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PUBLIC PRIVATE PARTNERSHIPS AND SUSTAINABILITY OF HEALTHCARE INFRASTRUCTURE PROJECTS IN ISIOLO COUNTY, KENYA

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ABSTRACT

Isiolo County, like many others, struggles with these issues, making it difficult to provide quality healthcare. Public-Private Partnerships (PPPs) have been identified as a potential solution to these challenges, yet their impact on the sustainability of healthcare infrastructure projects remains unclear. This study examined the impact of PPPs on the sustainability of healthcare infrastructure projects, focusing on Isiolo County, Kenya. The study was guided by key objectives: to establish the influence of co-project design and capacity building on the sustainability of healthcare infrastructure projects. The research was underpinned by Systems Theory, and Human Capital Theory, which collectively provide a theoretical framework for understanding the dynamics of PPPs in enhancing project outcomes. A descriptive survey research design was employed, targeting 63 respondents, including members of the PPP Committee, healthcare project managers, and officials from the PPP Unit at the National Treasury. A census approach was used due to the manageable size of the target population. Primary data were collected using structured questionnaires. Data were analyzed in SPSS version 28 using descriptive and inferential statistics, including Pearson correlation and multiple regression analysis, to explore the relationships between the study variables. The study findings revealed that capacity building had the most substantial impact on project sustainability ($\beta = 0.299$, $p = 0.000$), followed by co-project design ($\beta = 0.262$, $p = 0.001$). The study recommends emphasizing early stakeholder involvement in project design and continuous capacity building to optimize project outcomes in healthcare PPP arrangements.

Key Words: Public-Private Partnerships, Healthcare Infrastructure Projects, Co-Project Design, Capacity Building, Sustainability

Background of the Study

Over the last few decades, the sustainability of healthcare infrastructure has been a growing concern for economists and policymakers, who argue that the involvement of the private sector is essential for the long-term success of these projects. Traditionally managed solely by public authorities, healthcare infrastructure projects face numerous challenges, including limited public funds, inefficiencies, and the need for innovation. To address these challenges, the concept of Public-Private Partnerships (PPPs) has gained prominence as an effective model for financing, designing, constructing, and maintaining healthcare infrastructure (Hodge, Greve, & Biygautane, 2020).

PPPs are collaborative arrangements where public and private sectors, often with support from financial institutions, work together throughout various stages of a project, from planning and design to construction, operation, and maintenance. These partnerships aim to leverage the strengths of both sectors: the public sector's focus on public welfare and the private sector's expertise in efficiency, innovation, and risk management (Osei-Kyei & Chan, 2019). Recent studies emphasize that PPPs not only enhance service delivery and operational efficiency but also play a significant role in achieving the long-term sustainability of healthcare infrastructure projects (Bao, Peng, & Wang, 2021).

The importance of PPPs in healthcare is underscored by their ability to provide better value for money, reduce the financial burden on the government, and allow for the transfer of significant risks to private entities. According to recent research, PPPs facilitate the implementation of innovative solutions and advanced technologies, which contribute to improved service quality, cost efficiency, and environmental sustainability (Okumah, Ankomah, & Boateng, 2020). Furthermore, the private sector’s involvement often leads to higher operating efficiency, better service reliability, and the introduction of green building practices, making healthcare projects not only economically viable but also environmentally responsible (Liu, Zhang, & Wang, 2022).

Public perception and trust in healthcare services are also positively impacted by the transparency, accountability, and stakeholder engagement inherent in PPP models. This approach ensures that healthcare infrastructure projects meet public needs while maintaining high standards of service delivery and financial sustainability (Cabral, Mahoney, & McGahan, 2019). The integration of PPPs in healthcare infrastructure has therefore been identified as a critical strategy for governments worldwide seeking to balance limited resources with the growing demand for high-quality healthcare services.

Therefore, the evolving landscape of PPPs highlights their critical role in enhancing the sustainability of healthcare infrastructure projects. By fostering collaboration between the public and private sectors, PPPs help address the complex challenges of financing, efficiency, and innovation in healthcare, ultimately leading to more resilient and sustainable healthcare systems.

Statement of the Problem

An African Development Bank (2023) report on the status of health infrastructure in African reported a huge financing gap at $26 billion per year until 2030 to meet its health service delivery infrastructure investment needs. The World Health Organization (WHO) (2022) report noted that only 7% of government expenditure on health is spent on infrastructure and even so, of that, most of the health infrastructure is not sustainable with 65% experiencing time overruns and 87% experiencing cost overruns. WHO (20200 report on healthcare infrastructure reported that in terms of quality, only 48% of the developed health infrastructure is utilized given challenges in quality. Simply put, Africa’s health system and infrastructure are vulnerable and inadequate.

In Kenya, a report by KIPPRA (2020) indicated that Kenyan Counties inherited dilapidated structures and weak maintenance capacity and investments. The report further reported clear

disparities in access to health facilities with some counties having less than 1 health facility per 10,000 people such as Isiolo County against the WHO requirements. A report by the Institute for Social Accountability, TISA (2019) established that Isiolo County has dilapidated health infrastructures whereby up to 50% of the health infrastructure projects in the county are unsustainable, remain undelivered, poorly done and in a poor form.

The role of PPP in ensuring sustainability of health infrastructure projects in terms of efficiency, effectiveness, quality service delivery has been touted as important (Quinet, 2014; Hernandez-Aguado & Zaragoza, 2016; Strasser et al. 2021). However empirical evidence of the effect in the Kenyan ASAL context is limited and not conclusive. Previous studies such as Wibowo and Alfen (2013) linked adoption of PPP to sustainability of healthcare projects; Ismail (2014) on the contrary indicated that simply adopting PPP in health care projects is not enough to yield sustainability but also a consideration of other factors in the play. On the contrary, Wright, Barlow and Roehrich (2019) didn't establish significant effect of PPP in enhancing sustainability of health projects by indicating that PPP funded projects do not have noticeably better sustainability than state projects. Notably, these studies have been conducted in contexts outside Kenya which leads to contextual research gaps which this study sought to fill by focusing on the Kenyan context.

Objectives of the Study

The main objective of the study is to establish the influence of Public Private Partnerships (PPP) in sustainability of Healthcare Infrastructure Projects in Isiolo County, Kenya

The study was guided by the following specific objectives:

i. To establish the influence of co-project design on sustainability of Healthcare Infrastructure Projects in Isiolo County, Kenya

ii. To determine the influence of capacity building in sustainability of Healthcare Infrastructure Projects in Isiolo County, Kenya

LITERATURE REVIEW

Theoretical Review

Systems Theory

Systems Theory, developed by biologist Ludwig von Bertalanffy in the 1940s, is a multidisciplinary theory that views complex entities as systems composed of interconnected and interdependent components. Bertalanffy (1968) argued that understanding any system requires examining the interactions between its parts rather than studying each component in isolation. Systems Theory has since been adapted in various fields, including management, engineering, and social sciences, to explain how different elements within a system interact to achieve a common objective. In project management, Systems Theory emphasizes the holistic nature of projects, where inputs, processes, and outputs are interlinked and must be managed cohesively for successful outcomes.

Systems Theory has been widely supported and expanded by other scholars. Checkland (1981) applied the theory to soft systems methodology, emphasizing the importance of considering human factors, relationships, and stakeholder interactions in managing complex projects. Kast and Rosenzweig (1972) further supported Systems Theory in organizational contexts, arguing that understanding an organization as a system helps in identifying the critical factors that affect its performance. In the context of PPPs, Systems Theory provides a valuable framework for understanding the co-design process, where public and private entities collaborate, bringing diverse inputs to achieve a sustainable healthcare infrastructure.

Systems Theory has been applied in various studies involving PPPs. For instance, De Lancer Julnes (2015) used the theory to examine how different components of public and private sectors interact in the design and implementation of public projects. The theory has proven

useful in explaining how collaborative design processes in PPPs can lead to better integration of public needs with private sector innovation, enhancing the overall sustainability of infrastructure projects.

Despite its broad application, Systems Theory has been critiqued for being overly abstract and sometimes too general to provide specific guidance for practical implementation (Skyttner, 2005). Critics argue that the theory's emphasis on holistic approaches can lead to complexity and ambiguity in defining the exact relationships and processes that need management attention. Furthermore, Jackson (2003) critiques Systems Theory for its difficulty in handling conflicts and power imbalances within systems, which are common in PPPs where public and private interests may not always align.

Despite these critiques, Systems Theory remains suitable for the current study because it offers a comprehensive framework for understanding the collaborative nature of co-project design in PPPs. It facilitates the analysis of how various stakeholders' inputs can be aligned to achieve sustainable outcomes in healthcare infrastructure projects. In this study, Systems Theory is linked to the variable of co-project design by highlighting the interconnectedness of public and private sector contributions in the design phase of healthcare infrastructure projects. The theory helps explain how a well-coordinated design process, involving shared expertise and stakeholder engagement, can lead to the development of sustainable healthcare facilities. By viewing the co-design process as a system, the study can assess how different design elements, such as planning, stakeholder consultation, and resource allocation, collectively influence the sustainability of healthcare projects.

Human Capital Theory

Human Capital Theory, developed by economists Theodore Schultz (1961) and Gary Becker (1964), posits that investments in human skills, knowledge, and competencies enhance productivity and economic value. The theory argues that education, training, and professional development are key investments that improve individual performance and contribute to organizational and societal benefits. In the context of PPPs, Human Capital Theory underscores the importance of building the skills and capacities of those involved in healthcare infrastructure projects to ensure sustainable outcomes.

Human Capital Theory has been extensively supported in economics, education, and organizational development literature. Becker (1993) further elaborated on the theory, emphasizing how investments in human capital improve productivity, innovation, and organizational competitiveness. In PPPs, the theory is used to explain how capacity-building initiatives—such as training healthcare workers, enhancing managerial skills, and developing technical expertise—contribute to the successful implementation and sustainability of projects.

In the field of healthcare, Human Capital Theory has been applied to examine how workforce development impacts service quality and operational efficiency. Studies by Avolio et al. (2009) and Hartog and Maassen van den Brink (2007) have highlighted the positive effects of investing in human capital on the performance and sustainability of healthcare organizations.

Critics of Human Capital Theory, such as Bowles and Gintis (1975), argue that the theory tends to oversimplify the relationship between education and productivity, neglecting broader social and economic factors that influence outcomes. Additionally, some critics point out that Human Capital Theory often fails to account for the structural inequalities and power dynamics that affect access to education and training opportunities.

Despite these critiques, Human Capital Theory remains suitable for the current study as it provides a valuable framework for understanding the role of capacity building in enhancing the sustainability of healthcare projects. Its focus on developing skills and competencies aligns with the needs of PPPs to build strong, capable teams that can manage and sustain complex healthcare infrastructure projects. Human Capital Theory is directly linked to the capacity-building variable of this study by explaining how investments in training and skills

development contribute to the sustainability of healthcare infrastructure projects. The theory supports the idea that equipping healthcare workers, managers, and technical staff with the necessary skills enhances the efficiency, quality, and long-term viability of healthcare services. By emphasizing the importance of human capital in project sustainability, the study can better assess how capacity-building efforts impact the overall success of PPP healthcare initiatives in Isiolo County, Kenya.

Conceptual Framework

A conceptual framework is an organized structure that visually and narratively outlines the expected relationships among variables in a study, serving as a foundational guide throughout the research process (Miles & Huberman, 1994). It plays a crucial role in connecting theoretical insights with empirical research by demonstrating how independent variables are linked to dependent variables, thereby facilitating a deeper understanding of how different factors interact to influence outcomes. In this study, the conceptual framework is employed to illustrate the impact of Public-Private Partnerships (PPP) on the sustainability of healthcare infrastructure projects. The framework delineates the pathways through which specific PPP components—such as co-project design, and capacity building—function as independent variables that collectively or individually influence the sustainability of healthcare infrastructure, the dependent variable.

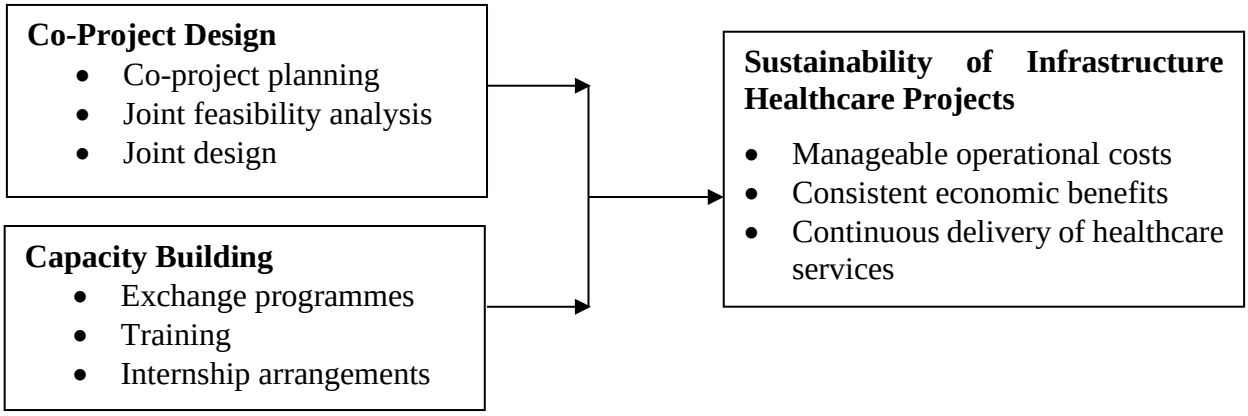

Figure 2. 1: Conceptual Framework

Co-Project Design

Co-Project Design refers to the collaborative planning, feasibility analysis, and design processes undertaken by public and private partners in PPPs to ensure that healthcare infrastructure projects are optimally configured to meet stakeholder needs. According to Engel et al. (2020), co-design incorporates a structured process where public and private partners jointly make decisions on project specifications, ensuring that the design meets both technical standards and user requirements. Silva and Rodrigues (2021) highlight that this collaborative design phase is critical for addressing potential challenges early in the project, thus enhancing overall project outcomes.

Co-Project Planning involves joint decision-making on project goals, scope, and implementation strategies. Effective co-project planning aligns stakeholder interests, reduces ambiguities, and ensures that the project roadmap addresses both technical and community needs (Yuan et al., 2020). Feasibility analysis involves evaluating the technical, financial, and operational viability of the project before commencement. A joint feasibility study allows both public and private partners to assess potential risks and benefits comprehensively, leading to more informed decision-making (Gatti, 2019). Joint Design emphasizes the collaborative aspect of the design process, where both sectors contribute expertise to create a project that is both functional and sustainable. Joint design fosters innovation and ensures that project

specifications cater to public health needs while leveraging private sector efficiencies (Akkermans & van Oppen, 2021).

Co-Project Design plays a significant role in the sustainability of healthcare infrastructure by ensuring that all aspects of a project, including technical, financial, and operational factors, are comprehensively addressed from the onset. A collaborative design process facilitates the identification of potential challenges early on, allowing for the development of more resilient and adaptable infrastructure (van den Hurk & Verhoest, 2019). This approach not only improves project quality but also ensures that facilities are better equipped to handle long-term operational demands, thus enhancing their overall sustainability. A study by Akintoye et al. (2020) emphasizes that collaborative design reduces project risks, such as cost overruns and delays, by incorporating diverse perspectives and expertise into the planning process. This shared approach aligns the objectives of both public and private sectors, leading to better decision-making and more sustainable project outcomes.

Capacity Building

Capacity Building refers to the activities that enhance the skills, competencies, and knowledge of personnel involved in PPP healthcare projects. It includes training, exchange programs, and internships aimed at improving the technical and managerial abilities of stakeholders (Merritt et al., 2019). Capacity building is crucial for developing the human resources needed to manage, operate, and sustain healthcare infrastructure effectively.

Exchange programs facilitate the sharing of knowledge and best practices between public and private sectors, enhancing skills through exposure to different operational environments and expertise (Obiri et al., 2020). Targeted training programs provide healthcare workers and project managers with the necessary skills to operate new technologies, manage facilities, and deliver quality healthcare services (Obeng-Odoom, 2021). Internships allow emerging professionals to gain hands-on experience in managing healthcare infrastructure projects, fostering a skilled workforce capable of sustaining these projects long-term (Merritt et al., 2019).

Capacity Building directly contributes to the sustainability of healthcare infrastructure by equipping stakeholders with the skills needed to address evolving challenges and optimize project outcomes. Training programs enhance operational efficiency, while exchange initiatives foster knowledge transfer and best practices, improving project governance and performance (Obiri et al., 2020). Capacity building also helps create a pool of skilled professionals who can ensure the continuity and resilience of healthcare services. Obeng-Odoom (2021) emphasizes that capacity-building initiatives are critical in low- and middle-income countries, where skill gaps can significantly impact the sustainability of healthcare infrastructure. By investing in human capital, PPPs can strengthen institutional capacity, enhance project management, and ensure that healthcare facilities are maintained to high standards over the long term.

Sustainability of Healthcare Infrastructure Projects (Dependent Variable)

Sustainability of Healthcare Infrastructure Projects refers to the ability of healthcare facilities to maintain their operational performance, deliver consistent services, and achieve long-term economic viability. According to Carbone and Neves (2020), sustainability in healthcare infrastructure encompasses environmental, financial, and social dimensions, ensuring that projects are not only economically feasible but also socially responsible and environmentally friendly.

Sustainable healthcare projects are characterized by cost-effective operations that minimize financial strain on the public sector while maintaining service quality (Boccia et al., 2020). Projects that generate ongoing economic benefits, such as job creation, improved healthcare access, and enhanced service delivery, are more likely to be sustainable over time (Kumah et al., 2020). Sustainability ensures that healthcare facilities can provide uninterrupted services,

adapting to changing healthcare needs without compromising quality or accessibility (de Carvalho & Bastian-Pinto, 2021).

Empirical Review

Co-Project Design and Project Sustainability

Akintoye et al. (2020) examined the role of co-design in enhancing the sustainability of PPP infrastructure projects. The study was grounded in Systems Theory, emphasizing how collaborative design processes between public and private stakeholders lead to more resilient project outcomes. A descriptive research design was employed, targeting construction and healthcare sectors in the UK. The study sampled 150 respondents using stratified random sampling, with data collected via structured questionnaires. Data were analyzed using regression analysis. Findings revealed that co-design significantly improves project quality and stakeholder satisfaction ($\beta = 0.65$, $p < 0.05$). The study concluded that early stakeholder involvement in project design reduces risks and enhances sustainability. The authors recommended incorporating structured co-design processes in PPP guidelines.

Engel et al. (2020) investigated the impact of co-design on the success of healthcare PPP projects, drawing on Systems Theory to explain the collaborative dynamics. The study used a mixed-methods design involving case studies and surveys targeting 200 project managers in European healthcare PPPs. A purposive sampling technique was used, with a final sample size of 120 respondents. Data were collected through in-depth interviews and questionnaires and analyzed using thematic analysis and multiple regression. Results indicated that co-design positively influenced project adaptability and service delivery outcomes ($\beta = 0.58$, $p < 0.01$). The study concluded that joint design initiatives help align project outputs with community needs and private sector efficiency. The authors recommended integrating co-design frameworks into PPP project management practices.

Silva and Rodrigues (2021) explored how joint design processes affect the sustainability of infrastructure projects under PPP arrangements. Using the Systems Theory framework, the study adopted a cross-sectional survey design targeting PPP projects in Brazil. A sample of 130 participants was selected through stratified sampling, with data gathered using surveys and focus group discussions. Structural Equation Modeling (SEM) was employed for data analysis. Findings showed a significant positive relationship between joint design efforts and project sustainability metrics (C.R. = 2.76, $p < 0.05$). The study concluded that collaborative design mitigates project risks and enhances long-term infrastructure viability. Recommendations included fostering stakeholder engagement in the design phase to ensure sustainable project outcomes.

Van den Hurk and Verhoest (2019) assessed the influence of governance and design collaboration on PPP project success, guided by Systems Theory. The study utilized a qualitative research design, focusing on case studies of PPP healthcare projects in Belgium and the Netherlands. A total of 12 projects were purposively selected, with data collected through semi-structured interviews and document analysis. Data were analyzed using thematic content analysis. The study found that well-structured co-design and governance frameworks significantly improved project performance and stakeholder satisfaction. The conclusion highlighted the importance of clear governance structures in facilitating effective co-design. The study recommended establishing transparent co-design protocols to enhance PPP project outcomes.

Akkermans and van Oppen (2021) examined the impact of co-project planning and design on the sustainability of PPP infrastructure projects. Grounded in Systems Theory, the study employed a longitudinal design, analyzing data from 15 ongoing PPP projects in the Netherlands. The study used purposive sampling to select key project stakeholders, with a sample size of 90 respondents. Data were collected using questionnaires and interviews and analyzed through path analysis. Results indicated that co-project planning significantly enhanced project alignment with sustainability goals ($\beta = 0.72$, $p < 0.01$). The study concluded

that integrating co-planning processes in PPPs fosters alignment between stakeholder expectations and project outcomes. The authors recommended the institutionalization of joint planning practices in PPP frameworks.

Capacity Building and Project Sustainability

Merritt et al. (2019) investigated the impact of capacity building on the performance of healthcare PPP projects, guided by Human Capital Theory. The study used a cross-sectional survey design targeting healthcare PPP projects in the UK. A sample of 120 respondents was selected using convenience sampling, with data collected through questionnaires. Data were analyzed using descriptive and inferential statistics. Findings showed that capacity building significantly enhances project performance and stakeholder engagement ($\beta = 0.65$, $p < 0.05$). The study concluded that investing in human capital is critical for sustainable healthcare infrastructure. Recommendations included integrating continuous training programs in PPP project frameworks.

Obiri et al. (2020) examined the role of training in enhancing the sustainability of healthcare PPP projects, using Human Capital Theory as the basis. A mixed-methods design was employed, focusing on healthcare PPPs in Ghana. The study used purposive sampling to select 80 respondents, with data collected via surveys and interviews. Data were analyzed using thematic analysis and regression models. Findings indicated that training significantly improves operational efficiency and service delivery ($\beta = 0.59$, $p < 0.01$). The study concluded that capacity building is essential for sustainable PPPs. Recommendations included expanding training initiatives to cover emerging healthcare technologies.

Moullin et al. (2020) examined how capacity building affects project sustainability in healthcare PPPs, guided by Human Capital Theory. A cross-sectional design was used, targeting PPP projects in Australia. The study sampled 150 respondents using stratified sampling. Data were collected through structured questionnaires and analyzed using Structural Equation Modeling (SEM). Findings indicated that capacity building significantly improves project sustainability by enhancing management competencies ($\beta = 0.68$, $p < 0.01$). The study concluded that capacity building is a critical factor in PPP sustainability. Recommendations included investing in leadership development programs.

Obeng-Odoom et al. (2020) explored the impact of internship programs on capacity building within healthcare PPP projects. The study, based on Human Capital Theory, employed a descriptive research design, focusing on PPP hospitals in Nigeria. A sample of 100 interns and project managers was selected using random sampling. Data were collected via surveys and analyzed using correlation analysis. Findings showed that internships significantly enhance practical skills and improve project outcomes ($r = 0.62$, $p < 0.05$). The study concluded that internships are a valuable component of capacity building in PPPs. Recommendations included expanding internship opportunities to improve workforce readiness.

RESEARCH METHODOLOGY

The study employed a descriptive survey research design. The target population for this study was various people involved in healthcare infrastructure projects at the county level as well as those involved in PPP at both county and national level. The study targeted PPP Committee at the county level, Healthcare Project Managers in Isiolo and the PPP Unit at the National Level (Treasury). In total, 63 respondents were targeted. The study employed a census approach, targeting all 63 respondents involved in healthcare projects and PPP arrangements, including PPP Committee members, Healthcare Project Managers, and officials from the PPP Unit at the National Treasury. The study utilized primary data collected through self-administered structured questionnaires. Data gathered using the questionnaires were analyzed quantitatively using both descriptive and inferential statistics using SPSS V. 28. Descriptive statistics including the mean, percentages, frequency and standard deviation were used to describe the study variables. Inferential statistics included Pearson correlation and Multiple regression analysis was also adopted

RESEARCH FINDINGS AND DISCUSSION

The study targeted a total of 63 respondents, including members of the PPP Committee, Healthcare Project Managers, and officials from the PPP Unit at the National Treasury. Six questionnaires were used for the pilot test, leaving 57 questionnaires for the main study. Out of these, 51 were completed and returned, yielding a response rate of 89.5%. This high response rate indicates strong engagement from the participants and enhances the reliability of the study findings. According to Sekaran and Bougie (2016), a response rate above 70% is considered excellent, reflecting a high level of data reliability.

Descriptive Analysis

Co-Project Design

The first objective of the study was to establish the influence of co-project design on sustainability of Healthcare Infrastructure Projects in Isiolo County, Kenya. Respondents gave their level of agreement with statements on co-project design and the findings were presented in Table 1

Table 1: Descriptive Statistics on Co-Project Design

Statements	Mean	Std. Dev.
Co-designing projects improves project quality and effectiveness.	4.154	0.722
Collaborative design processes reduce project risks.	4.087	0.735
Stakeholder involvement in design enhances project outcomes.	4.115	0.748
Joint design efforts lead to more innovative project solutions.	4.048	0.798
Co-design promotes alignment of project goals with stakeholder needs.	4.087	0.756
The co-design process fosters better communication among partners.	3.981	0.834
Co-design allows for better management of project expectations.	3.923	0.878
Early involvement of partners in design improves project sustainability.	4.173	0.701
Aggregate Score	**4.071**	**0.770**

The descriptive statistics on co-project design reveal strong agreement among respondents that collaborative design significantly enhances the sustainability of healthcare infrastructure projects. The highest mean score was for early involvement of partners in design (M = 4.173, SD = 0.701), indicating its perceived importance in improving project outcomes. Co-designing projects to improve quality and effectiveness followed closely (M = 4.154, SD = 0.722), along with stakeholder involvement enhancing project outcomes (M = 4.115, SD = 0.748). Respondents also agreed that collaborative design reduces project risks (M = 4.087, SD = 0.735) and promotes alignment of project goals with stakeholder needs (M = 4.087, SD = 0.756). Statements about fostering better communication (M = 3.981, SD = 0.834) and managing project expectations (M = 3.923, SD = 0.878) scored slightly lower but still reflect positive perceptions. Overall, the findings suggest that co-project design is viewed as a crucial component for achieving sustainable and effective outcomes in healthcare PPPs.

The aggregate score for co-project design was 4.071 (SD = 0.770), indicating that respondents generally agreed that co-project design positively impacts the sustainability of healthcare infrastructure projects. The high level of agreement suggests that collaborative design efforts, including stakeholder involvement and joint planning, are crucial for enhancing project outcomes. These findings align with Silva and Rodrigues (2021), who emphasized that early and active stakeholder involvement in project design leads to improved project quality, risk reduction, and alignment with stakeholder needs. Additionally, van den Hurk and Verhoest (2019) noted that collaborative design in PPPs fosters innovation, better communication, and enhanced project performance, highlighting the importance of joint efforts in the design phase for long-term project sustainability. The overall agreement indicates that collaborative design processes positively impact healthcare infrastructure projects in PPP arrangements.

Capacity Building

The second objective of the study was to determine the influence of capacity building in sustainability of Healthcare Infrastructure Projects in Isiolo County, Kenya. Respondents gave their level of agreement with statements on capacity building and results are presented in table 2.

Table 2: Descriptive Statistics on Capacity Building

Statements	Mean	Std. Dev.
Capacity building improves project management skills.	4.192	0.659
Training enhances the quality of project implementation.	4.144	0.678
Capacity building boosts the efficiency of project operations.	4.115	0.732
Skill development helps in addressing project challenges.	4.125	0.695
Continuous learning supports project sustainability.	4.106	0.717
Capacity building fosters innovation in project management.	4.067	0.762
Investing in human capital enhances overall project success.	4.173	0.681
Capacity building increases stakeholder engagement and participation.	4.154	0.703
Aggregate Score	**4.135**	**0.716**

The descriptive statistics on capacity building in Table 2 indicate strong agreement among respondents that investing in human capital significantly impacts the sustainability of healthcare infrastructure projects. The statement that investing in human capital enhances overall project success had the highest mean score (M = 4.173, SD = 0.681), highlighting the critical role of continuous skill development. There was also high agreement that capacity building improves project management skills (M = 4.192, SD = 0.659) and enhances the quality of project implementation (M = 4.144, SD = 0.678). Respondents also agreed that skill development helps address project challenges (M = 4.125, SD = 0.695) and that continuous learning supports project sustainability (M = 4.106, SD = 0.717). Statements such as capacity building fostering innovation (M = 4.067, SD = 0.762) and increasing stakeholder engagement (M = 4.154, SD = 0.703) reflect positive perceptions of capacity building's broader impact on project outcomes. The findings suggest that capacity building is viewed as essential for enhancing the competencies, engagement, and overall effectiveness of project teams in healthcare PPPs, thereby contributing to project sustainability.

Capacity building received the highest aggregate score of 4.135 (SD = 0.716), demonstrating strong agreement that investing in human capital significantly impacts project sustainability. Respondents agreed that continuous training, skill development, and stakeholder engagement are vital for enhancing project management skills and overall project success. These findings are consistent with Merritt et al. (2019), who emphasized that capacity building in PPPs fosters innovation, enhances decision-making, and improves the quality of project implementation. Obiri et al. (2020) also highlighted that capacity building boosts project efficiency by equipping stakeholders with the necessary skills to address project challenges and drive sustainable outcomes. The strong alignment with these literature sources underscores the critical role of capacity building in sustaining healthcare infrastructure projects, as it enhances the competencies and effectiveness of project teams within PPP arrangements.

Sustainability of Healthcare Infrastructure Projects

The main objective of the study is to establish the influence of Public Private Partnerships (PPP) in sustainability of Healthcare Infrastructure Projects in Isiolo County, Kenya. Respondents were therefore asked their level of agreement with various statements on sustainability of Healthcare Infrastructure Projects. Table 3 presents the findings obtained.

Table 3: Descriptive Statistics on Sustainability of Healthcare Infrastructure Projects

Statements	Mean	Std. Dev.
Sustainable projects maintain high operational efficiency.	4.096	0.711
Long-term financial stability is crucial for project sustainability.	4.152	0.724
Projects that are well-maintained last longer.	4.087	0.732
Effective capacity building enhances project sustainability.	4.102	0.688
Sustainability is achieved through proper resource management.	4.058	0.701
Collaborative efforts improve the sustainability of projects.	4.092	0.744
Regular updates and maintenance ensure the project's longevity.	4.073	0.765
Sustainable projects provide better value for money over time.	4.113	0.729
Aggregate Score	**4.097**	**0.724**

The findings in Table 3 indicate that respondents strongly agree on the importance of various factors contributing to the sustainability of healthcare infrastructure projects, with an aggregate mean score of 4.097 (SD = 0.724). The highest agreement was for the statement that long-term financial stability is crucial for project sustainability (M = 4.152, SD = 0.724), highlighting the critical role of financial management in maintaining project viability. High operational efficiency (M = 4.096, SD = 0.711) and well-maintained projects lasting longer (M = 4.087, SD = 0.732) were also viewed as essential components of sustainability, emphasizing the need for efficient operations and ongoing maintenance. Statements related to capacity building (M = 4.102, SD = 0.688) and collaborative efforts (M = 4.092, SD = 0.744) received strong support, reinforcing the view that team skills and cooperation among stakeholders are vital for sustaining projects. These findings align with Osipova and Eriksson (2020), who found that collaborative efforts and regular maintenance are key to enhancing project longevity and sustainability. The recognition that sustainable projects provide better value for money over time (M = 4.113, SD = 0.729) supports insights from Carbone and Neves (2020), who identified that well-managed projects yield long-term financial and operational benefits. Overall, these results affirm that financial stability, operational efficiency, proper resource management, and collaborative practices are fundamental to achieving sustainable healthcare infrastructure projects within PPP arrangements.

Correlation Analysis

Correlation analysis was conducted to determine the relationship between the independent variables (co-project design and capacity building) and the dependent variable (sustainability of healthcare infrastructure projects). If the correlation values are $r = \pm 0.1$ to ± 0.29 then the relationship between the two variables is small, if it is $r = \pm 0.3$ to ± 0.49 the relationship is medium, and when $r = \pm 0.5$ and above there is a strong relationship between the two variables under consideration. Significance was tested at 0.05 level of significance. Table 4 presents the findings obtained.

Table 4: Correlation Results

Variables		Project Sustainability	Co-Project Design	Capacity Building
Project Sustainability	Pearson Correlation	1.000		
	Sig. (2-tailed)			
	N	51		
Co-Project Design	Pearson Correlation	0.715**	1.000	
	Sig. (2-tailed)	0.000		
	N	51	51	
Capacity Building	Pearson Correlation	0.739**	0.624	1.000
	Sig. (2-tailed)	0.000	0.064	
	N	51	51	51

Correlation is significant at the 0.05 level (2-tailed).

Co-project design exhibited a strong positive correlation with project sustainability ($r = 0.715$, $p < 0.05$), suggesting that collaborative design processes significantly enhance the sustainability of healthcare infrastructure projects by aligning the project goals with stakeholder needs and ensuring the inclusion of diverse expertise. This finding supports Silva and Rodrigues (2021), who found that involving stakeholders early in the design phase leads to improved project outcomes, better risk management, and more innovative solutions tailored to specific needs. The strong correlation implies that co-design is not just a procedural step but a strategic approach that directly impacts the long-term success and sustainability of healthcare projects by fostering collaboration and shared ownership among partners.

Capacity building had the strongest positive correlation with project sustainability ($r = 0.739$, $p < 0.05$), indicating that investing in human capital significantly enhances the sustainability of healthcare infrastructure projects. This strong relationship suggests that continuous training, skill development, and stakeholder engagement are pivotal in equipping project teams with the necessary competencies to effectively manage and adapt to evolving challenges. Merritt et al. (2019) support this view, highlighting that capacity building fosters innovation, improves decision-making, and enhances overall project performance, making it a critical component of sustainable project management. The high correlation emphasizes that a skilled and well-prepared workforce is central to the success and long-term sustainability of healthcare projects in PPP arrangements.

Regression Analysis

The regression coefficients table shows the contribution of each independent variable to project sustainability, highlighting which factors have the most substantial impact.

Table 5: Regression Coefficients

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	1.203	0.398		3.024	0.003
Co-Project Design	0.262	0.077	0.285	3.401	0.001
Capacity Building	0.299	0.075	0.292	3.987	0.000

The coefficient for co-project design is 0.262 ($p = 0.001$), indicating that for every unit increase in co-project design efforts, project sustainability improves by 0.262 units. This result emphasizes that collaborative design significantly enhances project outcomes by ensuring stakeholder engagement and aligning project goals with community needs. This is consistent with Silva and Rodrigues (2021), who highlighted that effective stakeholder involvement in the design phase fosters better risk management and innovative solutions, directly contributing to project sustainability.

The coefficient for capacity building is the highest at 0.299 ($p = 0.000$), indicating that investing in human capital development has the most substantial impact on project sustainability among the studied variables. This highlights the critical role of continuous training and skill development in equipping project teams to effectively manage and adapt to evolving project demands. Merritt et al. (2019) found similar results, emphasizing that capacity building fosters innovation, enhances operational efficiency, and significantly contributes to overall project success. The strong influence of capacity building suggests that skilled personnel are essential for achieving and maintaining sustainable healthcare infrastructure.

Overall, the regression results suggest that project sustainability is positively influenced by all four independent variables. Based on the findings, the following regression equation was fitted;

Sustainability of Healthcare Projects = 1.203 + 0.262 (Co-Project Design) + 0.299 (Capacity Building)

Conclusions

The study concludes that co-project design is a critical factor in enhancing project sustainability. Collaborative design processes ensure stakeholder involvement, align project goals with needs, and foster innovative solutions, leading to improved project outcomes.

The study concludes that capacity building has the most substantial impact on project sustainability. Investing in human capital enhances project management skills, fosters innovation, and equips project teams with the competencies needed to manage and sustain healthcare infrastructure effectively.

Recommendations

To improve the sustainability of healthcare infrastructure projects, it is recommended that project stakeholders, including public authorities, private partners, and community representatives, be actively involved early in the design phase. This early involvement ensures that project designs are tailored to the specific needs of Isiolo County, aligning the project goals with local healthcare demands. Joint design workshops and collaborative planning sessions should be organized regularly to integrate stakeholder inputs, promote innovation, and reduce project risks. The establishment of a co-design committee within the PPP framework can further enhance communication and ensure that design decisions are made inclusively, leading to better project outcomes and long-term sustainability.

The study found capacity building to be the most significant contributor to project sustainability, underscoring the need for targeted investment in human capital. It is recommended that PPPs in Isiolo County implement continuous training and skill development programs tailored to the needs of healthcare project teams. These programs should focus on enhancing technical skills, project management, and stakeholder engagement. Specialized training workshops, mentorship programs, and professional development courses should be regularly conducted to equip project managers, healthcare professionals, and maintenance staff with the skills necessary to manage complex PPP projects effectively. Additionally, engaging local stakeholders in capacity-building initiatives will promote community involvement, enhance project ownership, and support sustainable healthcare infrastructure development in Isiolo County.

Suggestions for Further Studies

Based on the findings, this study explains 71.4% of the variance in the sustainability of healthcare infrastructure projects, leaving 28.6% unexplained. Future research could explore other factors influencing project sustainability, such as technological integration, stakeholder trust, and regulatory frameworks in PPPs. Additionally, comparative studies across different regions or sectors could provide further insights into the effectiveness of PPP models in enhancing project sustainability.

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