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GENDER DISPARITIES IN PURSUING ICT PROGRAMMES: A STUDY OF TANZANIAN UNDERGRADUATES' PERSPECTIVES

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ABSTRACT
The government of Tanzania is eying Information and Communication Technology (ICT) as a catalyst towards transforming the country into a middle-income. There have been several initiatives to increase both the size and quality of ICT-skilled human resource base in Tanzania. Thus, development of ICT programmes and specialised ICT colleges in Higher Education Institutions has been the government's concern. Consequently, number of students enrolled to pursue ICT programmes have been in the increase. However, statistics show that the number of females pursuing ICT programmes is constantly low as compared to that of males. In 2022/2023 academic year, out of 8,499 students enrolled to pursue ICT programmes in Tanzania's Higher Education Institutions, 5,768 (67.9%) were males while 2,731 (32.1%) were females. Thus, this study quested the factors affecting female enrolment in ICT programmes. A cross-sectional survey design was employed. Area of the study included Moshi Co-operative University and the Institute of Accountancy Arusha in Tanzania. A total of 122 randomly selected respondents consisting of students and admission officers were involved in the study. Results confirmed low number of female students enrolled in ICT programmes. Factors impeding females' enrolment in ICT programmes included lack of governing policies, lack of motivations for female students to pursue ICT programmes, unconducive job environments, and community perceptions that ICT is for men. Furthermore, the study found that among women in ICT programmes substantial part of them (45.5%) were motivated by their personal interests. Therefore, it is recommended that societies should prepare girls to undertake ICT career through proper upbringing. Also, Higher Education Institutions and their stakeholders should develop awareness creation campaign to encourage women to pursue ICT programmes.

Keywords: Gender, Higher Education, Higher Education Institutions, ICT, University Students, Undergraduates.
Paper type: Research paper
Type of Review: Peer Review

1. Introduction

Higher Education Institutions (HEIs) play a pivotal role in human development worldwide, providing essential education across various disciplines. As Yue (2022) asserts, higher education fosters expertise in fields like science, technology, engineering, medicine, business, humanities, and law, crucial for the contemporary labour market. Graduates from HEIs bring invaluable skills and capacity to develop solutions to societal challenges, as highlighted by Cortese (2003), who advocates for higher education to contribute to social vibrancy, economic security, and environmental sustainability.

Recognising the significance of higher education, many countries, including the United Republic of Tanzania (URT), have heavily invested in this sector. Regional initiatives, such as the Inter-University

Council for East Africa (IUCEA), have been established to support HEIs and enhance teaching and learning methodologies (IUCEA, 2023). In Tanzania, the government has prioritised higher education as a key driver of national development (Kibona, 2023). Initiatives such as the Higher Education for Economic Transformation (HEET) project, supported by the World Bank, aiming at enhancing learning environments and aligning academic programmes with workforce demands, as outlined in Tanzania's National Five-Year Development Plan III (2021/22-2025/26) and National Development Vision 2025 has been put in place. The aim being to ensure a well-educated and learning society, peace, stability and unity, good governance, competitive economy capable of producing sustainable growth and shared benefits and high-quality livelihood (The World Bank, 2021; URT, 1999).

The Tanzania Commission for Universities (TCU) show that the expansion of HEIs in Tanzania have increased from just two universities in 1990 to 47 by May 2022. This reflects the country's commitment to higher education. Consequently, student enrollment has increased, with 113,383 students admitted in the 2022/2023 academic year, compared to only 3,146 in 1990 (TCU, 2023). ICT courses have become integral to HEI curricula, reflecting the growing demand for ICT skills in the labour market (Ndibalema, 2020). The Tanzania's National ICT Policy, revised in 2016, underscores the importance of nurturing a skilled ICT workforce, leading to the establishment of dedicated ICT colleges and programmes in universities (URT, 2016). As Tanzania aims to transition into a middle-income country by 2025, ICT is recognized as a catalyst for industrial growth and global competitiveness (Ndibalema, 2020; Sife and Matto, 2022).

Despite these advancements, gender disparities persist in ICT enrollment within Tanzanian HEIs. Female representation in ICT programmes remains significantly low, mirroring broader trends in STEM disciplines (Innocent and Kipene, 2022; Matete, 2022). However, existing literature primarily focuses on motivating factors for women in STEM fields, assuming ICT as part of this domain, without distinct investigation into ICT-specific factors (Vooren et al., 2022; Christie et al., 2017; Randolph, 2019). This study addresses this gap by focusing explicitly on ICT programmes and examining the perceptions of female undergraduate students in Tanzania. Through investigating factors influencing female enrollment in ICT, this study seeks to contribute to a deeper understanding of gender dynamics within the field. The main objective of the study was to investigate the perceptions of university undergraduate students regarding female enrollment in ICT programmes in Tanzania. The study was guided by the following research questions:

(i) Do female students express interest in pursuing ICT programmes?
(ii) What factors deter female students from enrolling in ICT programmes?
(iii) What motivates female students to pursue ICT programmes?

2. Theoretical Framework

This study was primarily underpinned Cheryan et al. (2017) model which elucidates gender differences in Higher Learning Institutions (HLIs) with a focus on factors influencing lower female enrollment in ICT programmes. While originally centred on gender dynamics in science, technology, engineering and mathematics (STEM) fields within the United States, this study adopted and adapted the model to narrow its focus to ICT and contextualize it for the Tanzania’s educational landscape. Cheryan et al.'s model comprises three key elements such as variability in micro-level factors, variability in macro-level factors, and variability in the representation of women across the field of ICT. These elements are hypothesised to shape female students' choices, preferences, and interests in ICT programmes (see Figure 1).

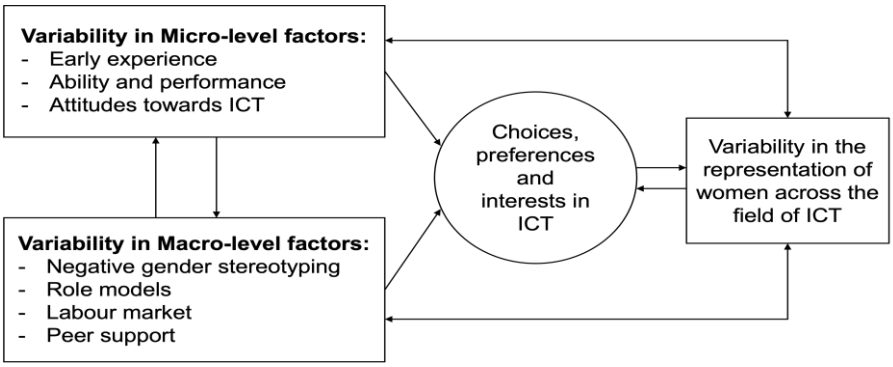

Figure 1: Adopted Research Framework
Source: Modified from Cheryan et al., 2017.

The first element which is variability in micro-level factors, encompasses various determinants influencing women's engagement with ICT. Especially, early experiences, abilities, and attitudes towards ICT play important roles in shaping female students' choices. A study by George et al. (2020) highlights the significance of early exposure to ICT classes in fostering girls' interest in ICT education. Similarly, studies by Yates and Plagnol (2022) and Matete (2021) show the importance of early exposure and positive attitudes towards ICT in influencing career aspirations, suggesting that boys' early exposure to computers through childhood games may contribute to their higher likelihood of pursuing ICT programmes.

The second element of the model focuses on variability in macro-level factors, encompassing broader societal influences on female enrollment in ICT programmes. Negative stereotypes, lack of role models, and societal norms surrounding ICT careers are identified as significant barriers. A study by Yates and Plagnol (2022) emphasises the social construction of these factors, highlighting their origins in community perceptions. Studies by Reinking and Martin (2018) and Bowman et al. (2022) further elucidate the impact of stereotype threats and peer influences on girls' participation in STEM fields, indicating that negative stereotypes and lack of peer support can deter female students from pursuing ICT programmes. Moreover, the absence of prominent female figures in ICT leadership roles, as noted by George et al. (2020) and Broadley (2015), reinforces the notion that women require visible success stories to be motivated to pursue ICT careers. Early career preparation is also deemed crucial, with Morton et al. (2018) suggesting that early exposure to ICT pathways increases the likelihood of pursuing ICT programmes among female students.

Finally, the third element of the model addresses the underrepresentation of women in ICT fields compared to other disciplines, as highlighted by Meyer et al. (2015). This discrepancy may contribute to female students' reluctance to pursue STEM courses, including ICT, further exacerbating gender disparities in enrollment.

3. Research Methods

This study employed a mixed methods approach, integrating both qualitative and quantitative methodologies. The rationale for adopting this approach was twofold including to explore the research area comprehensively and to mitigate the limitations inherent in each method by leveraging the strengths of the other. Data collection took place between December 2022 and January 2023 at two Tanzania's Higher Education Institutions (HEIs) such as Moshi Co-operative University (MoCU) and the Institute of Accountancy Arusha (IAA). MoCU is situated in the Kilimanjaro region, while IAA is located in Arusha, neighbouring regions in Northern Tanzania. These institutions were selected for three primary reasons. Firstly, both offer ICT programmes, aligning with the study's focus. Secondly, to capture perspectives from students enrolled in non-ICT programmes regarding female enrollment in ICT, MoCU and IAA were chosen for their common non-ICT degree offerings including Bachelor of Procurement and Supply Chain Management and Bachelor of Accounting and Finance/ Bachelor of Accountancy. Thirdly, the proximity of the study area to the researchers' residence in Moshi facilitated accessibility.

A total of 122 participants were involved in this study including two admission officers (one from each HEI) purposively selected due to their roles, and 120 students randomly chosen from a population of approximately 19,000 students (around 9,000 from MoCU and 10,000 from IAA). The population size was confirmed through interviews with admission officers. The study followed Israel's (1992) recommendation for sample size determination, suggesting a sample of 100 for a population of 20,000 with a precision of ±10%. However, following Dolnicar et al.'s (2016) suggestion to optimize sample size, the initial sample size was increased to 120.

Data collection involved both qualitative and quantitative methods. Qualitative data were gathered through key informant interviews and documentary review, while quantitative data were obtained through questionnaires. Scheduled interviews were conducted with admission officers, while questionnaires were distributed randomly to every 10th student encountered by researchers. Participation was voluntary, with respondents having the freedom to decline. In case of refusal, the subsequent 11th student was approached. Qualitative data were analysed using content analysis, while quantitative data were analysed using frequency distribution, simple percentages, and cross-tabulation. SPSS software facilitated quantitative data analysis. Ethical considerations were paramount throughout the study. Informed consent was obtained from all participants, and measures were taken to ensure privacy, confidentiality, and anonymity during data collection and analysis.

4. Findings and Discussions

4.1 Description of Respondents

This study involved 60 respondents from each of the two surveyed Higher Education Institutions (HEIs), totalling 120 participants. However, it was observed that students from Moshi Co-operative University (MoCU) exhibited greater proactivity in completing and returning questionnaires compared to those from the Institute of Accountancy Arusha (IAA). Consequently, 64 respondents (53.3%) were from MoCU, while 56 (46.7%) were from IAA. Despite the slightly lower response rate from IAA, it remained within acceptable levels according to Fincham (2008). Regarding gender distribution, 66 respondents equivalent to 55%, were male, while 54 respondents 45%, were female with the distribution of 29 from MoCU and 25 from IAA. Although there was a slight imbalance in the number of male and female respondents, the difference was not statistically significant. Thus, the study obtained balanced representation from both genders across the two HEIs.

In addition to soliciting the opinions of students enrolled in ICT programmes, it was imperative to gather insights from those pursuing non-ICT programmes regarding their perspectives on female enrollment in ICT programmes. This approach ensured a comprehensive and balanced representation of views. The two surveyed Higher Education Institutions (HEIs) were identified as offering two common non-ICT degree programmes: Bachelor of Procurement and Supply Chain Management, and Bachelor of Accounting and Finance/Bachelor of Accountancy. These programmes were selected due to their similarity in student demographics across both institutions. As indicated in Table 1, a total of 71 respondents (59.2%) were enrolled in ICT programmes, while 49 respondents (40.8%) were pursuing non-ICT programmes.

Table 1: Description of Respondents in term of Study Programmes

Programme Category	Programme Name	Frequency			Percentage
		Female	Male	Total	
ICT Programmes	Bachelor of Computer Science / IT	11	14	25	20.8
	Bachelor of Science in Business Information and Communication Technology	19	27	46	38.4
	Total (ICT Programmes)	**30**	**41**	**71**	**59.2**
Non-ICT Programmes	Bachelor of Accounting and Finance / Accountancy	24	18	42	35.0
	Bachelor of Procurement and Logistics Management	0	7	07	5.8
	Total (Non-ICT Programmes)	**24**	**25**	**49**	**40.8**
	Total	**54**	**66**	**120**	**100**

Source: Survey data, 2023

4.2 Enrolment trend per gender and programme

To discern enrolment trends within the surveyed Higher Education Institutions (HEIs), the study conducted interviews with admission officers at each institution. Enrolment data for both ICT and non-ICT programmes across five consecutive academic years, spanning from 2015/2016 to 2019/2020, was obtained and analysed. The analysis revealed a persistent disparity in the enrolment of female students in ICT programmes compared to their male counterparts. For instance, as depicted in Figure 2, the number of male students enrolled in ICT programmes fluctuated over the years: 88 in the 2015/2016 academic year, 55 in 2016/2017, 63 in 2017/2018, 129 in 2018/2019, and 227 in 2019/2020. In contrast, the enrolment numbers for female students remained consistently low during the same period, with figures of 17, 5, 11, 25, and 67, respectively.

While there was a noticeable increase in overall ICT enrolment in the 2019/2020 academic year, the disparity between male and female enrolment persisted. Although the number of male students reached 227, surpassing even that of female non-ICT students (212), the enrolment of female students remained markedly lower, totalling only 66. This finding substantiates the assertions made by previous scholars including Innocent and Kipene (2022), George et al. (2020), and The Open University of Tanzania (2018) regarding the persistent underrepresentation of female students in ICT and other STEM disciplines compared to their male counterparts.

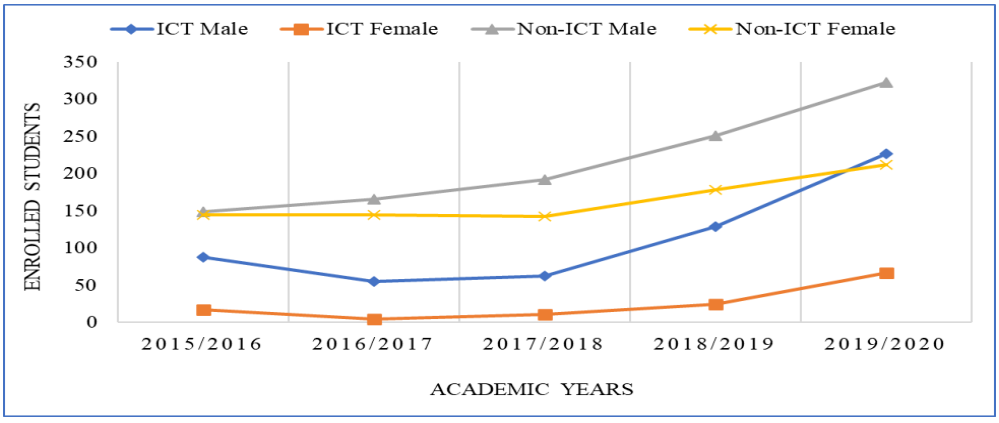

Figure 2: Five Years Enrolment Trends per Gender and Programme
Source: Survey data, 2023.

4.3 Respondents' perception on whether females like to pursue ICT programmes or not

Given the limited enrolment of females in ICT programmes, the study sought to explore whether respondents perceived female students as being inclined or disinclined towards pursuing ICT programmes. Both male and female respondents were asked to share their views on this matter. Majority of respondents covering 45 males (37.5%) and 28 females (23.5%) expressed the belief that female students did not have a preference for pursuing ICT programmes. A smaller proportion of respondents including 20 males (16.7%) and 25 females (20.8%) held the opposite view.

Along the same line, during an interview, one of the admission officers said that: "It is likely that female don't like to pursue ICT programmes because when most of them come here to inquire about our programmes, we normally recommend programmes congruent with their academic performance in secondary schools. But, even if they have minimum required qualifications, most of them don't show interest in pursuing ICT programmes." (KI 1, January, 2023).

4.4 Factors hindering female students to pursue ICT programmes

Given the low representation of female students in ICT programmes, it is crucial to identify the underlying reasons. Therefore, the study focused into the factors impeding female students from pursuing ICT programmes. To achieve this, a 5-point Likert scale such as 1-Strongly agree, 2-Agree, 3-

Neutral, 4-Disagree, 5-Strongly disagree was utilised to assess seven potential hindering factors. The summarised findings are presented in Figure 3.

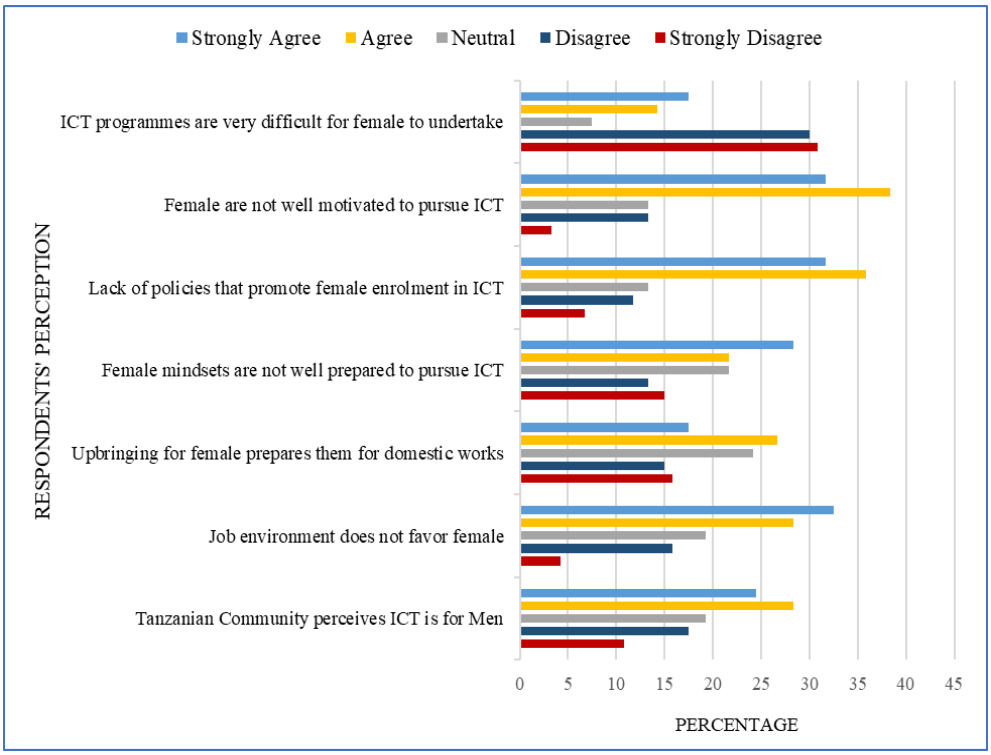

Figure 3: Factors hindering female enrolment into ICT Programme [N=120]
Source: Survey data, 2023.

As depicted in Figure 3, respondents overwhelmingly identified several key factors hindering female enrolment in ICT programmes. These included concerns about the job environment (32.5%), the absence of governing policies promoting female enrolment in ICT programmes (31.7%), lack of motivation for females to pursue ICT programmes (31.7%), and established societal perceptions regarding females' suitability for ICT programmes (28.3%). Interestingly, respondents did not perceive ICT programmes as inherently difficult for females. This sentiment was shared by 30.8% of respondents (18 males, 19 females) who strongly disagreed with the notion that ICT programmes are overly challenging for females. Additionally, 30.0% (21 males, 15 females) disagreed, 7.2% (5 males, 4 females) neither agreed nor disagreed, only 14.2% (11 males, 6 females) agreed, and 17.5% (11 males, 10 females) strongly agreed.

During interviews, a Key Informant (KI) shed light on this aspect, suggesting that societal expectations and early gender-specific upbringing might influence females' reluctance to pursue ICT programmes. This sentiment was echoed in January 2023 by KI 2, who remarked: "I think females do not gravitate towards ICT programmes due to societal norms ingrained in their upbringing. Many parents tend to steer their daughters towards traditional gender roles, providing them with dolls and kitchen items, while boys are encouraged to explore toys that foster interest in science and technology." These findings communicated that the hindrances to female students' engagement with ICT programmes extend beyond perceived program difficulty. Rather, they are rooted in societal attitudes, early exposure, and the absence of supportive initiatives and environments conducive to female participation in ICT.

4.5 Motivating factors for those pursuing ICT programmes

Among the respondents in this study, a total of 30 female students were enrolled in ICT programmes, as presented in Table 1. The study aimed to identify the factors motivating these female students to pursue ICT studies. The findings, depicted in Figure 4, shed light on the primary motivating factors. According to the results, personal interest emerged as the predominant motivation, cited by 45.5% of female

respondents enrolled in ICT programmes. Additionally, factors such as persuasion from parents or friends (26.4%), perceived job opportunities (22.0%), and the belief that ICT knowledge offers better prospects for high-paying employment opportunities (6.1%) were also cited.

These findings communicate the importance of addressing the motivation gap among female students in ICT. The data suggests that many female students are primarily driven by their personal interests rather than external influences from ICT stakeholders such as Higher Education Institutions (HEIs) or governmental bodies responsible for policy formulation. This aligns with the broader sentiment revealed in Figure 3, where a significant portion of respondents agreed that female students lack adequate motivation to pursue ICT programmes.

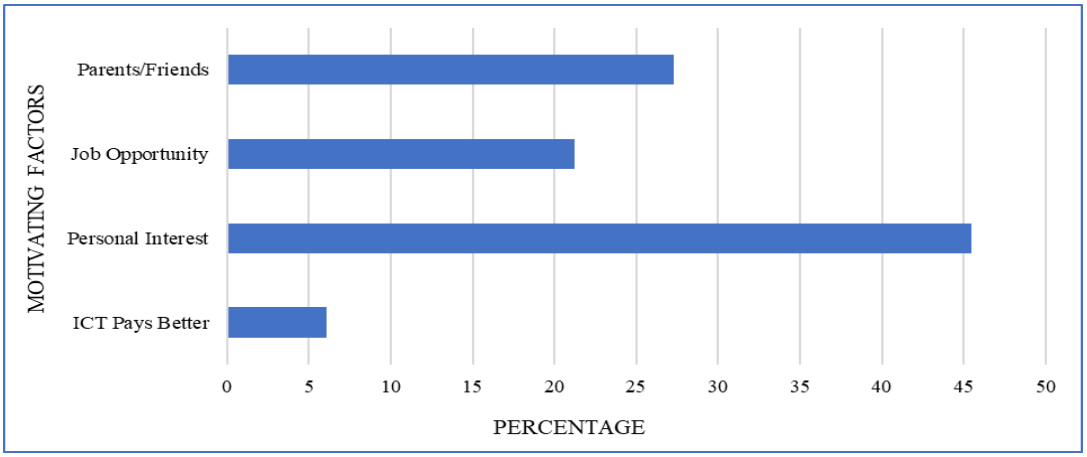

Figure 4: Motivating factors for females who were enrolment into ICT Programme [N=30]
Source: Survey data, 2023.

5. Discussion of Findings

The findings of this study communicate a persistent gender disparity in the enrolment trends of Tanzania's HEIs, particularly within ICT programmes. Despite efforts to promote gender equality, data reveals a stark reality including ICT programmes remain predominantly male-dominated. This trend mirrors previous studies, including those conducted by Innocent and Kipene (2022) and George et al. (2020), highlighting the ongoing challenge of female underrepresentation in ICT fields. Additionally, our findings align with Matete's (2022) study, indicating a preference among female students for non-ICT programmes such as Humanities and Social Sciences. Several factors stated to have been contributed to the low enrolment of female students in ICT programmes show that many of which were deeply entrenched in societal norms and cultural perceptions. This study echoed the observations made by Muro and Gabriel (2016), revealing how traditional gender roles and parental attitudes often discourage girls from pursuing STEM fields, including ICT. The perpetuation of gender stereotypes, as documented by Yates and Plagnol (2022) and Bowman et al. (2022), further compounds this issue, fostering an environment where technical fields are perceived as masculine domains unsuitable for women.

Furthermore, the study highlighted the unwelcoming nature of the job environment for female ICT professionals, reflecting persistent gender biases and a digital divide in the industry. Such barriers perpetuated a cycle of underrepresentation, prompting women to gravitate towards non-ICT professions perceived as more accommodating. While the factors identified in the Cheryan et al.'s model (2017) provide valuable insights, this study identified a critical gap concerning the role of policies and governing instruments. The absence of supportive policies hindered efforts to encourage female participation in ICT programmes, as emphasised by Matete (2022). Effective policy interventions are essential for addressing systemic barriers and fostering an inclusive environment conducive to female engagement in ICT.

Regarding motivating factors for female students pursuing ICT programmes, the findings in this study emphasised the significance of personal interest as the primary driver. This concurs with the Cheryan et

al. (2017) model which suggests early experience under the variability in micro-level factors entices female students to undertake ICT programmes. While parental influence, peer persuasion, and job prospects play a role, they pale in comparison to individual passion and intrinsic motivation. This suggests a need for targeted interventions aimed at nurturing and fostering a genuine interest in ICT among female students. Thus, addressing the gender gap in ICT enrolment requires multifaceted approaches that challenge societal norms, promote inclusive policies, and cultivate a supportive environment conducive to female participation. Through recognising and addressing these barriers, HEIs and policymakers can foster a more equitable landscape for women in ICT-related fields.

6. Conclusion and Recommendations

The persistently low enrolment of females in ICT programmes communicates significant barriers that hinder gender diversity in Tanzania's HEIs. Factors such as an unwelcoming job environment, inadequate policies promoting female participation, and societal perceptions of ICT as a male-dominated field contribute to this disparity. However, it is noteworthy that the difficulty of ICT programmes is not a significant deterrent for females, and those who do pursue ICT do so driven by personal interest, familial influence, and aspirations for better career prospects. In the light of these findings, several recommendations have been provided including:

1. Society must actively work to prepare girls for science and technology careers from an early age, challenging traditional gender roles and fostering an environment that encourages female participation in STEM fields.
2. HEIs and other educational stakeholders play a crucial role in raising awareness and promoting inclusivity in ICT programmes, ensuring that women are actively encouraged and supported in pursuing these disciplines.
3. Government intervention is imperative, with a focus on creating conducive environments for female students, implementing policies that safeguard against discrimination, and incentivising the uptake of science subjects among women at all educational levels.
4. Government bodies such as the Tanzania Commission for Universities (TCU) and the National Council for Technical and Vocational Education and Training (NACTVET) should actively promote ICT programmes to highly qualified female students, fostering a supportive ecosystem for their academic and professional development.

Addressing these recommendations, stakeholders can collectively work towards dismantling systemic barriers and fostering a more inclusive and equitable landscape for female participation in ICT programmes in Tanzanian HEIs.

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