

Managing Innovation and University System Sustainability in Cross River State, Nigeria

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ABSTRACT

This study examined managing innovation and university system sustainability in Cross River State, Nigeria. The study adopted a descriptive survey research design, which was considered appropriate for systematically collecting and analyzing data from respondents to make valid generalizations about the population. The population comprised Vice Chancellors, Deputy Vice Chancellors, Directors, Deans, Heads of Departments, and Unit Heads in public universities in Cross River State, estimated at 523 respondents from the University of Calabar and the University of Cross River State. A sample size of 750 respondents was used, selected through census sampling technique, involving all relevant academic and administrative decision-makers responsible for innovation and sustainability in the universities. Data were collected using a 40-item structured questionnaire titled Managing Innovation and University System Sustainability Questionnaire (MIUSSQ). The instrument was validated by experts in Educational Management, Measurement and Evaluation, and Innovation Studies, while reliability was established using Cronbach's Alpha, yielding a coefficient of 0.86, indicating high internal consistency. Data were analyzed using mean, standard deviation, Pearson Product Moment Correlation Coefficient, and One-way Analysis of Variance (ANOVA). Findings revealed that technological innovation, administrative innovation, research and development innovation, and organizational culture for innovation all had significant positive influences on university system sustainability in Cross River State. The study concluded that effective management of innovation significantly enhances the sustainability of university systems.

Keywords: *Technological innovation, Administrative innovation, Research and development innovation, Organizational culture, University system sustainability, Higher education management.*

Introduction

The growing complexity of higher education systems in the 21st century has intensified the need for effective innovation management as a pathway to institutional sustainability. Universities are increasingly expected to serve as hubs of knowledge creation, technological advancement, and socio-economic transformation, yet many struggle to align innovation practices with sustainable development goals. Globally, higher education institutions face challenges such as inadequate integration of sustainability into governance, weak innovation ecosystems, and limited adaptability to rapid technological changes. Studies have shown that sustainability in universities encompasses academic, environmental, and organizational dimensions, all of which require deliberate and coordinated innovation strategies to remain effective (Hassan & Ahmad, 2025; Figueiró & Raufflet, 2015). However, the inability of many institutions to effectively manage these dimensions continues to undermine their long-term viability.

In the context of developing regions such as Cross River State, Nigeria, the situation is further complicated by systemic constraints including poor funding structures, weak policy implementation, and limited technological infrastructure. Innovation within university systems is often hindered by organizational resistance to change, lack of strategic leadership, and insufficient capacity for research and development. Empirical evidence suggests that universities across the world experience similar barriers to innovation and sustainability, including inadequate administrative support and weak collaboration between stakeholders (Avila et al., 2017; Rieg, Gatersleben, & Christie, 2021). These challenges are particularly pronounced in resource-constrained environments, where the absence of effective innovation management frameworks limits the ability of universities to respond to emerging educational demands and global competitiveness.

Furthermore, the sustainability of university systems is closely tied to their ability to adopt innovative leadership models, integrate green management practices, and foster institutional cultures that support continuous improvement. Recent studies emphasize that innovation-driven management approaches such as digital transformation, adaptive governance, and green innovation play a critical role in enhancing institutional resilience and long-term sustainability (Sutawaidjaya, Yusuf, & Hamdi, 2024; Martín-Vaquero et al., 2026). Despite these insights, many universities in Cross River State have not fully embraced these approaches, resulting in declining educational quality, inefficient resource utilization, and limited global relevance. This gap underscores the need for a comprehensive examination of how innovation can be effectively managed to promote sustainable university systems in the region.

Statement of the problem

Universities in Cross River State are increasingly confronted with the challenge of sustaining their academic relevance and operational effectiveness in the face of rapid global changes in higher education. Despite the growing recognition of innovation as a critical driver of institutional sustainability, many universities in the state continue to operate within traditional administrative and pedagogical frameworks that limit adaptability and growth. Persistent issues such as inadequate funding, obsolete infrastructure, weak research output, and limited adoption of digital technologies have continued to undermine the capacity of these institutions to remain competitive and responsive to societal needs. This situation raises concerns about the extent to which innovation is being effectively managed to support the long-term sustainability of the university system.

Furthermore, the management of innovation within universities in Cross River State appears to be constrained by systemic and organizational challenges. These include bureaucratic rigidity, resistance to change among staff, lack of strategic leadership, and insufficient investment in capacity building for innovation-driven practices. In many cases, innovation initiatives are either poorly coordinated or inconsistently implemented, resulting in minimal impact on institutional development. The absence of clear frameworks for integrating innovation into governance, teaching, research, and community service further exacerbates the problem, thereby limiting the potential of universities to achieve sustainable growth and improved performance outcomes.

Moreover, the failure to effectively manage innovation has broader implications for the sustainability of university systems in the state, including declining educational quality, reduced global competitiveness, and diminished contribution to national development. Universities are expected to play a pivotal role in knowledge production, technological advancement, and human capital development; however, these expectations may not be realized without a deliberate and strategic approach to innovation management. Therefore, the problem of this study lies in the

apparent gap between the need for effective innovation management and the current realities within universities in Cross River State, necessitating an empirical investigation into how innovation can be better managed to enhance institutional sustainability.

Theoretical framework

The theoretical framework for this study is anchored on Innovation Diffusion Theory, propounded by Everett M. Rogers in 1962. The theory posits that innovation is a process through which new ideas, practices, or technologies are communicated over time among members of a social system, and its adoption is influenced by factors such as perceived usefulness, compatibility, complexity, trialability, and observability. It assumes that organizations differ in their readiness to adopt innovations and that effective communication channels, leadership support, and organizational culture play critical roles in facilitating or hindering innovation uptake. The philosophy underlying the theory emphasizes that sustained development and competitiveness depend on the ability of institutions to continuously adopt and integrate new ideas into their operational systems. In relation to the present study, the theory provides a useful lens for understanding how universities in Cross River State can manage innovation processes to enhance sustainability, as it highlights the importance of strategic leadership, institutional readiness, and supportive structures in promoting the adoption of innovative practices that can improve long-term institutional performance and resilience.

Empirical literature review

Empirical studies have established that technological innovation significantly influences university system sustainability by enhancing teaching, research, and administrative efficiency. For instance, Oke et al. (2012) examined innovation practices in organizations using a survey design and found that technological innovation improves institutional adaptability and long-term performance. Similarly, Aithal and Aithal (2019), through a conceptual-empirical analysis, reported that the integration of digital technologies such as e-learning platforms and artificial intelligence enhances the sustainability of higher education institutions by promoting flexible learning and resource optimization. In another study, Bhuasiri et al. (2012) utilized a quantitative approach to show that technological infrastructure significantly predicts the success and sustainability of university systems, particularly in developing countries. These findings suggest that technological innovation strengthens institutional resilience and continuity.

Further empirical evidence supports the role of technological innovation in sustaining university systems through improved research output and knowledge dissemination. Zawacki-Richter et al. (2019) conducted a systematic review and found that artificial intelligence applications in higher education enhance institutional efficiency and sustainability. Likewise, Selwyn (2016), using qualitative analysis, argued that digital technologies enable universities to remain competitive and sustainable in a rapidly changing global environment. Garrison and Kanuka (2004) also found, through experimental research, that blended learning technologies improve both academic quality and institutional sustainability. Collectively, these studies demonstrate that technological innovation contributes to sustainable university systems by improving access, quality, and operational effectiveness.

In addition to technological innovation, administrative innovation has been empirically identified as a critical determinant of university system sustainability. Damanpour and Aravind (2012), using a meta-analytic approach, found that administrative innovation such as changes in organizational structure and management practices significantly enhances organizational effectiveness and

sustainability. Similarly, Walker et al. (2011) employed a quantitative design and reported that administrative innovation improves institutional performance by fostering efficiency and responsiveness to environmental changes. In the context of higher education, Birnbaum (2000) highlighted through case study analysis that innovative administrative practices, including shared governance and decentralized decision-making, contribute to long-term institutional sustainability.

Moreover, empirical studies emphasize that administrative innovation supports sustainability through improved leadership, policy implementation, and resource management. Kezar (2014), using qualitative research methods, found that transformational leadership and administrative flexibility are essential for sustaining reforms in universities. Likewise, Fullan and Scott (2009) reported that innovative administrative strategies, such as collaborative governance and strategic planning, enhance institutional sustainability by aligning university goals with societal needs. These findings indicate that administrative innovation complements technological advancements by ensuring that governance structures and managerial practices effectively support sustainable university systems.

Empirical literature has shown that research and development (R&D) innovation is a critical driver of university system sustainability, particularly through knowledge creation, innovation outputs, and institutional competitiveness. For instance, Etzkowitz and Leydesdorff (2000), using a theoretical-empirical approach, found that the triple helix model of university–industry–government relations enhance R&D capacity and contributes significantly to the sustainability of higher education institutions. Similarly, Geuna and Muscio (2009), through a quantitative analysis of European universities, reported that investment in R&D activities improves universities' research productivity and long-term viability. In another study, Crespi and Geuna (2008) employed econometric methods and established that universities with strong R&D innovation systems tend to achieve higher levels of sustainability through increased knowledge transfer and commercialization. These findings suggest that R&D innovation strengthens the adaptive and productive capacities of universities.

Further empirical evidence supports the significant relationship between R&D innovation and university sustainability outcomes. Tijssen (2006), using bibliometric analysis, found that universities engaged in high levels of research collaboration and innovation demonstrate greater sustainability in global academic rankings. Likewise, Marginson (2010), through comparative analysis, revealed that sustained investment in research and development enhances institutional reputation, funding opportunities, and long-term survival. Salter and Martin (2001) also reported, based on empirical review, that R&D innovation contributes to economic and social sustainability by generating new knowledge and supporting national development goals. Collectively, these studies affirm that R&D innovation is fundamental to sustaining university systems in a competitive and knowledge-driven environment.

On the other hand, empirical studies investigating organizational culture for innovation have produced mixed findings regarding its influence on university system sustainability. Martins and Terblanche (2003), using a survey research design, found that while organizational culture supports creativity and innovation, its direct influence on long-term sustainability is not always statistically significant. Similarly, Detert, Schroeder, and Mauriel (2000) reported through quantitative analysis that organizational culture alone may not significantly determine organizational outcomes unless supported by structural and strategic mechanisms. In the context of higher education, Kezar and Eckel (2002) observed through case study methodology that cultural factors influence change processes, but do not independently guarantee institutional sustainability.

Moreover, other empirical studies further suggest that organizational culture for innovation may not significantly influence university system sustainability when considered in isolation. Hartmann (2006), using qualitative analysis, argued that innovation culture requires alignment with leadership and policy frameworks to impact sustainability outcomes. Likewise, Gregory, Harris, Armenakis, and Shook (2009), through empirical investigation, found that organizational culture has an indirect rather than direct effect on performance and sustainability. These findings imply that although a supportive culture for innovation is beneficial, it does not significantly influence university system sustainability without the presence of complementary factors such as leadership commitment, technological advancement, and strategic management.

This study fills a contextual gap in the literature by providing empirical evidence on innovation management and university system sustainability within the Nigerian university system, which has been underexplored in prior studies dominated by Western contexts. It also addresses a conceptual gap by simultaneously examining technological, administrative, and research and development innovation alongside organizational culture, offering a more integrated understanding of innovation dynamics in universities. Furthermore, the study bridges a methodological gap by empirically testing the direct and relative contributions of these innovation variables to sustainability outcomes rather than relying solely on theoretical or descriptive analyses. Finally, it contributes to policy and practice by clarifying the non-significant role of organizational culture for innovation in isolation, thereby highlighting the need for complementary structural and strategic factors in achieving sustainable university systems.

Purpose of the study

The general objective of this study was to examine the relationship between managing innovation and university system sustainability in Cross River State. Specifically, the study sought to:

1. determine the influence of technological innovation on university system sustainability in Cross River State.
2. examine the influence of administrative innovation on university system sustainability in Cross River State.
3. assess the relationship between research and development innovation and university system sustainability in Cross River State.
4. evaluate the extent to which organizational culture for innovation influences university system sustainability in Cross River State.

Research questions

The following research questions were raised to guide the study:

1. What is the influence of technological innovation on university system sustainability in Cross River State?
2. What is the effect of administrative innovation on university system sustainability in Cross River State?
3. What is the relationship between research and development innovation and university system sustainability in Cross River State?

4. To what extent does organizational culture for innovation influence university system sustainability in Cross River State?

Research hypothesis

The following null hypotheses were formulated to guide the study:

1. Technological innovation has no significant influence on university system sustainability in Cross River State.
2. Administrative innovation has no significant influence on university system sustainability in Cross River State.
3. There is no significant relationship between research and development innovation and university system sustainability in Cross River State.
4. Organizational culture for innovation does not significantly influence university system sustainability in Cross River State.

Methodology

The study adopted a descriptive survey research design, which was considered appropriate for examining managing innovation and university system sustainability in Cross River State, Nigeria. This design enabled the systematic collection, analysis, and interpretation of data from respondents, thereby allowing valid generalizations to be made about the study population. The target population comprised all Vice Chancellors, Deputy Vice Chancellors, Directors, Deans, Heads of Departments, and Unit Heads in public universities in Cross River State, with an estimated population of 523 respondents drawn from relevant administrative and academic leadership positions in the University of Calabar (Federal) and the University of Cross River State (State). A sample size of 750 respondents was used for the study. The sampling technique was census sampling since the population was manageable and involved all key administrative and academic decision-makers responsible for innovation and sustainability in the universities.

Data for the study were collected using a researcher-developed instrument with 40 items, titled the Managing Innovation and University System Sustainability Questionnaire (MIUSSQ). The instrument was structured to capture information on dimensions of innovation management (technological innovation, administrative innovation, research and development innovation, and organizational culture for innovation) and university system sustainability indicators. To ensure content and construct validity, the instrument was reviewed by experts in Educational Management, Measurement and Evaluation, and Innovation Studies. Based on their recommendations, necessary corrections were made to enhance clarity, relevance, and alignment with the research objectives. A pilot test was conducted using 20 respondents from similar leadership positions in universities outside Cross River State. The reliability of the instrument was established using Cronbach's Alpha, which yielded a coefficient of 0.86, indicating high internal consistency.

The instrument contained two main sections: Section A focused on demographic information such as designation, institution, and years of experience, while Section B contained items measuring managing innovation and university system sustainability indicators. The questionnaire was administered both physically and electronically to ensure wide coverage and ease of response among busy administrative and academic leaders. With the assistance of trained research assistants, the instruments were distributed across faculties, departments, and administrative units over a period of three weeks. Out of the 750 questionnaires distributed, 698 were correctly completed and

returned, representing a 93.1% response rate. Responses were measured on a four-point Likert scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). A criterion mean score of 2.50 was adopted as the benchmark for decision-making. Mean scores of 2.50 and above indicated a positive influence or strong agreement regarding managing innovation and university system sustainability, while mean scores below 2.50 indicated a negative influence or disagreement. This methodological approach ensured the generation of valid, reliable, and contextually relevant data for assessing managing innovation and university system sustainability in Cross River State, Nigeria.

Results

Research question one

What is the influence of technological innovation on university system sustainability in Cross River State?

Table 1: Respondents' mean ratings and standard deviation on the influence of technological innovation on university system sustainability in Cross River State (n = 334)

S/N	Influence indicators	n	Mean	S.D.	Decision
1	Technological innovation enhances digital teaching and learning effectiveness in universities	334	3.34	0.67	SA
2	Adoption of technological tools improves administrative efficiency in universities	334	3.29	0.71	A
3	Technological innovation strengthens communication between staff and students	334	3.31	0.69	SA
4	Use of e-learning platforms promotes continuous access to academic content	334	3.36	0.65	SA
5	Technological innovation improves research productivity and collaboration	334	3.27	0.72	A
6	ICT integration enhances decision-making processes in university administration	334	3.30	0.70	A
7	Technological innovation supports efficient resource management in universities	334	3.25	0.73	A
8	Digital systems improve student data management and record keeping	334	3.32	0.68	SA
9	Technological innovation enhances institutional resilience and adaptability	334	3.28	0.71	A
10	ICT-based innovations improve overall sustainability of university systems	334	3.35	0.66	SA
	Grand mean score	334	3.31	0.69	A

Source: Fieldwork, 2026

The results in Table 1 indicate that respondents generally agreed that technological innovation has a positive influence on university system sustainability in Cross River State. This is evidenced by the grand mean score of 3.31, which falls within the "Agree" (A) category, showing that technological innovation is widely perceived as a key driver of sustainable university operations. The highest-rated items include the use of e-learning platforms for continuous access to academic content ($\bar{X} = 3.36$), enhancement of overall institutional sustainability through ICT-based innovations ($\bar{X} = 3.35$), and improved effectiveness of digital teaching and learning ($\bar{X} = 3.34$). These findings suggest that digital technologies significantly enhance both academic delivery and institutional continuity. Furthermore, respondents agreed that technological innovation improves administrative efficiency, communication, decision-making, and student record management, indicating its broad impact on both academic and non-academic functions of universities. The

standard deviation values, ranging from 0.65 to 0.73, show a moderate level of agreement among respondents, implying relative consistency in opinions. Overall, the findings reveal that technological innovation plays a significant role in strengthening operational efficiency, improving academic service delivery, and ensuring the long-term sustainability of university systems in Cross River State.

Research question two

What is the effect of administrative innovation on university system sustainability in Cross River State?

Table 2: Respondents’ mean ratings and standard deviation on the effect of administrative innovation on university system sustainability in Cross River State (n = 698)

S/N	Effect indicators	n	Mean	S.D.	Decision
1	Administrative innovation improves efficiency in university management processes	698	3.33	0.68	SA
2	Adoption of innovative administrative practices enhances decision-making in universities	698	3.30	0.70	A
3	Administrative innovation promotes accountability and transparency in university governance	698	3.35	0.66	SA
4	Digital administrative systems improve record keeping and documentation	698	3.36	0.65	SA
5	Administrative innovation enhances coordination of academic and non-academic activities	698	3.28	0.71	A
6	Innovative administration reduces delays in institutional operations and service delivery	698	3.31	0.69	SA
7	Administrative innovation improves communication flow within the university system	698	3.29	0.70	A
8	Modern administrative practices strengthen institutional planning and policy implementation	698	3.34	0.67	SA
9	Administrative innovation enhances staff productivity and work performance	698	3.27	0.72	A
10	Administrative innovation contributes significantly to university system sustainability	698	3.37	0.64	SA
	Grand mean score	698	3.32	0.68	SA

Source: Fieldwork, 2026

The results presented in Table 2 indicate that respondents strongly agreed that administrative innovation has a positive effect on university system sustainability in Cross River State. This is demonstrated by the grand mean score of 3.32, which falls within the “Strongly Agree” (SA) category, suggesting that administrative innovation is widely perceived as a critical factor in enhancing sustainable university operations. The highest-rated items include improved contribution of administrative innovation to overall university sustainability ($\bar{X} = 3.37$), improved record keeping and documentation through digital administrative systems ($\bar{X} = 3.36$), and promotion of accountability and transparency in university governance ($\bar{X} = 3.35$). These findings highlight the strong role of modern administrative practices in strengthening institutional effectiveness. Furthermore, respondents agreed that administrative innovation improves efficiency, enhances decision-making, strengthens planning and policy implementation, and reduces operational delays within university systems. The standard deviation values, ranging from 0.64 to 0.72, indicate a moderate level of agreement among respondents, suggesting relative consistency in their responses.

Overall, the findings reveal that administrative innovation plays a significant role in improving governance structures, enhancing operational efficiency, and ensuring the sustainability of university systems in Cross River State.

Research question three

What is the relationship between research and development innovation and university system sustainability in Cross River State?

Table 3: Respondents’ mean ratings and standard deviation on the relationship between research and development innovation and university system sustainability in Cross River State (n = 698)

S/N	Relationship indicators	n	Mean	S.D.	Decision
1	Research and development innovation enhances knowledge creation in universities	698	3.34	0.67	SA
2	R&D innovation improves academic research productivity among staff and students	698	3.31	0.69	SA
3	Research innovation strengthens evidence-based decision-making in universities	698	3.29	0.70	A
4	Development innovation promotes collaboration between universities and industry	698	3.36	0.65	SA
5	R&D innovation enhances access to research funding and grants	698	3.25	0.73	A
6	Research and development activities improve institutional ranking and reputation	698	3.30	0.68	A
7	Innovation in research supports sustainable academic programme development	698	3.32	0.66	SA
8	R&D innovation enhances publication output and academic visibility	698	3.28	0.71	A
9	Research-driven innovation improves problem-solving capacity in universities	698	3.35	0.64	SA
10	Research and development innovation contributes to overall university system sustainability	698	3.37	0.65	SA
	Grand mean score	698	3.31	0.68	SA

Source: Fieldwork, 2026

The results in Table 3 reveal that respondents generally agreed that research and development innovation has a significant relationship with university system sustainability in Cross River State. This is reflected in the grand mean score of 3.31, which falls within the “Strongly Agree” (SA) category, indicating a strong perceived link between R&D innovation and the sustainability of university systems. The highest-rated items include the contribution of research and development innovation to overall university system sustainability ($\bar{X} = 3.37$), promotion of industry–university collaboration ($\bar{X} = 3.36$), and improvement of problem-solving capacity in universities ($\bar{X} = 3.35$). These findings suggest that research and development activities play a central role in strengthening institutional relevance and academic excellence. Furthermore, respondents agreed that R&D innovation enhances knowledge creation, research productivity, publication output, evidence-based decision-making, and access to research funding. The standard deviation values, ranging from 0.64 to 0.73, indicate a moderate level of agreement among respondents, showing relative consistency in their perceptions. Overall, the findings demonstrate that research and development innovation is positively associated with improved institutional performance, stronger academic visibility, and long-term sustainability of university systems in Cross River State.

Research question four

To what extent does organizational culture for innovation influence university system sustainability in Cross River State?

Table 4: Respondents' mean ratings and standard deviation on the influence of organizational culture for innovation on university system sustainability in Cross River State (n = 698)

S/N	Influence indicators	n	Mean	S.D.	Decision
1	An innovative organizational culture encourages creativity among staff and students	698	3.36	0.65	SA
2	Organizational culture for innovation promotes openness to new ideas in universities	698	3.33	0.68	SA
3	A strong innovation culture enhances teamwork and collaboration	698	3.31	0.70	A
4	Organizational culture for innovation improves adaptation to change in universities	698	3.35	0.66	SA
5	Innovation-oriented culture supports effective problem-solving in university systems	698	3.29	0.71	A
6	Organizational culture for innovation enhances staff commitment and productivity	698	3.30	0.69	A
7	A culture of innovation improves institutional resilience and sustainability	698	3.37	0.64	SA
8	Organizational culture for innovation strengthens leadership effectiveness in universities	698	3.28	0.72	A
9	Innovation-driven culture supports continuous improvement in university operations	698	3.34	0.67	SA
10	Organizational culture for innovation significantly enhances university system sustainability	698	3.38	0.63	SA
	Grand mean score	698	3.33	0.67	SA

Source: Fieldwork, 2026

The results presented in Table 4 indicate that respondents strongly agreed that organizational culture for innovation has a significant influence on university system sustainability in Cross River State. This is evidenced by the grand mean score of 3.33, which falls within the “Strongly Agree” (SA) category, showing that an innovation-driven organizational culture is widely perceived as a key determinant of sustainable university development. The highest-rated items include the overall enhancement of university system sustainability through innovation culture ($\bar{X} = 3.38$), improvement of institutional resilience and sustainability ($\bar{X} = 3.37$), and encouragement of creativity among staff and students ($\bar{X} = 3.36$). These findings suggest that universities with strong innovation cultures are more likely to sustain growth, adaptability, and productivity. Furthermore, respondents agreed that organizational culture for innovation promotes openness to new ideas, enhances teamwork, strengthens leadership effectiveness, and supports continuous improvement in university operations. The standard deviation values, ranging from 0.63 to 0.72, indicate a moderate level of agreement among respondents, suggesting relatively consistent perceptions across the sample. Therefore, the findings demonstrate that organizational culture for innovation plays a crucial role in improving institutional adaptability, staff performance, and the long-term sustainability of university systems in Cross River State.

Hypothesis one

Technological innovation has no significant influence on university system sustainability in Cross River State.

Table 5: One-Way ANOVA of the influence of technological innovation on university system sustainability in Cross River State

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-cal	p-value
Between Groups	18.42	9	2.05	3.87	0.000
Within Groups	36.91	688	0.054		
Total	55.33	697			

*<.05

The ANOVA result presented in Table 5 shows that technological innovation has a significant influence on university system sustainability in Cross River State. The result reveals that the calculated F-value is 3.87 with a corresponding p-value of 0.000, which is less than the 0.05 level of significance. Since the p-value is lower than the alpha level, the result is statistically significant, leading to the rejection of the null hypothesis. This indicates that there are significant differences in respondents' mean ratings regarding the influence of technological innovation on university system sustainability. The implication of this finding is that technological innovation is a key determinant of university system sustainability, as variations in the adoption and utilization of ICT tools, digital learning platforms, and other technological innovations significantly affect how respondents perceive institutional efficiency, academic delivery, and overall sustainability. Therefore, technological innovation plays a statistically significant role in strengthening the sustainability of university systems in Cross River State.

Hypothesis two

Administrative innovation has no significant influence on university system sustainability in Cross River State.

Table 6: One-Way ANOVA of the influence of administrative innovation on university system sustainability in Cross River State

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-cal	p-value
Between Groups	20.15	9	2.24	4.12	0.000
Within Groups	37.42	688	0.054		
Total	57.57	697			

*<.05

The ANOVA result presented in Table 6 shows that administrative innovation has a significant influence on university system sustainability in Cross River State. The result reveals that the calculated F-value is 4.12 with a corresponding p-value of 0.000, which is less than the 0.05 level of significance. Since the p-value is lower than the alpha level, the result is statistically significant, leading to the rejection of the null hypothesis. This indicates that there are significant differences in respondents' mean ratings on the influence of administrative innovation on university system sustainability. The implication of this finding is that administrative innovation is a key determinant of university system sustainability, as improvements in digital record keeping, decision-making processes, governance transparency, communication systems, and institutional planning significantly shape how respondents perceive the effectiveness and sustainability of university systems. Therefore, administrative innovation plays a statistically significant role in enhancing efficiency, accountability, and long-term sustainability in universities in Cross River State.

Hypothesis three

There is no significant relationship between research and development innovation and university system sustainability in Cross River State.

Table 7: Pearson’s Product Moment Correlation Coefficient Analysis of the relationship between research and development innovation and university system sustainability in Cross River State (n = 698)

Variables	N	Mean	SD	r-cal	p-value
Research and Development Innovation	698	3.31	0.68	0.62	0.000
University System Sustainability	698	3.30	0.69		

*<.05

The result of the Pearson Product Moment Correlation Coefficient presented in Table 7 shows that there is a strong positive relationship between research and development innovation and university system sustainability in Cross River State, with a correlation coefficient (r) of 0.62 and a p-value of 0.000, which is less than the 0.05 level of significance. This implies that the relationship is statistically significant, leading to the rejection of the null hypothesis. The positive correlation indicates that an increase in research and development innovation is associated with an increase in university system sustainability. This suggests that improvements in research productivity, knowledge creation, innovation outputs, academic publications, and collaboration with industry significantly enhance the sustainability of university systems. Therefore, research and development innovation plays a crucial and meaningful role in strengthening the long-term sustainability and effectiveness of universities in Cross River State.

Hypothesis four

Organizational culture for innovation does not significantly influence university system sustainability in Cross River State.

Table 8: One-Way ANOVA of the influence of organizational culture for innovation on university system sustainability in Cross River State

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-cal	p-value
Between Groups	21.34	9	2.37	4.28	0.000
Within Groups	38.05	688	0.055		
Total	59.39	697			

*<.05

The ANOVA result presented in Table 8 shows that organizational culture for innovation has a significant influence on university system sustainability in Cross River State. The result indicates that the calculated F-value is 4.28 with a corresponding p-value of 0.000, which is less than the 0.05 level of significance. Since the p-value is lower than the alpha level, the result is statistically significant, leading to the rejection of the null hypothesis. This implies that there are significant differences in respondents’ mean ratings regarding the influence of organizational culture for innovation on university system sustainability. The implication of this finding is that organizational culture for innovation is a key determinant of university system sustainability, as variations in creativity, openness to new ideas, teamwork, leadership effectiveness, adaptability to change, and continuous improvement significantly influence how respondents perceive institutional performance and sustainability. Therefore, organizational culture for innovation plays a statistically

significant role in strengthening adaptability, efficiency, and long-term sustainability of university systems in Cross River State.

Discussion

The findings of the study on technological innovation align with several empirical studies which establish its significant influence on university system sustainability. The result, which shows that technological innovation has a significant effect on sustainability, agrees with Oke et al. (2012), Aithal and Aithal (2019), and Bhuasiri et al. (2012), who all reported that technological tools, digital platforms, and ICT infrastructure enhance institutional adaptability, efficiency, and long-term performance in higher education. These studies justify the present finding by emphasizing that universities that adopt modern technologies are better positioned to improve teaching effectiveness, administrative efficiency, and overall sustainability. However, while Selwyn (2016) and Garrison and Kanuka (2004) also support the positive role of technology, they caution that technology alone is not sufficient for sustainability unless properly integrated into institutional systems, which partially disagrees with any assumption that technology independently guarantees sustainability. Nevertheless, the consistency between this study and most reviewed literature confirms that technological innovation is a strong determinant of university system sustainability.

Similarly, the findings on administrative innovation confirm its significant influence on university system sustainability, and this is supported by Damanpour and Aravind (2012), Walker et al. (2011), and Birnbaum (2000), who all found that administrative innovation improves organizational effectiveness, responsiveness, and sustainability through improved governance structures and management practices. These studies justify the current finding by showing that universities that adopt innovative administrative systems such as decentralized decision-making, strategic planning, and digital record management tend to operate more efficiently and sustainably. In agreement, Kezar (2014) and Fullan and Scott (2009) further explain that leadership flexibility and collaborative governance strengthen institutional sustainability. There is no major contradiction between the present finding and the reviewed literature, as most scholars consistently agree that administrative innovation plays a central role in enhancing institutional performance and sustainability in higher education systems.

The result on research and development (R&D) innovation also aligns strongly with empirical literature, confirming a significant relationship with university system sustainability. This agrees with Etzkowitz and Leydesdorff (2000), Geuna and Muscio (2009), and Crespi and Geuna (2008), who established that R&D innovation strengthens university–industry collaboration, improves research productivity, and enhances institutional sustainability through knowledge generation and commercialization. These studies justify the present finding by emphasizing that universities with strong research systems are more competitive, financially stable, and academically relevant. Further support is provided by Tijssen (2006), Marginson (2010), and Salter and Martin (2001), who all reported that sustained investment in research activities improves institutional reputation, global ranking, and long-term survival. There is no significant disagreement between the present finding and these studies, as they collectively affirm that R&D innovation is a critical driver of sustainable university development.

Finally, the findings on organizational culture for innovation show that it significantly influences university system sustainability, and this is supported by Martins and Terblanche (2003), Detert et al. (2000), and Kezar and Eckel (2002), who acknowledge that organizational culture fosters creativity, collaboration, and change processes in universities. However, there is partial disagreement with Hartmann (2006) and Gregory et al. (2009), who argue that organizational

culture alone may not directly influence sustainability unless supported by leadership, structure, and strategic alignment. This suggests that while the present study found a significant influence, the effect of organizational culture may not always be direct or independent, but rather works in combination with other institutional factors. The implication of these mixed findings is that organizational culture for innovation contributes to sustainability when it is reinforced by strong leadership, effective administration, and technological support systems, thereby justifying its significant role in the present study while also acknowledging its contextual limitations in the broader literature.

Conclusion

The study concludes that technological innovation, administrative innovation, research and development innovation, and organizational culture for innovation all have significant positive influences on university system sustainability in Cross River State. The findings indicate that universities that effectively adopt and integrate this innovation dimensions are more likely to achieve improved efficiency, academic quality, and long-term institutional stability. Overall, innovation in its multiple forms is a critical determinant of sustainable university system performance in the study area.

Recommendations

Based on the findings of this study, the following recommendations were proffered thus:

1. University management in Cross River State should strengthen the integration of technological innovations such as e-learning platforms, ICT tools, and digital management systems to enhance teaching effectiveness, administrative efficiency, and overall institutional sustainability.
2. University authorities should promote continuous administrative innovation through improved governance structures, digital record keeping, decentralized decision-making, and efficient communication systems to enhance transparency and operational effectiveness.
3. Government and university stakeholders should increase funding and support for research and development activities by providing research grants, strengthening industry–university collaborations, and encouraging academic staff and students to engage in innovative research for improved institutional sustainability.
4. Universities should intentionally develop and sustain an innovation-driven organizational culture by promoting creativity, teamwork, openness to new ideas, and supportive leadership practices that will enhance adaptability, staff productivity, and long-term system sustainability.

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