Effectiveness of Innovation Hubs in Supporting Quality Secondary Education in Tanzania: A Case of Bwejuu Innovation Hub, At Kusini District, Zanzibar

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ABSTRACT

This study examined the effectiveness of innovation hubs in supporting quality secondary education in Tanzania, with a specific focus on the Bwejuu Innovation Hub in Kusini District, Unguja, Zanzibar. It assessed how the services provided by innovation hubs enhance the quality of secondary education. A cross-sectional mixed-methods research design was employed, involving 150 respondents drawn from seven satellite secondary schools affiliated with the Bwejuu Innovation Hub, together with four key informants selected through purposive and stratified random sampling techniques. Quantitative data were analyzed using IBM SPSS Statistics Version 27, while qualitative data were analyzed using thematic analysis. The findings indicate generally positive perceptions regarding the contribution of innovation hub services to teaching and learning processes. Descriptive results revealed high mean scores for service availability and accessibility (M = 4.46), perceived impact on quality education (M = 4.44), and usefulness and relevance of services (M = 4.33). Pearson correlation analysis further revealed significant positive relationships between availability and accessibility of services and perceived impact on quality education (r = 0.533, p < 0.001), as well as between usefulness and relevance of services and perceived impact on quality education (r = 0.522, p < 0.001). Despite these positive perceptions, several challenges were identified, including limited learning resources and accessibility constraints affecting some satellite schools. The study concludes that innovation hubs contribute meaningfully to improving learning environments and student engagement in secondary education. However, strengthening infrastructure, expanding learning resources, and improving accessibility mechanisms are necessary to maximize the impact of innovation hubs on educational quality in Zanzibar.

Keywords: Innovation hubs, Quality education, Secondary schools and Zanzibar

INTRODUCTION

The concept of innovation hubs (hubs) has been interpreted differently across disciplines and according to various scholars' perspectives. According to Nicolopoulou et al. (2015), a hub is a strategic space where different stakeholders collaborate through networks to co-create innovative solutions aimed at addressing social challenges. In the context of education, innovation hubs are described as spaces that facilitate interactive learning, knowledge transfer, and networking among various stakeholders (Wawa, 2018). Historically, hubs primarily functioned as physical nexus points where technological communities, including developers and hackers, gathered to collaborate and share ideas (Gathege & Moraa, 2013). Currently, innovation hubs serve as collaborative environments that integrate digital technologies, experimentation facilities, and mentorship structures to enhance both teaching and learning processes. Friederici (2016) further notes that hubs are typically equipped with Wi-Fi-enabled spaces, hot desks, meeting rooms, and tools that support activities such as events, competitions, group meetings, and mentorship sessions. In the context of this study, an innovation hub is conceptualized as one embodiment of a broader "lab" ecosystem, which includes structures such as incubators,

accelerators, action labs, living labs, and co-working spaces that support collaboration and innovation (Sambuli & Whitt, 2017).

Globally, innovation hubs have increasingly been recognized for their role in promoting digital skills development, entrepreneurship, collaborative learning, and community engagement. For instance, in countries such as Germany, Iran, innovation hubs have played an important role in advancing these areas, similarly, across Africa, the growth of innovation hubs has been remarkable in Kenya, Zambia, and Uganda (Gavkalova et al., 2024; Jiménez & Zheng, 2016; UNDP, 2021). Between 2016 and 2019, the number of tech hubs in Africa increased significantly from 314 in 2016 to 442 in 2018, and further to 643 by October 2019, reflecting the expanding innovation ecosystem on the continent (Giuliani & Ekeledo, 2019; Cherunya & Ahlborg, 2020). Despite this growth, research in Tanzania, particularly on the mainland, has largely focused on the contributions of innovation hubs to technological innovation and entrepreneurship ecosystems (Banele et al., 2023; Mwantimwa et al., 2021). Comparatively, limited attention has been given to examining the role of innovation hubs in supporting formal secondary education, which highlights an important research gap that this study seeks to address.

United Nations International Children's Emergency Fund (UNICEF, 2000) emphasized that quality education encompasses several key dimensions: learners who have different things such as healthy, well-nourished, and ready to participate in learning; safe, protective, and resource-equipped learning environments; relevant curricula and learning materials that promote literacy, numeracy, life skills, and attitudes aligned with national development goals and active societal participation. Quality education is a driving force for socio-economic development, as it fosters economic growth, promotes innovation, enhances social cohesion, and empowers individuals (Kayani et al., 2017; Misra, 2011); where as, sustainable socio-economic development cannot be achieved without substantial investment in human capital (Sakmurzaeva, 2018; Ozturk, 2001). Zhao (2024) supports that, quality education significantly contributes to economic development by enhancing labor quality, facilitating technological innovation and diffusion, improving health and demographic structures, and strengthening social capital.

Despite global recognition of the importance of quality education, significant challenges remain. Chinapah et al. (2013), revealed that although many countries have made progress, substantial gaps in the quality of education persist. Similarly, Hemed (2019) reported that the quality of education in Zanzibar remains unsatisfactory compared to other African countries, as many graduates lack the competencies required to apply classroom knowledge in real-life situations. In response to these challenges and in alignment with Sustainable Development Goal 4 (SDG 4), Zanzibar has implemented several initiatives aimed at improving education quality. One such initiative is the Zanzibar Improving Students' Prospects (ZISP) project, through which innovation hubs have been established to strengthen the provision of quality education.

In Zanzibar, education has long been regarded as a central pillar of national development (RGoZ, 1999; RGoZ, 2024). Despite various reforms in curriculum and system structure (i.e. 2-6-4-2-3+) education structure and competency-based approaches, several challenges persisted, particularly in rural districts of Zanzibar (MoEVT, 2017; Hemed, 2019; UNICEF Innocenti et al, 2024) where schools often face shortages of laboratory facilities, ICT tools, language learning resources, and qualified teachers, particularly in Mathematics, Science, and English (MSE) subjects (UNICEF Innocenti et al., 2024). Due to these factors, Zanzibar continued to lag behind academically in comparison to many African countries in terms of education quality (Hemed, 2019). To address these structural challenges and improve students' performance in MSE subjects, the Revolutionary Government of Zanzibar, in collaboration with the World Bank through the Zanzibar Improving Students' Prospects (ZISP) Project, established 22 innovation hubs 13 in Unguja and 9 in Pemba equipped with science laboratories, computer laboratories, language laboratories, and libraries (MoEVT, 2025; MoEVT, 2021). The Ministry of Education has supported these innovation hubs through professional development for hub staff, funding, and the provision of instructional resources. Nevertheless, their impact has remained limited. According to the Ministry of Education (MoEVT, 2025), although the Form Four (FIV) examination pass rate to Form Five improved steadily between 2020 and 2023, the progress was not fully sustained, as the overall pass rate declined slightly to 81.8% in 2024, with government schools being particularly affected. Moreover, satellite schools utilizing the hubs continued to record relatively low academic performance in the Certificate of Secondary Education

Examination (CSEE), averaging Grade D in the 2024 academic year, which is below the expected threshold of Grade C. This trend highlights persistent challenges in achieving consistent academic improvement (MoEVT, 2025).

Although these hubs hold considerable potential for enhancing educational quality, evidence regarding their actual impact is still scarce. Therefore, this paper assesses the effectiveness of innovation hubs in supporting quality secondary education in Kusini District, Zanzibar, with particular attention to the availability and accessibility of services and the usefulness and relevance of services provided by the hubs. The study was guided by the following research question: **How effective are the services provided by innovation hubs in enhancing the quality of secondary education?**

LITERATURE REVIEW

Innovation hubs have increasingly emerged as contemporary educational spaces that support knowledge creation, collaborative learning, and innovation-driven education (Banele et al., 2023). These hubs function as dynamic environments where technology, mentorship, experimentation, and networking converge to enhance both teaching and learning processes. Unlike traditional educational settings, innovation hubs emphasize experiential learning, practical problem-solving, and interdisciplinary collaboration, enabling learners to apply theoretical knowledge to real-world contexts. Several studies highlight the growing role of innovation hubs in modern education systems. For example, Chowdhury et al. (2022) examined the contribution of innovation hubs to regional development in Sweden and found that these hubs significantly contribute to both economic and social development. Their study revealed that innovation hubs attract knowledge, expertise, and investment while supporting start-ups, entrepreneurship, and smart specialization. Furthermore, hubs promote sustainable development by creating social value and facilitating cross-regional collaboration through the exchange of resources and knowledge.

Similarly, in Zimbabwe, innovation hubs and industrial parks have been recognized as important mechanisms for bridging the gap between academic knowledge and innovation in higher education. These platforms foster commercialization and industrialization by transforming academic research into practical and market-oriented applications (Ministry of Higher and Tertiary Education, Science and Technology Development, 2018). However, Muzira and Bondai (2020) noted that the successful utilization of innovation hubs requires adequate financial investment and recommended that universities seek partnerships with business organizations and financial institutions to support the development of innovation infrastructure aligned with the Education 5.0 framework. In addition, Sarraipa et al. (2023) explored a learning framework for supporting Digital Innovation Hubs (DIHs) and found that such hubs provide significant opportunities for accessing advanced technologies, innovative solutions, and essential resources for digital transformation; their study proposed a flexible learning framework that positions DIHs as facilitators of education, training, and capacity development, and suggested innovation hubs should move beyond serving merely as technological infrastructures and instead function as platforms that support skills development and institutional learning.

Similarly, Galdonez et al. (2023) investigated students' experiences and acceptance of a Knowledge Hub as a Learning Management System. The findings indicated that students demonstrated high levels of satisfaction, perceived usefulness, and ease of use when interacting with the platform. Although the system was widely perceived as effective in supporting teaching and learning processes, the study highlighted the importance of addressing technical challenges, improving user training, and examining teachers' experiences to ensure effective integration of educational technologies. Muliarevych et al. (2023) also examined digital learning hubs as components of the information and digital learning environment. Their study demonstrated that digital learning hubs function as important sociocultural components of modern education systems by supporting flexible and technology-driven learning environments. The findings further indicated that digital hubs enhance decentralization of education, promote competitive learning through regular assessments, and can be effectively integrated within higher education libraries by leveraging existing digital infrastructure and resources.

Furthermore, Vance et al. (2021) examined learning hubs in California and found that they played a significant role in addressing educational inequalities, particularly during the COVID-19 pandemic. The study revealed that

learning hubs provided safe and structured learning environments that supported students' social, emotional, cognitive, and academic needs. These hubs were particularly beneficial for students facing challenges related to limited internet connectivity, lack of digital devices, or insufficient academic support at home. The study also emphasized that effective implementation of learning hubs requires strong collaboration among schools, communities, and learning professionals. Despite the growing recognition of innovation hubs as transformative educational spaces, existing studies largely focus on higher education institutions, entrepreneurship ecosystems, or digital innovation systems. Empirical studies examining the contribution of innovation hubs to the provision of quality secondary education remain limited globally. Therefore, this study seeks to examine the role of innovation hubs in supporting quality secondary education by focusing on the availability and accessibility of hub services and the usefulness and relevance of these services in improving teaching and learning processes

CONCEPTUAL FRAMEWORK

The conceptual framework illustrates the relationship between innovation hub services and the quality of secondary education. In this study, the independent variables consist of the effectiveness of innovation hub services, which include availability and accessibility of services and the usefulness and relevance of services provided by the hubs. These services represent the operational dimensions through which innovation hubs support teaching and learning processes. The dependent variable is quality secondary education, which is measured through student performance in Mathematics, Science, and English (MSE) subjects and student engagement in learning activities. The framework assumes that when innovation hubs provide accessible, relevant, and useful educational services, students gain better opportunities for practical learning, improved academic support, and increased engagement in educational activities. Consequently, enhanced access to hub services is expected to improve students' learning experiences and academic performance, thereby contributing to improved quality of secondary education. The conceptual framework therefore demonstrates how the effectiveness of innovation hub services influences educational outcomes within secondary schools
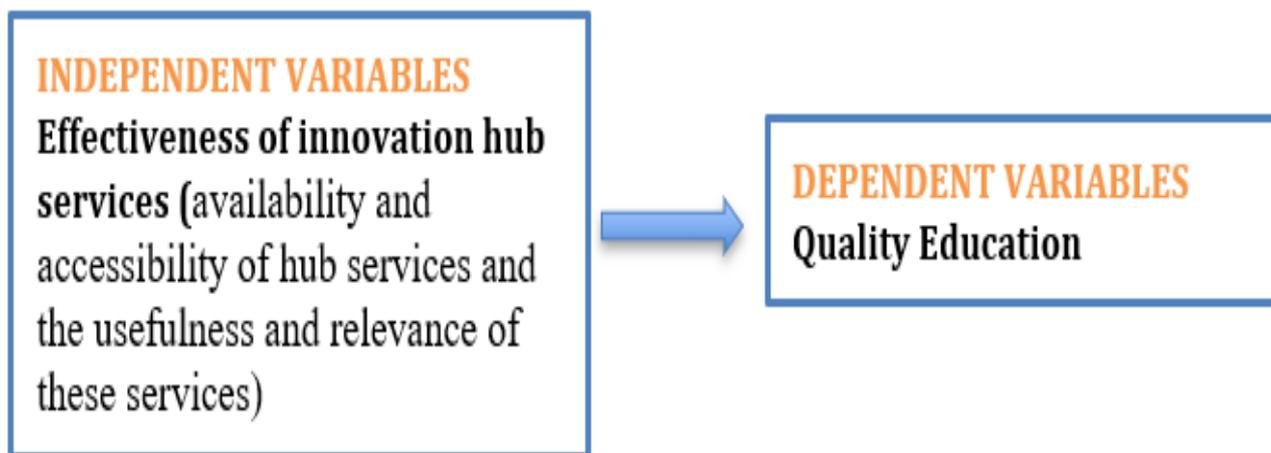

Figure 2.1: Conceptual Framework for the Study

METHODOLOGY

The study adopted a Cross-Sectional Study integrating both Qualitative Research and Quantitative Research approaches to assess the contribution of innovation hubs to quality secondary education in Kusini District, Zanzibar. A total sample of 150 participants comprising 110 students, 32 teachers, and 8 hub staff was selected using Purposive Sampling and Stratified Random Sampling techniques to ensure representation of key stakeholders. Data were collected using structured questionnaires administered through KoboToolbox, complemented by key informant interviews. Quantitative data were analyzed using descriptive and inferential statistics in IBM SPSS Statistics Version 27, while qualitative data were analyzed using Thematic Analysis to generate deeper insights into the effectiveness of innovation hubs.

Ethical Considerations

The researchers obtained research clearance letters from the relevant authorities prior to conducting the study. In addition, informed consent was sought from participants by providing them with consent forms to sign, indicating their voluntary willingness to participate after being assured that the information collected would be used strictly for research purposes. Furthermore, the participants were guaranteed confidentiality, and all information provided was handled with privacy throughout the data collection and analysis process.

Validity and reliability

The validity of the research instrument was assessed to ensure that the questionnaire accurately measured the intended study variables related to the influence of innovation hubs in supporting the provision of quality secondary education. Content Validity was established through expert review by academic supervisors and education specialists who evaluated the relevance and clarity of the questionnaire items in relation to the study objectives, and their recommendations were incorporated to improve the instrument. In addition, External Validity was considered to ensure that the study findings could be generalized to the broader population, supported through the use of Inferential Statistics during data analysis. The reliability of the questionnaire was tested using Cronbach's Alpha in IBM SPSS Statistics. The results indicated a Cronbach's Alpha coefficient of 0.835 for the 12 items measuring the effectiveness of innovation hub services. This value exceeds the recommended threshold of 0.70, indicating that the instrument had high internal consistency and was reliable for data collection.

Findings

Demographic Characteristics of Respondents

The Demographic characteristics of the respondents in this study included sex, educational level, and years of experience in innovation hub programs. These characteristics provided important background information for understanding the respondents involved in the study and help ensure the credibility, diversity, and representativeness of the collected data as shown in Table 1.

Table 1: Demographic Characteristics of Respondents (N = 150)

Variable	Category	Frequency	Percent (%)
Sex	Female	69	46.0
	Male	81	54.0
	Total	**150**	**100.0**
Educational Level	Advanced Level	21	14.0
	First Degree	30	20.0
	Secondary Education	90	60.0
	Diploma	9	6.0
	Total	**150**	**100.0**
Years of Experience	Less than 1 year	51	34.0
	1–2 years	66	44.0
	3–5 years	31	20.7
	More than 5 years	2	1.3
	Total	**150**	**100.0**

Source: Field Data (2025)

The findings from Table 1 showed the demographic distribution of respondents based on sex, educational level, and years of experience. The results indicated that male respondents (54.0%) slightly outnumbered female respondents (46.0%), suggesting a relatively balanced gender representation among participants. In terms of educational level, the majority of respondents (60.0%) had secondary education, indicating that most participants were students or individuals at the secondary school level, while 20.0% held a first degree, 14.0% had advanced level education, and 6.0% possessed a diploma. Regarding years of experience, the largest proportion of respondents (44.0%) had 1–2 years of experience, followed by 34.0% with less than one year, 20.7% with 3–5 years, and only 1.3% with more than five years of experience. This distribution suggested that the majority of respondents had relatively limited experience, which was consistent with the dominance of secondary-level participants in the study. Overall, the demographic profile indicated that the study largely captured the perspectives of relatively young and less-experienced individuals involved in the education and innovation hub environment.

The Effectiveness of Services Provided by Innovation Hubs

The descriptive statistics results indicate generally high perceptions of innovation hub services and their contribution to education among the 150 respondents. The findings in Table 6 revealed that, the availability and accessibility of services recorded the highest mean score *(M = 4.46, SD = 0.487)*, suggesting that respondents strongly agreed that innovation hub services are readily available and accessible. This was followed by the perceived impact on quality education *(M = 4.44, SD = 0.462)*, indicating that participants believe the innovation hub significantly contributes to improving the quality of secondary education. Meanwhile, usefulness and relevance of services had a slightly lower but still high mean score *(M = 4.33, SD = 0.520)*, showing that respondents generally perceive the services as useful and relevant to their educational needs. Overall, the high mean values (above 4.0 on the Likert scale) suggest a strong positive perception of the innovation hub services and their role in supporting quality education.

Table 2: The Effectiveness of Services Provided by Innovation Hubs

	N	Mean	Std. Deviation
Perceived impact on quality education	150	4.4356	.46173
Availability and accessibility of services	150	4.4600	.48732
Usefulness and relevance of services	150	4.3293	.52027

Source. Field data (2025)

These results aligned with the study by Galdonez *et al.* (2023), which reported positive student experiences and acceptance of Knowledge Hubs as learning management systems, emphasizing their usefulness in facilitating academic engagement. However, Key informant I (Academic master) insights supported these findings, by emphasizing that *"The hub services are highly effective for both teachers and students; however, only a few teachers and learners benefit regularly due to the long distance between some schools and the hub."*

In inferential statistics, a Pearson correlation analysis was conducted to examine the relationship between innovation hub services and the perceived quality of secondary education among 150 respondents, as presented in Table X.

Table 3: The Correlation of Usefulness and relevance of services, Availability and accessibility of services and Perceived impact on quality education

		Perceived impact on quality education	Availability and accessibility of services	Usefulness and relevance of services
Pearson Correlation	Perceived impact on quality education	1.000	.533	.522

	Availability and accessibility of services	.533	1.000	.743
	Usefulness and relevance of services	.522	.743	1.000
Sig. (1-tailed)	Perceived impact on quality education	.	.000	.000
	Availability and accessibility of services	.000	.	.000
	Usefulness and relevance of services	.000	.000	.

The results from Table 3 show a moderate positive correlation between availability and accessibility of services and perceived impact on quality education *(r = 0.533, p < 0.001)*, indicating that increased access to innovation hub services is associated with improvements in education quality. Similarly, usefulness and relevance of services also demonstrated a moderate positive relationship with the perceived impact on quality education *(r = 0.522, p < 0.001)*, suggesting that services considered useful and relevant contribute positively to educational outcomes.

Additionally, there was a strong positive correlation between availability and accessibility of services and usefulness and relevance of services *(r = 0.743, p < 0.001)*, implying that services that are more accessible tend to be perceived as more useful and relevant. Overall, these findings indicate that the availability, accessibility, and relevance of innovation hub services play a significant role in enhancing the quality of secondary education.

DISCUSSIONS

The findings of this study provide important insights into the effectiveness of innovation hub services in supporting quality secondary education in Kusini District, Zanzibar. The demographic results indicate a relatively balanced gender representation among respondents, with males slightly outnumbering females. The majority of respondents had secondary-level education and relatively limited experience in innovation hub programs, reflecting that most participants were students who are the primary beneficiaries of hub services.

The descriptive results revealed generally positive perceptions of innovation hub services. Availability and accessibility of services recorded the highest mean score (M = 4.46), followed by perceived impact on quality education (M = 4.44) and usefulness and relevance of services (M = 4.33). These findings suggest that respondents view innovation hubs as accessible and beneficial learning environments that support teaching and learning processes. This aligns with the findings of Galdonez et al. (2023), who reported positive student experiences with knowledge hubs in supporting academic engagement. Qualitative insights also highlighted certain operational challenges.

Although hub services were considered effective, some respondents noted that distance from satellite schools limits regular access to hub facilities. This suggests that geographical accessibility remains a barrier to maximizing the benefits of innovation hub services. The inferential analysis further demonstrated significant relationships between the study variables.

Availability and accessibility of services showed a moderate positive correlation with perceived impact on quality education (r = 0.533, p < 0.001), while usefulness and relevance of services also showed a moderate positive relationship with perceived impact on quality education (r = 0.522, p < 0.001). Additionally, a strong positive correlation was found between availability and accessibility of services and usefulness and relevance of services (r = 0.743, p < 0.001). These findings suggest that accessible and relevant innovation hub services contribute positively to improving educational experiences and supporting quality secondary education

CONCLUSION

The findings of this study indicate that innovation hub services contribute positively to supporting the provision of quality secondary education in Kusini District, Zanzibar. Respondents generally perceived the services provided by the innovation hub as accessible, useful, and relevant to their educational needs. High mean scores for availability and accessibility of services, perceived impact on quality education, and usefulness and relevance of services suggest that innovation hubs enhance teaching and learning processes. Furthermore, the correlation analysis revealed significant positive relationships between innovation hub services and the perceived quality of education, indicating that accessible and relevant services are associated with improved educational experiences. However, the study also identified several operational challenges that may limit the full effectiveness of innovation hubs. In particular, limited learning resources and accessibility constraints for some satellite schools reduce the regular utilization of hub services. Therefore, strengthening infrastructure, expanding learning resources, and improving accessibility mechanisms are necessary to maximize the impact of innovation hubs in enhancing the quality of secondary education.

Suggestions for further research

Future research should examine the long-term impact of innovation hubs through longitudinal studies that track students' academic performance and skills development over time. Comparative studies across multiple hubs in Unguja and Pemba are also needed to identify variations in effectiveness, resource use, and governance. To strengthen causal evidence, future studies should apply experimental or quasi-experimental designs comparing schools with and without hub access. Further studies should explore teachers' professional development, focusing on how hub-based training influences pedagogy and classroom practice. Additional inquiry should assess the inclusiveness of innovation hubs, especially their support for learners with disabilities through assistive technologies and inclusive practices. Cost-effectiveness and sustainability analyses are required to determine whether educational benefits justify public investment. Future studies should also investigate community and private-sector partnerships in strengthening hub resources and mentorship. Finally, research on virtual and hybrid innovation hubs is recommended to explore digital solutions for expanding access to underserved and remote schools.

Declaration of Competing Interests

The authors declare that there are no conflicts of interest related to this study. No financial, personal, or professional relationships have influenced the work reported in this manuscript.

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