia and Egypt significantly influence how innovation impacts institutional sustainability, shaping educational practices and institutional responses [21,22]. The success of sustainability initiatives is thus deeply intertwined with understanding and adapting to the prevailing cultural context, which can vary by gender, location, and the specific type of institution (e.g., public versus private universities).

2.3. Technological Infrastructure and Institutional Sustainability (IS)

Technological infrastructure forms a fundamental pillar of institutional sustainability, significantly influencing staff performance, educational outcomes, and financial resilience within universities [23,24]. A robust infrastructure, characterized by modern hardware, reliable software, high-speed internet, and secure networks, provides the essential foundation for integrating innovative practices and maintaining operational efficiency [5,25]. Institutions equipped with advanced technological systems can readily facilitate interactive and flexible learning environments, leading to enhanced student engagement and improved academic performance [26]. Conversely, outdated or unreliable infrastructure presents substantial obstacles, hindering for example the successful implementation of technological initiatives and impeding the adoption of innovative tools by both educators and students [27].

Adequate technological infrastructure also plays a crucial role in lowering barriers to innovation among staff. Comprehensive, user-friendly systems, coupled with effective training and technical support, foster confidence and acceptance among employees, thereby minimizing disruptions during transitions to new methods or platforms [5]. From a financial sustainability perspective, strategic investments in scalable and efficient technological systems enable institutions to streamline processes, reduce reliance on physical resources, and implement cost-effective solutions such as automated administrative functions [28]. Over time, these benefits can offset initial infrastructure costs and contribute to long-term financial stability. Moreover, a strong technological backbone enhances institutional adaptability, allowing universities to respond swiftly to evolving educational demands and external challenges. This adaptability not only ensures the institution's resilience but also positions it as a competitive leader in the educational sector [5,29]. Its direct role in supporting overall institutional sustainability is undeniable, particularly in enabling digital transformation efforts in Saudi and Egyptian HEIs [30,31]. The level and quality of technological infrastructure can vary significantly between public and private institutions, as well as by geographical location, impacting their capacity for sustainable growth.

2.4. Economic Factors and Institutional Sustainability (IS)

Economic factors are foundational to institutional sustainability, profoundly influencing a university's capacity to achieve long-term operational stability, educational excellence, and innovation [5]. The financial health of an institution dictates its ability to invest in critical areas such as infrastructure development, staff training, and program expansion [32,33]. Also, budgetary constraints can significantly heighten staff resistance to change due to insufficient support and resources [5].

The strategic allocation of financial resources is paramount for an institution's sustainability. Universities that prioritize optimizing resource utilization and spending for value maximization tend to achieve greater returns on investment [34]. For instance, targeted investments in digital tools and blended learning systems can lead to reduced long-term operational costs, improved student outcomes, and increased enrollment capacities, thereby

bolstering financial resilience [5]. Furthermore, economic factors influence an institution's adaptability to external challenges, such as shifts in funding policies or economic downturns. Institutions with diversified income streams, including government grants, private partnerships, and tuition revenues, are better positioned to navigate financial uncertainties and sustain their missions [35]. Economic considerations also drive decisions regarding staff compensation and incentives, which are crucial for attracting and retaining qualified personnel aligned with institutional goals [36]. Integrating sound economic planning with sustainable practices is indispensable for creating a stable and adaptive framework that supports educational innovation and long-term growth [5]. The attached study confirmed a direct influence of economic factors on institutional sustainability [5], and supplementary research further underscores the importance of financial sustainability in Saudi public universities [37] and the challenges faced by Egyptian universities in securing funding for sustainable initiatives. These economic realities can vary significantly by gender, location, and the type of institution, impacting their capacity to achieve sustainability goals.

2.5. Theoretical Framework Underpinning the Selection of EF, CN, TI, and CMT

The selection of the four independent constructs—Economic Factors (EF), Cultural Norms (CN), Technological Infrastructure (TI), and Change Management Techniques (CMT)—is not arbitrary but is grounded in a convergence of established theoretical frameworks that collectively explain how organizations sustain themselves through periods of transformation. Each construct is anchored to a distinct theoretical tradition relevant to the higher education context in the Arab world.

The inclusion of Cultural Norms (CN) is theoretically justified by Hofstede's Cultural Dimensions Theory [38], which identifies power distance, uncertainty avoidance, and collectivism as key cultural variables that shape organizational behavior. In Arab academic settings, these dimensions are particularly salient: high power distance limits bottom-up innovation, while collectivist orientations determine how change initiatives are framed and received. CN is therefore a theoretically sound predictor of sustainability outcomes in these contexts.

Technological Infrastructure (TI) is grounded in both the Technology Acceptance Model (TAM) [39] and the Resource-Based View of the firm (RBV) [40]. TAM posits that the perceived usefulness and ease of use of technology determine adoption, while RBV identifies technological capabilities as strategic resources that confer competitive and operational advantage. Together, these frameworks explain why TI is positioned as a direct driver of institutional sustainability.

Economic Factors (EF) are theoretically anchored in Resource Dependency Theory (RDT) [41], which argues that organizations are constrained by their dependence on external resources and must manage these dependencies to ensure survival and growth. In the higher education context, this translates into the centrality of funding structures, budget allocation, and financial diversification as determinants of institutional capacity to pursue sustainability goals. EF thus represents the resource-side constraints and enablers that RDT identifies as fundamental to organizational sustainability.

Finally, Change Management Techniques (CMT) draw theoretical support from both the ADKAR model (Awareness, Desire, Knowledge, Ability, Reinforcement) [11] and Kotter's Eight-Step Change Model (1996), both of which emphasize that successful institutional transformation requires structured human-centered processes. In HEIs, where faculty autonomy and institutional inertia are well-documented obstacles to change, CMT provides the procedural scaffolding through which sustainability initiatives can be effectively embedded. Collectively, these four constructs form a theoretically coherent framework that bridges cultural, technological, economic, and managerial dimensions of institutional

sustainability—a synthesis not previously applied in the comparative study of Egyptian and Saudi universities.

3. The Methodological Approach

The study featured using a mixed methodological strategy gathered data via online questionnaires (see Appendix A) completed by a sample of 427 respondents drawn from a wider population of private and public universities in Saudi Arabia and Egypt (see Supplementary File). A pilot study was first carried out to confirm the questionnaire's validity and reliability, after which PLS-SEM analyses were employed to evaluate content validity, construct validity, and measurement consistency across institutions in both countries.

A snowball non-probability sampling method was adopted to reach university personnel in both countries. While the technique does not permit full randomization, efforts were made to strengthen sample diversity and representativeness by incorporating faculty members from varied institutional backgrounds, experience levels, academic ranks, age brackets, and genders. The questionnaire was first circulated within existing professional networks of university staff and subsequently extended to a wider pool of respondents.

The dataset sample was stratified to include a Multiple Group Analysis (MGA) of a representative sample segmented by gender, university ownership categories if the respondent belongs to a (private–public–others) and finally followed by a segmentation across location in Egypt and Saudi Arabia. The structural modeling PLS-SEM is employed to test and ensure face, content, constructs, convergence and discriminant and nomological validities [42,43]. The exploratory study (See Appendix A.2.) and pilot study preceded the survey phase to cross validate and check the sample selection and exclude any bias. The bootstrapping is optimized as a resampling technique to re-assess the associations between the constructs and latent variables [44]. Finally, a Multiple Group analysis PLS-MGA comes in handy to provide further insights into the differences between groups, when considering the main independent variables of EF, CN and TI. Finally, the research relied entirely on anonymous, self-administered online questionnaires targeting adult professionals, with no collection of identifiable private information. So, no IRB was applicable.

PLS-SEM Conceptual Model Construct

Some of the virtues of PLS partial structural equation models rely on its capacity to handle data of high dimensionality, size and complexity and it opts to find a converging solution to reach the precise underlying structure of the data and relationship between the variables [45,46]. Second, it applies a battery of indicators and metrics ranging from the goodness of fit to validate the relationship between the variables and ensure the reliability of its constructs used to measure each of the main independent variables and estimates in and out of the sample predictions. Third, PLS SEM makes the best use of the data without compromising the richness of the data and omitting any of the original determinants with the purpose of explaining as much as possible the variability in the latent constructs. Finally, it corrects for outliers and extreme values to realize the most efficient results with lowest possible variance [47].

Keeping track with the survey's conceptual model, Figure 1 below represents the construct of PLS-SEM structure following the theoretical foundation, the literature and questionnaire construct Appendix A.1. Figure 2 shows the conceptual model, which treats Change Management Techniques (CMT), Economic Factors (EFs), Cultural Norms (CN) and finally Technological Infrastructure (TI) as independent variables introduced to the model to impact sustainability of educational institutions for Egypt and Saudi Arabia.

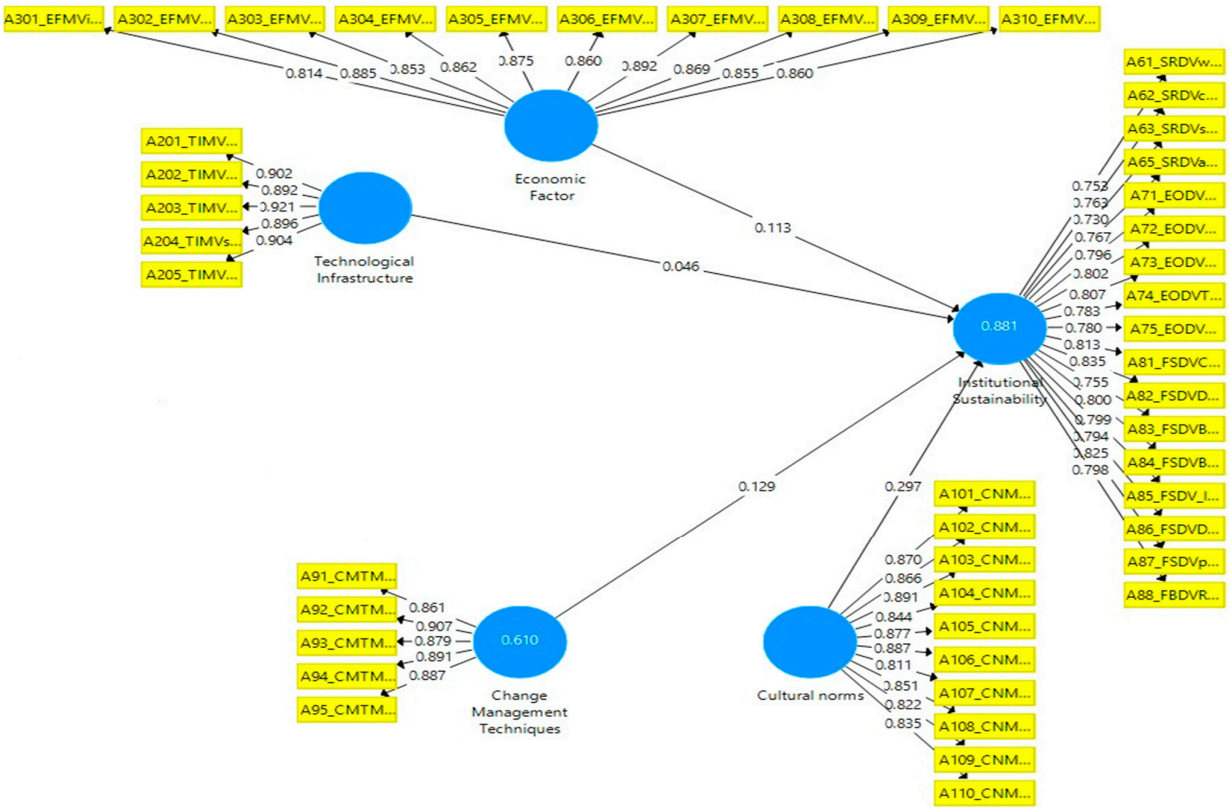

Figure 1. The graphical constructs of the PLS-SEM.

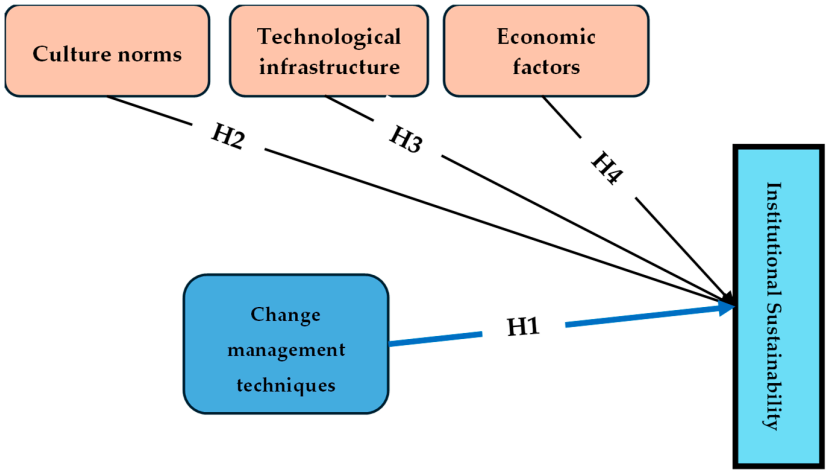

Figure 2. The conceptual model and its variables. Made by authors.

Accordingly, driven by the conceptual model insights, coupled with the graphical research model in Figure 2 below and the PLS-SEM graphical constructs, each hypothesis will be investigated for each group to consider the Multiple Group Analysis (MGA) that is conducted in the methodology stage, and the work's four main hypotheses boil down to:

H1: *Change management techniques (CMT) has a positive effect on the institutional sustainability (IS) in Saudi and Egyptian Universities by gender, location and type of institution.*

H2: *Culture norms significantly affect the institutional sustainability in Saudi and Egyptian universities by gender, location and type of institution.*

H3: *Technological infrastructure significantly affects the institutional sustainability in Saudi and Egyptian universities by gender, location and type of institution.*

H4: *Economic factors significantly affect the institutional sustainability in Saudi and Egyptian universities by gender, location and type of institution.*

4. Presentation and Discussion of Main Results of PLS-SEM

4.1. The Model's Outer Loadings and Collinearity Inner Model Matrix

The model's dynamics kicks off with its outer construct indices in addition to the inner stability of its structure which reflects by far the extent to which those variables could be used to test the same objectives and hypotheses throughout different contexts. The two most crucial evaluation criteria used to comment on the model's stability are the convergent analysis pivoting on the composite reliability coefficient (CR) and the Average Variance Extracted (AVE). The outer construct poses the factor loadings of the variables' statements and significance of their probabilities and how statements and factors add up till the point where there is a reliable relationship between the variables [44,48]. In parallel, it detects the internal stability, reliability and absence of evident collinearity, when assessing the Variance of Inflated Factors (VIF). This is particularly important if redundant statements which overexplain the variables should be omitted. Table 1 shows that the model's construct statement loadings with the least one estimated reaching no less than 0.707 and the highest one reaching to 0.891, which is satisfactory and consistent with the literature benchmark threshold of 0.7 [22]. This shows that every element of all the 4 variables explains no less than 0.707 of the change in IS. As for the AVE, it explains the variability that is supposed to be extracted from the underlying statements explaining each of the chosen categories of variables, which has reached up to 0.622 for the lowest category of IS juxtaposed to a minimum threshold of 0.5 recorded when compared to benchmark studies [49].

Table 1. Measurement of model's testing.

Constructs and Their Indicators	Items	Loadings	Outer VIF	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted AVE
Change Management Techniques	A91_CMT	0.860	3.59	0.931	0.948	0.783
	A92_CMT	0.908	3.685			
	A93_CMT	0.879	4.767			
	A94_CMT	0.892	3.348			
	A95_CMT	0.887	4.142			
Cultural Norms (CN)	A101_CN	0.870	4.252	0.959	0.965	0.733
	A102_CN	0.866	2.705			
	A103_CN	0.891	3.25			
	A104_CN	0.844	2.998			
	A105_CN	0.877	3.049			
	A106_CN	0.887	3.766			
	A107_CN	0.811	3.398			
	A108_CN	0.851	3.323			
	A109_CN	0.823	3.161			
	A110_CN	0.835	3.092			

Table 1. *Cont.*

Constructs and Their Indicators	Items	Loadings	Outer VIF	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted AVE
Economic Factors (EF)	A301_EF	0.814	3.961	0.962	0.967	0.744
	A302_EF	0.885	3.375			
	A303_EF	0.853	2.977			
	A304_EF	0.862	3.853			
	A305_EF	0.875	3.612			
	A306_EF	0.860	3.101			
	A307_EF	0.892	3.085			
	A308_EF	0.869	3.912			
	A309_EF	0.855	4.645			
	A310_EF	0.860	4.513			
Institutional Sustainability (IS)	A61_SR	0.748	2.8	0.962	0.965	0.622
	A62_SR	0.760	3.041			
	A63_SR	0.730	2.776			
	A65_SR	0.764	2.591			
	A71_EO	0.793	3.055			
	A72_EO	0.799	3.167			
	A73_EO	0.804	3.599			
	A74_EO	0.781	3.032			
	A75_EO	0.778	3.047			
	A81_FS	0.814	3.115			
	A82_FS	0.837	3.806			
	A83_FS	0.758	3.532			
	A84_FS	0.803	3.229			
	A85_FS	0.802	3.355			
	A86_FS	0.796	2.804			
	A87_FS	0.828	3.734			
	A88_FB	0.802	3.346			
Technological Infrastructure (TI)	A201_TI	0.902	3.592	0.943	0.957	0.816
	A202_TI	0.892	3.389			
	A203_TI	0.921	4.223			
	A204_TI	0.896	3.448			
	A205_T1	0.904	3.710			

Inclusively, the validity of the construct resonates through the CR which refers to the internal consistency of the constructs driven from the survey statements and its benchmark is preferred not to fall below 0.6 and particularly most of the construct measures in Table 1 exceed 0.95, which shows expected results [50]. The model's inner construct and multicollinearity VIF marker has not exceeded 5 for any of the model's statements. The main interpretation of this result is driven by the distinction between TI which is directly

involved in upgrading HEI sustainability as contrasted to sustainability initiatives and their integration as a condition which promotes the sustainable ESG ranking of institutions to induce pedagogical change [51]. This signifies that there is no overlap and there is clear distinction in results between the TI-induced initiatives by each particular HEI having them at their pace, compared to the initiatives which are externally mobilized and mandated on the level of the country. Finally, Cronbach's alpha score is employed to assess the reliability of the research variables and estimators when they exceed the probability of 0.9 which confirms the appearance of a strong internal consistency and reliability of the model's construct, but it is also verified through the VIF as the multicollinearity marker, indicating that no potential redundancy among closely related scales of the construct exist [52].

4.2. The Model's Validity Discriminant Analysis

Table 2 identifies the model's validity known by discriminant analysis which is determined via the Fornell–Larcker Criteria (FLC) estimating the square root of the AVE to act as the gauge for discriminant validity in addition to the fact that each construct or statement of measure is closer to itself than other constructs, which captures variability of measures for each category of the variables and shows that it takes a diversity of factors to implement TI, fulfil EF and reach the highest possible level of acceptance for CN [53]. Since the FLC sometimes defies its purpose in detecting whether there is a strong similarity between constructs, another indicator named the Heterotrait–Monotrait Ratio (HMR) which should not exceed strictly 0.85 or is more flexibly allowed to be less than 0.95 is employed. For Table 2 the highest score reaches 0.903 which is within the range, given it should not surpass the threshold of 0.95 and it could pose a potential problematic validity measure in the discriminant analysis if higher than 0.95 [54].

Table 2. Fornell–Larcker criterion discriminant validity analysis.

	Change Management Techniques (CMT)	**Cultural Norms (CN)**	**Economic Factors (EF)**	**Institutional Sustainability (IS)**	**Technological Infrastructure (TI)**
Change Management Techniques (CMT)	0.885				
Cultural Norms (CN)	0.826	0.856			
Economic Factors (EF)	0.768	0.871	0.863		
Institutional Sustainability (IS)	0.728	0.891	0.847	0.789	
Technological Infrastructure (TI)	0.789	0.808	0.835	0.796	0.903

4.3. The Model's Metrics and Goodness of Fit

Apart from the previous coefficient of determination explaining the model's construct and statements that can explain up to 83.5% variability in the sustainability of HEI adopting all sets of independent variables as marked in Ramadhani et al. [43], comparatively, Table 3 detects an overall adjusted R^2 of 0.833 for sustainability of HEI which adheres to results when contrasted to other benchmark studies in the literature [19]. In the meantime, the

Standardized Root Mean Square Residual (SRMSR) does not surpass 0.054 coupled with a Normed Fit Index (NFI) above 0.80, which is acceptable for this model.

Table 3. Coefficient of determination.

	R Square	R Square Adjusted	SRMR	NFI
Institutional Sustainability (IS)	0.835	0.833	0.054	0.822

4.4. Multiple Group Analysis (MGA) Across Gender, Location and HEI Type

The next part of the results contributes to enriching the scope of the analysis through broadening the relationship between variables to include comparisons between the group's demographics. Hence, it utilizes the "Multiple Group Analysis" which verifies whether the relationship between the survey's constructs is heterogeneous when comparing two different group of respondents [19,55]. In the case of the survey, demographics such as [gender–location–university type] can act as an effective classifier to extract and pinpoint to insightful and differentiated results between groups. Tables 4–6 are all testaments to the following results. On the one hand, Table 4 asserts that there seems to be partially significant difference between the impact of variables on institutional sustainability at 0.1 level of significance level for gender; however, with a deeper insight into the bootstrapping results, some patterns could be detected here. First, for male as gender CMT plays a significant role in influencing institutional sustainability (IS) at 95% confidence level compared to females and this resonates with the fact that inclusive change management practices that address diverse needs and perspectives are more likely to succeed across all demographic groups within an institution. Comparably, both EF and TI for females show a positive significant impact on the IS at 90% confidence level. This confirms that females tend to believe in effectiveness of technological advanced infrastructure and economic power to be the turning point in HEI and its impact on enhancing sustainability compared to males who believe in a real implementation of change in management which is aligned with results driven from Larsson and Thesing [56] Finally, changing CN has a positive significant impact on IS at 95% confidence level, which provides very interesting insights to confirm that combating staff resistance and their reluctance to adopt sophisticated teaching tools is still a valid point across both genders [57].

On the other hand, in Table 5, handling the bootstrapping results through location, even though there seems to be no significant difference between the impact of variables on IS is at 0.1 level of significance level; nevertheless, the particularly HEI in Saudi Arabia show that the EF and TI both have a positive and significant contribution on the IS at 90% confidence level. For CN, it has a positive significant impact on IS at 99% confidence level. This main distinction confirms the fact that the economic endowment of countries as in the case of Saudi Arabia HEI, facilitated by the strategic technological adoption, enables them to retain highly skilled, qualified and productive staff members. This comes hand in hand with the considerable budget allocated by their government to fund sophisticated digital pedagogical tools which helps in moving forward the sustainability of their HEI in the correct trajectory, whereas in the case of Egypt's HEI there is still a dire need to work further on the scalability of the Egypt's technological infrastructure, particularly in the HEI sector [58].

Table 4. Assessment of group differences by gender.

	Hypotheses	β Path Coefficients	σ Alpha	t-Value	*p*-Value	Decision
Male	H1 CMT -> IS	0.178	0.079	2.25	0.025	Supported
	H2: CN -> IS	0.282	0.079	3.579	0	Supported
	H3 TI -> IS	0.488	0.056	8.746	0	Supported
	H4 EF -> IS	0.076	0.07	1.088	0.277	Not supported
Female	H1: CMT -> IS	0.061	0.107	0.57	0.05	Supported
	H2: CN -> IS	0.349	0.076	4.621	0	Supported
	H3 TI -> IS	0.152	0.067	2.27	0.001	Supported
	H4: EF -> IS	0.111	0.061	1.823	0.077	Supported

Table 5. Assessment of group differences by university location.

	Hypotheses	β Path Coefficients	σ Alpha	t-Value	*p*-Value	Decision
Saudi Arabia	H1: CMT -> IS	0.203	0.095	2.127	0.034	Supported
	H2: CN -> IS	0.49	0.082	5.977	0	Supported
	H3: TI -> IS	0.34	0.104	2.246	0.034	Supported
	H4: EF -> IS	0.21	0.102	2.062	0.04	supported
Egypt	H1: CMT -> IS	0.268	0.09	2.974	0.003	supported
	H2: CN -> IS	0.441	0.083	5.268	0	Supported
	H3: TI -> IS	0.05	0.073	0.692	0.489	Not supported
	H4: EF -> IS	0.213	0.074	2.892	0.004	supported

The final insight driven from Table 6 inspects the difference between HEI type whether it pertains to a public, private or other and how has it been significant or not in adopting EF, CN and TI. The general results have revealed that CMT has a positive significant impact on both IS at 95% confidence level for private and public universities only as opposed to others; in the meantime, CN has proven to be significant for IS across all types of HEI at 95% confidence level. This result driven implies that only private universities witness TI having a positive significant impact on IS at 95% confidence level due to their capabilities to inject investments. Finally, EF stood out to show a positive significant impact on IS at 95% confidence level across all types of HEI, which resonates with its importance, and which was confirmed in many studies to include the work by Mousa et al. [59].

Table 6. Assessment of group differences by HEI type.

	Hypotheses	β Path Coefficients	σ Alpha	t-Value	p-Value	Decision
Private	H1: CMT -> IS	0.269	0.075	3.6	0	supported
	H2:CN -> IS	0.462	0.08	5.748	0	supported
	H3: TI -> IS	0.523	0.076	2.686	0.049	supported
	H4: EF -> IS	0.19	0.08	2.366	0.018	supported
Public	H1: CMT -> IS	0.24	0.094	2.565	0.011	supported
	H2:CN -> IS	0.436	0.088	4.977	0	supported
	H3:TI -> IS	0.038	0.071	0.54	0.589	Not supported
	H4: EF -> IS	0.462	0.233	1.988	0.047	supported
Others	H1: CMT -> IS	−0.267	0.263	1.017	0.31	Not supported
	H2:CN -> IS	0.462	0.233	1.988	0.047	supported
	H3:TI -> IS	0.505	0.213	2.368	0.018	Supported
	H4:EF -> IS	0.239	0.235	1.248	0.213	Not supported

5. Discussion

This study provides a comparative analysis of institutional sustainability (IS) and change management within the unique higher education landscapes of Egypt and Saudi Arabia, shedding light on the roles of cultural norms, technological infrastructure, and economic factors. The findings underscore the critical importance of context-specific approaches, challenging the direct applicability of Western-derived sustainability and change management frameworks in non-Western settings, particularly using the comparative case of two countries in the Arab region [38,60]. The research successfully addresses the theoretical gap by demonstrating how localized change management practices, influenced by unique cultural, economic, and political landscapes, and even demographic factors shape institutional sustainability outcomes.

One of the most salient findings is the pervasive influence of cultural norms across all demographics (gender, location, and institution type) on institutional sustainability. This aligns with the study's initial premise that cultural dynamics, such as power distance and collective decision-making, significantly influence the sustainability initiatives [61]. In Egypt, hierarchical structures and a collectivist society often lead to resistance to top-down mandates, favoring initiatives that emphasize communal benefits and consensus-building. Conversely, Saudi Arabian universities, while also collectivist, navigate the tension between rapid modernization under Vision 2030 and cultural preservation, where changes conflicting with Islamic principles or national identity may encounter passive resistance due to CN [62].

The study also highlights the distinct roles of economic factors and technological infrastructure. Economic factors (EF) were found to be highly significant, particularly in private higher educational institutions in Saudi Arabia, especially when empowered by advanced technological infrastructure. This supports the argument that Saudi HEIs benefit from centralized funding and technological infrastructure investments under Vision 2030, enabling sustained implementation of large-scale reforms [63,64]. In contrast,

Egyptian institutions, grappling with resource constraints and unstable international partnerships, face significant challenges in sustaining reforms beyond initial donor-funded phases [65,66]. Technological infrastructure (TI) has a direct role in supporting overall institutional sustainability, particularly in enabling digital transformation efforts in Saudi and Egyptian HEIs [30,31].

Change management techniques (CMT) play a crucial role, particularly in reducing staff resistance and enhancing institutional sustainability. The study's multi-group analysis revealed interesting gender-based differences: for males, CMT acts as a significant facilitator with various technological strategies promoting institutional sustainability, whereas for females, economic factors and technological infrastructure show a more direct positive impact on institutional sustainability. This suggests that while both genders acknowledge the importance of cultural norms and technological advancements, their perception of effective change implementation strategies diverge [56]. Furthermore, private universities in both countries showed CMT as a significant variable, indicating that the agility and resource allocation in private institutions might allow for more effective implementation of change initiatives [5].

6. Managerial Implications

The findings of this study offer several critical managerial implications for leaders and policymakers in higher education institutions in Egypt and Saudi Arabia, aiming to foster institutional sustainability:

- Culturally Adaptive Change Strategies: Given the pervasive influence of cultural norms, leaders must develop change management strategies that are deeply sensitive to local values, hierarchical structures, and collective decision-making processes [38]. In Egypt, this may involve fostering consensus-building and decentralizing decision-making to reduce resistance to top-down mandates. In Saudi Arabia, aligning sustainability initiatives with national identity and Vision 2030 objectives can legitimize reforms and encourage broader acceptance [62].
- Strategic Investment in Technological Infrastructure: While the direct impact of technological infrastructure may be complex to measure, its foundational role in enabling institutional sustainability is undeniable [30,31]. Institutions, particularly those in resource-constrained environments like Egypt, must prioritize strategic investments in robust and scalable technological systems. For Saudi HEIs, leveraging Vision 2030 funding for advanced infrastructure should be coupled with continuous training and support to ensure effective utilization and long-term sustainability.
- Tailored Economic Models for Sustainability: Economic factors are paramount to the success of sustainability initiatives. Egyptian universities need to explore diversified funding streams, including partnerships with NGOs and international agencies, and conduct rigorous cost–benefit analyses to demonstrate the long-term financial benefits of sustainability efforts [65,66]. Saudi institutions, with greater fiscal flexibility, should ensure that their substantial investments in sustainability are aligned with culturally relevant outcomes and social equity goals, moving beyond global prestige to localized impact [64].
- Gender-Sensitive Change Management: The observed gender-based differences in perceiving change management and its drivers highlight the need for tailored communication and engagement strategies. For male staff, emphasizing the structured processes and strategic benefits of CMT may be more effective, while for female staff, highlighting the tangible improvements brought by technological and economic support could yield better engagement [56]. This nuanced approach can help mitigate staff resistance across diverse groups.

- Leveraging Private Sector Agility: The significant role of CMT in private universities suggests that their organizational agility and resource allocation models can serve as benchmarks. Public institutions could explore adopting more flexible and responsive change management frameworks, potentially through strategic partnerships or by empowering departmental-level initiatives, to enhance their capacity for sustainable transformation [5].

7. Conclusions

This comparative study significantly contributes to the understanding of institutional sustainability and change management within the unique higher education landscapes of Egypt and Saudi Arabia. By employing a mixed-methods approach, the research has elucidated the intricate interplay of cultural norms, technological infrastructure, and economic factors in shaping sustainability outcomes. The findings unequivocally demonstrate that a one-size-fits-all approach to institutional sustainability is ineffective, highlighting the necessity of context-specific strategies that acknowledge regional socio-cultural and economic realities.

The study's primary contribution lies in refining institutional sustainability frameworks to account for Arab-specific contexts, offering actionable insights for policymakers and HEI leaders. It confirms that while economic factors are profoundly significant, particularly in resource-rich environments like Saudi Arabia, cultural norms exert a universal influence across diverse demographics. Future research should build upon these findings by conducting longitudinal studies to track the long-term impacts of Vision 2030 on Saudi universities and to further explore Egypt's adaptive strategies amidst the ongoing economic pressures [67,68]. Additionally, investigating these variables in other understudied Arab higher education systems and broadening the scope to include other Gulf countries to be contrasted against Maghreb countries in the MENA region would further enrich the scholarly understanding of context-responsive change management and institutional sustainability in the region. Ultimately, this research provides a robust foundation for designing frameworks that reconcile global sustainability paradigms with local realities, thereby advancing equitable progress in higher education across the Arab world.

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Author Contributions: A.S.A. and Y.T.H. have scrutinized the literature and formulated the research gap. In addition, they wrote down the literature review. A.M.M., A.S.A. and E.M.K. formulated the methodical framework of this study to achieve the desired objectives. They selected the sample size from the available population, and designed, together with Y.T.H., the data collection instrument and suggested the method of data analysis. E.M.K. and A.M.M. have presented the discussion of results. The discussion of different data collected is presented in the results. A.S.A., A.M.M. and E.M.K. contributed to this research by collaborating with Y.T.H. in the design of the data collection instruments. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: Ethical review and approval were not required for this study under the applicable regulations in Saudi Arabia and Egypt, as the research constituted a non-clinical, minimal-risk investigation and did not involve patients, healthcare-related data, biological samples, or sensitive personal information. The study was conducted in accordance with the principles of the Declaration of Helsinki (2013), the regulations of the Saudi National Committee of Bioethics, and relevant research ethics requirements in Egypt.

Informed Consent Statement: Informed consent for participation was obtained from all subjects involved in the study.

Data Availability Statement: The authors declare they have full access to all study data, take full responsibility for the accuracy of the data analysis, and have authority over manuscript preparation and decisions to submit the manuscript for publication.

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Appendix A

Appendix A.1. Questionnaire

The following statements' study investigates the multifaceted dynamics of institutional sustainability (IS) within the higher education sectors of Saudi Arabia and Egypt. It examines the direct influence of cultural, technological, and economic factors, alongside change management techniques (CMT), on the sustainability of universities in these two nations.

So please indicate your level of agreement towards the following statements (5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, 1 = Strongly Disagree).

#	Statement	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
Institutional Sustainability						
1	Cost-effectiveness of digital tools compared to traditional teaching methods.					
2	Digital investments are yielding adequate returns for the institution.					
3	Budget allocation for digital tools is appropriate.					
4	Benefits associated with the use of technologies for digital teaching justify these costs.					
5	There is adequate long-term financial sustainability of the university's digital strategy.					
6	Digitalization might affect tuition fees in the future.					

#	Statement	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
7	The most important factor in deciding to adopt new technology is the payback period.					
8	The ROI of previous technologies is highly relevant to our new technology adoption decisions.					
Change Management Techniques						
9	Adequate training and support are provided to make effective use of digital teaching technologies.					
10	Any vision and plan for the use of digital technologies in teaching are communicated to staff.					
11	Level of involvement of management in the implementation of digital teaching technologies is active.					
12	Institutionally, it is ready for the rigors of change attendant on the adoption of digital teaching technologies.					
13	Staff are involved in the process of adopting digital teaching technologies.					
Cultural Norms						
14	The institution's cultural values are aligned to the adoption of digital teaching technologies.					

#	Statement	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
15	Cultural norms (e.g., gender roles, individualism vs. collectivism, hierarchical structures, attitudes towards technology, workplace norms, communication styles, attitudes toward authority, and adherence to traditional teaching methods) drive acceptance and use of the digital teaching technologies.					
16	The institutional culture allows for the use of the digital teaching technologies.					
17	Cultural norms influence staff attitudes on the adoption of the digital teaching technologies.					
18	Digital teaching technologies are adapted into the context of the institutional culture.					
19	Digital teaching technologies are implemented in a way that is consistent with the culture and values of our institution.					
20	There is some resistance to digital teaching technologies within the culture of our institution.					
21	Staff are aware of integrating digital teaching technologies into the institutional culture.					

#	Statement	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
22	The deployment of digital teaching technologies is sensitive, in terms of the culture and traditions of our institution.					
23	The leadership of our institution promotes cultural acceptance of digital teaching technologies.					
Technological Infrastructure						
24	My institution's technological infrastructure is supportive of digital teaching technologies.					
25	The digital teaching technologies used are reliable and perform as expected.					
26	The staff can easily access the teaching technologies.					
27	There is adequate support services associated with the use of digital teaching technologies available.					
28	The technological infrastructure is relatively recent and can thus be better suited to support new digital teaching tools.					
Economic Factors						
29	The institution provides adequate financial resources for the acquisition of digital teaching technologies.					
30	The digital technologies of teaching bring in an economic boost for the institution.					

#	Statement	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
31	The potential for reduction in labor outlay is a major trigger toward adopting new technologies.					
32	The huge retraining and hiring costs of skilled labor to operate new technology presses heavy on us.					
33	The tax incentives or credits support a crucial role in the decision of adoption of new technologies.					
34	Government economic policies have a greater influence on my organization's decisions in regard to embracing new technology.					
35	The perceived economic risk in the adoption of new technology will greatly influence the organizational choice.					
36	The uncertainty in the expected return makes us very cautious about decisions involving the adoption of new technologies.					
37	High initial costs greatly hinder the assimilation of new technology into the group.					
38	Potential adoption of new technology will also greatly be influenced by an economic recession.					

Personal Information

1. Gender
    - Male ☐
    - Female ☐
2. Age
    - Less than 25 years old ☐
    - From 25 to less than 35 years old ☐
    - From 35 to less than 45 years old ☐
    - 45 years old and older ☐
3. Degree
    - Teaching Assistant ☐
    - Assistant Lecturer ☐
    - Assistant Professor ☐
    - Associate Professor ☐
    - Professor ☐
4. University Type
    - Private ☐
    - Governmental ☐
    - Other (specify)...... ☐
5. Nationality
    - African (e.g., Egyptian, Sudanese....)
      ....
    - Asian (e.g., KSA, UAE, Syrian....)
      ....
    - American
      ....
    - European (British, French, German, Italian, Spanish....)
      ....
    - Other (specify)......
      ....
6. University Location
    - KSA ☐
    - Egypt ☐

Appendix A.2. Exploratory Research Questions

1. What are the main sources of resistance among university staff toward organizational change and technological transformation initiatives?
2. How do change management techniques (e.g., training, communication, leadership support) influence staff acceptance and reduce resistance to change?
3. To what extent do prevailing cultural norms within universities shape staff attitudes toward change, innovation, and sustainability initiatives?
4. What economic factors (e.g., funding availability, budget constraints, investment priorities) influence the implementation of sustainability and technological initiatives in universities?

5. How does the quality and availability of technological infrastructure affect the adoption of innovation and institutional sustainability efforts?
6. In what ways do technological and organizational changes contribute to improving educational outcomes and operational efficiency within universities?
7. How do change management practices, cultural norms, technological infrastructure, and economic factors collectively impact the long-term institutional sustainability of universities?

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