



# TANZANIA DATA VALIDATION WORKSHOP REPORT

Enhancing Participation and Quality of  
Experiences of Women in Science  
Technology Engineering and Mathematics  
Postgraduate Training Programs and  
Careers In Tanzania.

*Hyatt Regency Hotel Dar es Salaam, Tanzania  
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## Acronyms

<b>APHRC</b>	African Population and Health Research Center
<b>ARU</b>	Ardhi University
<b>COSTECH</b>	Tanzania Commission for Science and Technology
<b>DIT</b>	Dar es Salaam Institute of Technology
<b>HKMU</b>	Hurbert Kairuki Memorial University
<b>IUCEA</b>	Inter-University Council for East Africa
<b>KCMC</b>	Kilimanjaro Christian Medical College
<b>MUHAS</b>	Muhimbili University of Health and Allied Sciences
<b>MUST</b>	Mbeya University of Science and Technology
<b>NACTVET</b>	National Council for Technical and Vocational Education and Training
<b>NM-AIST</b>	Nelson Mandela African Institution of Science and Technology
<b>OUT</b>	Open University of Tanzania
<b>STEM</b>	Science, Technology, Engineering, and Mathematics
<b>SUA</b>	Sokoine University of Agriculture
<b>SUZA</b>	State University of Zanzibar
<b>TCU</b>	Tanzania Commission for Universities
<b>UDOM</b>	University of Dodoma
<b>UDSM</b>	University of Dar es Salaam

## Executive Summary

This report encapsulates the findings and outcomes of a study conducted to assess gender disparities in postgraduate STEM supervision and mentorship within Tanzanian universities affiliated with the Inter University Council for East Africa (IUCEA). Stemming from the recognition of STEM education's crucial role in advancing sustainable development goals, the study aimed to tackle persistent barriers hindering women's participation in STEM fields.

Conducted on December 19, 2023, the validation workshop convened key stakeholders to scrutinize and authenticate the study's findings. Participants, including representatives from the Commission for Science and Technology Tanzania, IUCEA, and Tanzanian academic institutions, engaged in deliberations.

Findings unveiled significant gender disparities in STEM postgraduate enrollment, graduation rates, and faculty representation. Despite initiatives to promote women's involvement in STEM, enduring challenges persist, largely attributed to socio-cultural and psychological factors such as patriarchal systems, cultural myths, and female students' lack of confidence.

Recommendations from the workshop centered on crafting a bespoke mentorship and supervision framework for East Africa, aimed at fostering gender inclusivity in STEM education and careers. Additional emphasis was placed on early orientation towards STEM subjects at the primary school level and ongoing training of science educators to address underlying barriers. The study's findings underscore the imperative for concerted efforts to augment female participation in STEM fields, not only to rectify gender imbalances but also to fortify research capacity and innovation in the region. Through the implementation of evidence-based policies and practices, East African institutions can cultivate a more inclusive STEM ecosystem conducive to the growth and success of all students, irrespective of gender.

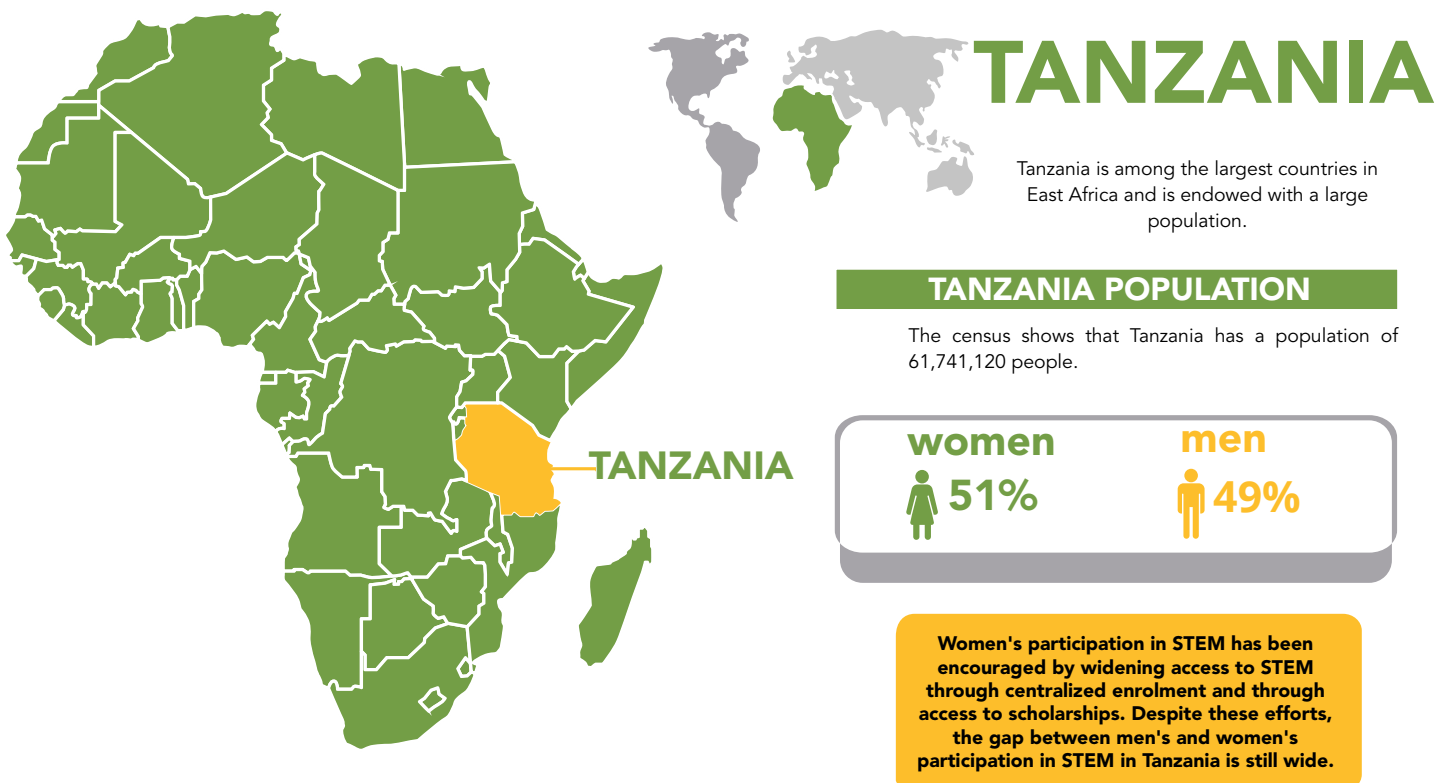
The scoping review conducted identified pivotal barriers and facilitators affecting women's involvement in STEM, including societal expectations, family responsibilities, and gender stereotypes. Qualitative insights further delved into gender disparities in STEM education and careers, emphasizing resilience, mentorship, and supportive environments. A supervision and mentorship framework was developed to address gender inequalities, with stakeholders offering invaluable insights and recommendations for formalized mentorship programs and enhanced collaboration with educational institutions and policymakers.

Recommendations for future action include active engagement with relevant authorities, the implementation of the proposed framework, and the promotion of scholarships and initiatives supporting women in STEM. Closing remarks underscored the ongoing dialogue and the necessity for sustained collaboration to realize gender equality in STEM.

# 1. Introduction

Postgraduate training in Science, Technology, Engineering, and Mathematics (STEM) is crucial for the development of strong science systems in sub-Saharan Africa, which are essential for achieving the Sustainable Development Goals. Despite its importance, the full potential for scientific progress is often hindered by barriers that prevent women from participating in STEM-related careers.

Effective supervision and mentorship have a significant impact on the success of postgraduate students in STEM fields, particularly for underrepresented groups like women. To address the challenges women in STEM face, it is necessary to have a clear understanding of the extent of the problem. Unfortunately, there is limited data on the number of women studying and working in postgraduate STEM programs especially in East Africa. This makes it challenging to identify gaps in supervision and mentorship specifically for women.



Tanzania is among the largest countries in East Africa and is endowed with a large population. The 2022 census shows that Tanzania has a population of 61,741,120 people. Out of 61,741,120 people, women are 31,687,990, 51% while men are 30,053,130, 49%. Tanzania as a country has a long history of higher education since the establishment of the first university which is University of Dar es Salaam. Women's participation in STEM has been encouraged by widening access to STEM through centralized enrollment and through access to scholarships. Despite these efforts, the gap between men's and women's participation in STEM in Tanzania is still wide.

## 2. Validation Workshop



The African Population and Health Research Center in partnership with the Inter University Council for East Africa (IUCEA) and in close collaboration with University of Dar es Salaam conducted a study to examine the gender disparities in STEM postgraduate supervision and mentorship in Tanzanian universities that are members of the IUCEA. This study was funded by the International Development Research Centre (IDRC), Canada. It utilized a mixed methods approach, including a scoping review, qualitative interviews, and analysis of secondary data.

On 19th December 2023, APHRC and IUCEA, in collaboration with the University of Dar es Salaam faculty members, hosted a data validation workshop at the Hyatt Regency, Dar es Salaam, Tanzania. Prominent guests, including the Representative of the Tanzania Commission for Science and Technology, a representative from IUCEA, and university faculty members in Tanzania attended. The aim of the workshop was to review and validate the findings of the study.

## 3. Workshop Objectives

The workshop had specific objectives aimed at achieving various important outcomes:

**1. Presentation of preliminary findings:** One of the primary goals was to share the initial findings derived from the study titled "Participation and Quality of Experiences of Women in STEM." This presentation allowed participants to gain insights into the research's early outcomes.

**2. Discussion of key study findings and recommendations:** The second crucial objective was to enable thorough conversations concerning the study findings. These deliberations provided a forum for participants to dissect the data and collaboratively devise recommendations grounded in the research results. This input sought to verify that the gathered data faithfully portrayed the intricacies and actualities of the research field. Essentially, it presented an opportunity to improve and elevate the research's quality of representation.

**3. Development and enhancement of mentorship and supervision framework:** Lastly, the workshop was dedicated to engaging in constructive dialogue about the creation, improvement, and eventual adoption of a Mentorship and Supervision Framework tailored for the East African context. This framework would play a pivotal role in supporting individuals pursuing STEM pathways, fostering growth, and addressing gender-related challenges within the field.



## WORKSHOP OBJECTIVES

## 4. Opening Remarks

### Dr. Albert Tarmo - University of Dar es Salaam



**Dr. Albert Tarmo**

Dr. Albert Tarmo, the local collaborator for the study in the host country based at the University of Dar es Salaam, extended a warm welcome to all participants and underscored the fundamental objectives of this study. He emphasized that the research was undertaken with the overarching goal of bolstering research capacity within the realm of STEM gender studies and aligning with the Sustainable Development Goals (SDGs).

Dr. Tarmo went on to emphasize the pivotal role of this research in uncovering and dissecting the various barriers that impede women's active involvement in STEM careers, as well as the prevalent issue of underrepresentation of Women in STEM fields. In doing so, this study has effectively contributed to the body of evidence surrounding women's participation in STEM careers, shedding light on both the challenges and opportunities.

Moreover, Dr. Tarmo expressed his appreciation for the institutions that played a crucial role in the success of this research endeavor. These

institutions generously granted access to their institutional databases, which proved instrumental in collecting data related to enrollment, graduation, and staffing.

Additionally, he extended gratitude to the University of Dar es Salaam (UDSM) for graciously hosting and supporting the research activities, highlighting the collaborative efforts that made this endeavor possible. This recognition reflects the importance of partnerships and cooperation in advancing research and fostering positive change within the STEM landscape.

### Professor Mawa - The Inter-University Council for East Africa



**Professor Mawa**

Representing the Inter-University Council for East Africa (IUCEA), Professor Mawa, the Senior Principal, Quality Assurance and Qualifications Framework conveyed the profound significance of the national stakeholders' workshop convened to validate the APHRC-IUCEA study focused on the participation and quality of women's

experiences in Science, Technology, Engineering, and Mathematics (STEM) postgraduate training, supervision, and careers within East Africa.

He underscored that this topic carries immense importance as it holds the potential to unlock the region's full capabilities and foster an inclusive, sustainable development trajectory. STEM disciplines, as he emphasized, played a pivotal role in driving innovation, propelling economic growth, and advancing social progress. Therefore, promoting gender equality in STEM fields, especially at the postgraduate level, was a crucial imperative for the region.

Prof. Mawa articulated the view that East Africa possesses abundant talents and Opportunities to bridge the gender gap within STEM and harness the untapped potential of women in these fields. He emphasized the need to acknowledge both the contributions that women have made and the barriers that impede their full participation.

To empower women in STEM, Prof. Mawa stressed the importance of creating an enabling environment that nurtures their academic and professional growth. This entailed addressing critical aspects such as enhancing access to quality education and training for women across all educational levels, confronting systemic biases and stereotypes that hinder women's progress in STEM, and prioritizing the development of robust networks and partnerships that offer women mentorship, networking opportunities, and collaborative platforms. Recognizing and celebrating the achievements of women in STEM were also highlighted as pivotal components of this endeavor.

Prof. Mawa also reminded stakeholders that IUCEA had incorporated women's participation in STEM into its strategic plan, demonstrating

a commitment to this cause. Additionally, he highlighted two scholarship programs, the Africa Higher Education Centers of Excellence (ACE) II Scholarship with a focus on providing 100% support for women and the German Development Bank-KfW Scholarship, which reserves up to 40% of scholarships for women. These initiatives aimed at further promoting gender inclusivity in STEM education and careers.

In conclusion, Prof. Mawa underscored the potential impact of the data generated by this study in influencing evidence-based policy reforms. He expressed gratitude to the diverse range of stakeholders who participated in the study and commended the ongoing partnership between IUCEA and APHRC, which serves as a driving force in advancing gender equality in STEM across the East African region.

**Hildegalda Prosper Mushi – Representative of the Tanzania Commission for Science and Technology (COSTECH)**



**Hilda Prosper Mushi**

In her welcoming address, Ms. Mushi, the Manager of the Social Sciences Section (SSSM) within the Directorate of Research Coordination

& Development at the Tanzania Commission for Science and Technology, (COSTECH). She introduced COSTECH as a Commission endowed with the crucial responsibility of harmonizing the efforts of various research stakeholders, both within and beyond the borders of the country. The overarching aim was to cultivate a balanced research and innovation ecosystem.

She highlighted COSTECH's multifaceted commitment to fostering women's participation in STEM fields, including the establishment of a dedicated fund designed to bolster research and innovation endeavors within the nation. Moreover, Ms. Mushi highlighted COSTECH's role in coordinating research activities and shaping national research priorities. By aligning these priorities with the pressing needs of the nation, COSTECH ensures that research efforts are not only relevant but also impactful. The Commission provided comprehensive frameworks that serve as guiding principles for research and innovation initiatives in Tanzania, thereby promoting structured and purposeful exploration in these areas.

Ms. Mushi also underscored COSTECH's Collaborative efforts with other ministries to address the critical intersections of technology and research. This partnership approach ensured that technological advancements and research endeavors receive the attention and support they merit.

In terms of gender inclusivity, Ms. Mushi elaborated on COSTECH's extensive initiatives. These encompassed the development of Capacity-building frameworks to empower women in STEM, as well as the establishment of a national framework designed to mainstream gender considerations into research and innovation practices. These initiatives collectively aimed to create a more equitable and inclusive environment within the STEM landscape.

Ms. Mushi concluded her remarks by extending an invitation to stakeholders to participate in the forthcoming national science, technology, and innovation conference organized by COSTECH. The workshop stood as a testament to COSTECH's commitment to advancing the frontiers of science, technology, and innovation in Tanzania and serves as an inclusive platform for the exchange of ideas and collaboration within the research and innovation community.

**Dr. Anne Khisa - Co-Investigator, APHRC**



**Dr. Anne Khisa**

In her address, Dr. Anne Khisa, representing APHRC, extended a welcome to all the stakeholders gathered at the data validation workshop. She began by conveying her appreciation to various entities, including the Government of Tanzania, IUCEA, different university management teams in Tanzania, and notably, the University of Dar es Salaam, for graciously hosting this significant workshop.

She commenced her remarks by drawing attention to a critical global concern: the limited representation of African research on the international stage. She highlighted that Africa accounts for only 1% of global research

publications, emphasizing the pressing need for greater involvement in generating research evidence. Furthermore, she underscored the fact that there is an even more acute underrepresentation of women researchers, constituting less than 30% of the continent's research community. Building upon this foundation, Dr. Khisa stressed the necessity for systemic change and collaborative efforts between men and women. These collaborative endeavors are instrumental in fostering inclusive policies, programs, and initiatives that not only encourage but actively support women's participation in STEM fields.

In conclusion, it was evident that the future of STEM fields in East Africa hinged on achieving gender equality in participation. It was necessary for the team to think about taking action now to ensure equal opportunities for both women and men. This was not just a choice but an imperative and vital step towards realizing the full potential of STEM in the region.

## 5. Presentations of the Study Results



**Leah Mwangi**

Leah Mwangi presented the secondary data results of the study to the stakeholders. She highlighted that Tanzania, like any other Sub-Saharan country, had been grappling for a long time with gender inequality in higher education. During the study, secondary data was collected from eight Tanzanian universities affiliated to IUCEA who willingly shared different strands of data available in their institutions.

Nevertheless, the study encountered numerous obstacles, including the difficulty of obtaining some data because certain institutions still stored records manually, as well as complications arising from the archival of data in formats that did not align with other data sets. As a result, identifying the specific faculty and discipline of PhD Candidates or ascertaining their gender was challenging in certain instances. Additionally, some institutions supplied incomplete data for several academic years, which led to discontinuities in the trend analysis. She presented the findings of enrollment data from five universities, graduation data from six institutions, and data on women faculty members from four academic institutions. The challenges related to data availability and bureaucratic processes were deliberated upon by the stakeholders, and the proposed solutions can be found in the following Q&A section.

### 5.1.1. PhD Enrollment Trends in Tanzania Between 2010-2020

The secondary data gathered from the academic institutions provided insights into PhD level enrollment trends over a 10-year period, from 2011 to 2020. During this time frame, there was a combined national enrollment of 5232 men students and 1,376 women students at the PhD level which accounted for 26.3 % of women students enrolled as depicted on Table 1. This highlighted the ongoing need for measures and initiatives aimed at achieving greater gender parity and inclusivity in PhD programs.

Universities and Colleges Sampled In Tanzania	Total Number of Students Enrolled for PhD	Total Number of Women Students Enrolled	Proportion of Women Students Enrolled for PhD Courses
3	5232	1376	26.3%

Table 1: Proportion of women students enrolled in PhD degrees

Over the years, there had been a steady rise in the enrollment of both men and women students in Tanzanian universities pursuing STEM PhD programs. However, a noteworthy trend emerged during the period from 2018 to 2020, where a gap in enrollment between both genders became more pronounced. This divergence can be primarily partly be attributed to the impact of the COVID-19 pandemic on higher education from 2019.

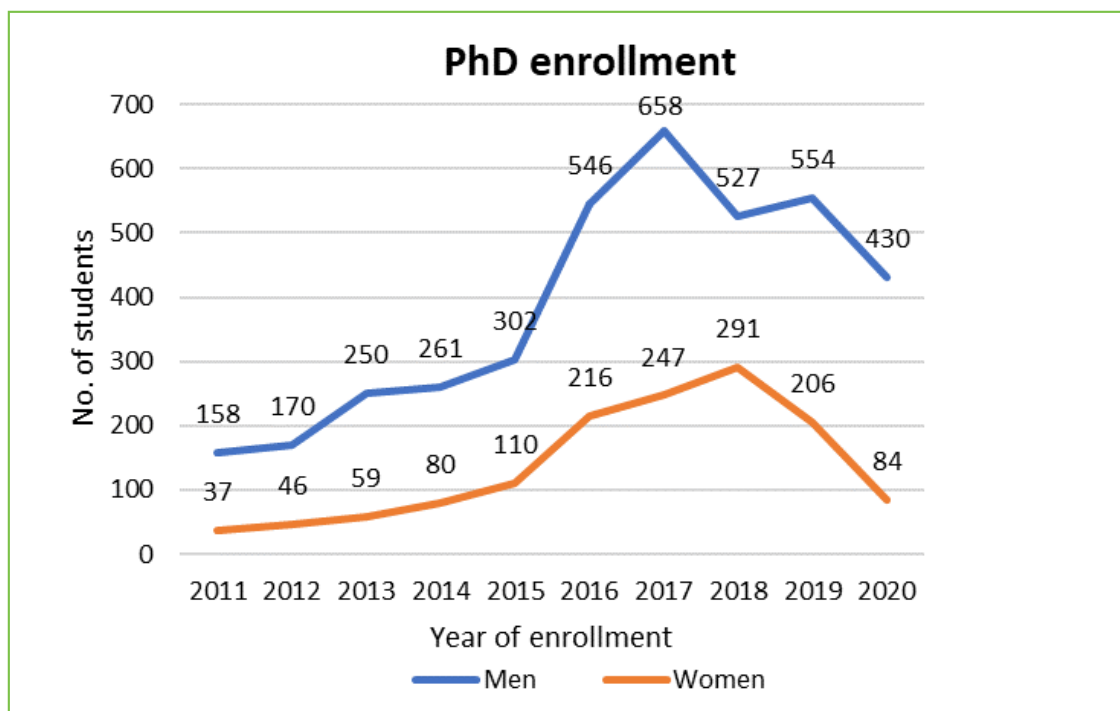


Figure 1: PhD enrollment trends in Tanzania 2010-2020

### 5.1.2. PhD Graduation Trends in Tanzania Between 2010-2020

The data indicated a gradual decline in the overall number of graduates emerging from Tanzanian universities with PhD qualifications since the year 2017. Of particular concern within this down trend was the disproportionately low percentage 25.2% of women graduates obtaining Ph.D. degrees in the STEM disciplines.

Universities and Colleges Sampled in Tanzania	Total Number of Students Graduating with STEM PhD Degree	Total Number Of Women Students Graduating With STEM PhD Degree	Proportion Of Women Students Graduating With STEM PhD Degree
64	674	170	25.2%

Table 2: Proportion of women students graduating with STEM PhD degree

This pattern pointed to potential systemic issues in higher education and raised questions about the effectiveness of initiatives aimed at gender equality in STEM fields.

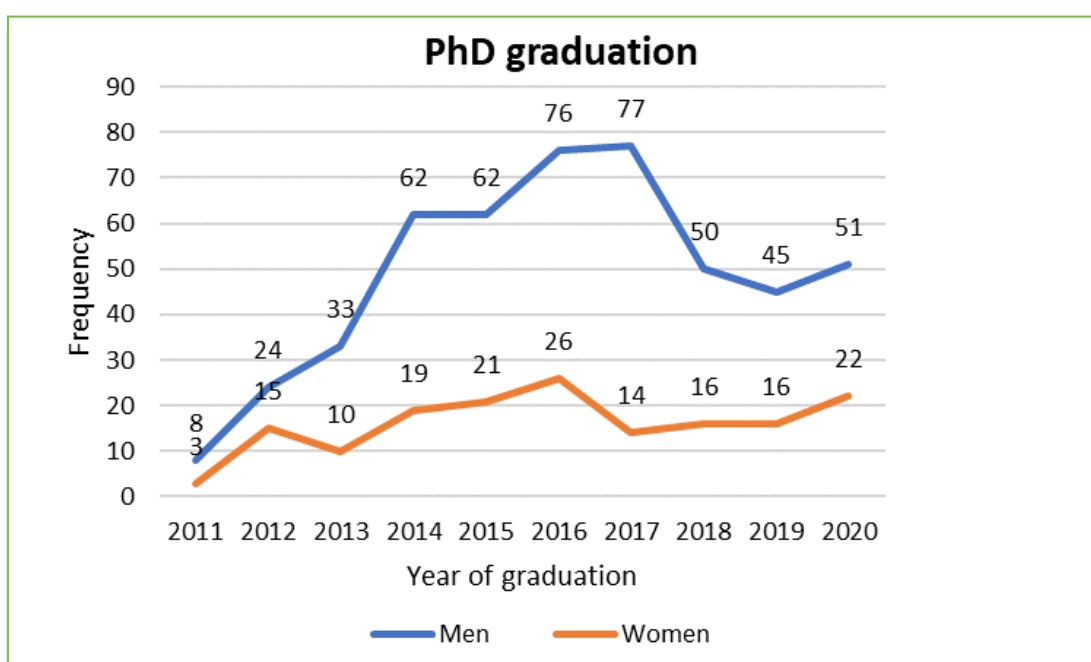


Figure 2: PhD graduation trends in Tanzania

The decrease indicated in Figure 2 above suggested that there may be underlying factors that could be influencing these outcomes. The trend has important implications for the representation of women in academia and research potentially impacting the country's innovation capabilities and gender balance in the workforce.

However, it's important to acknowledge that this trend may be somewhat distorted due to the absence of comprehensive data sets, particularly during the COVID-19 pandemic period. The incomplete data could have influenced the observed decline in graduation numbers.

### 5.1.3. Masters Enrollment Trends in Tanzania Between 2011-2020

The research team through secondary data search acquired enrollment data for both men and women in Tanzania at master's level as presented in figure 3 below;

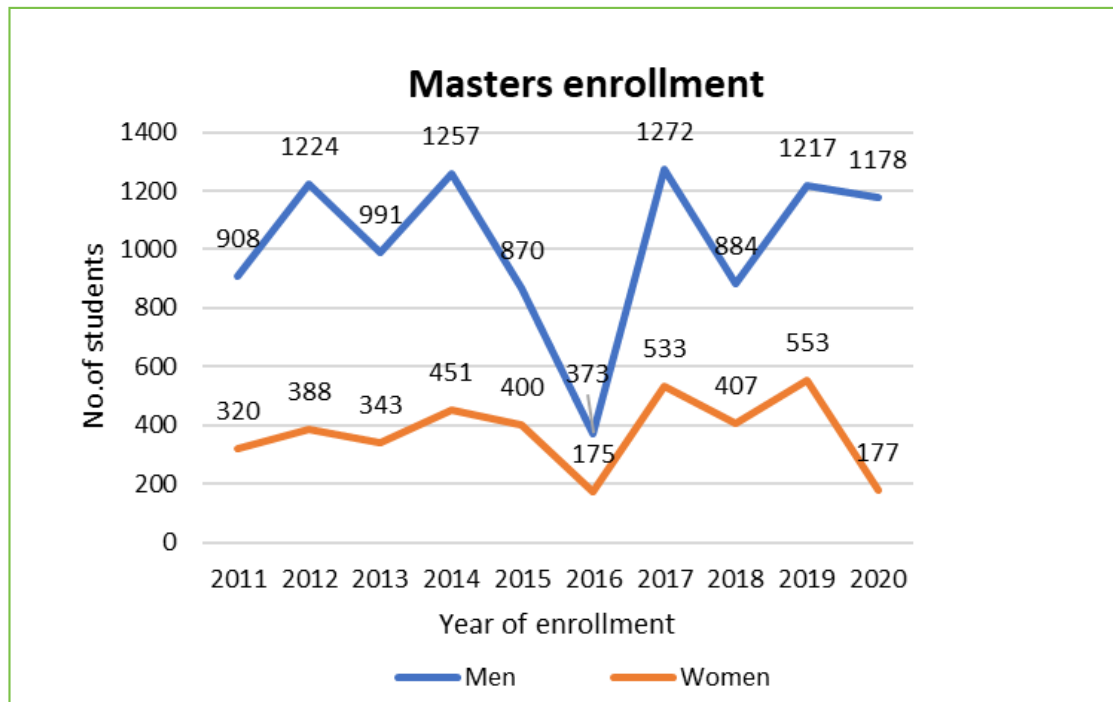


Figure 3: Masters' enrollment trends in Tanzania

In 2016 there was a notable decline in the enrollment of students, possibly due to investigations that were carried out in Tanzania universities and the quality of education. Subsequently, the Tanzania Commission for Universities (TCU) later on prohibited 19 local and foreign higher learning institutions from enrolling new students in the following year for failing to meet the established standards.

This action by TCU, was prompted by the findings from an assessment report conducted between September and October 2016 which evaluated the quality of education provided by the universities and colleges in the country.

### 5.1.4. Masters Graduation Trends in Tanzania Between 2011-2020

Over time, there had been a slow and steady rise in the number of students successfully completing their STEM master's degrees. Notably, there had been a slight improvement in the gender gap between men and women students in this regard. This indicated a positive trend toward a more balanced representation of both genders in STEM master's degree programs.

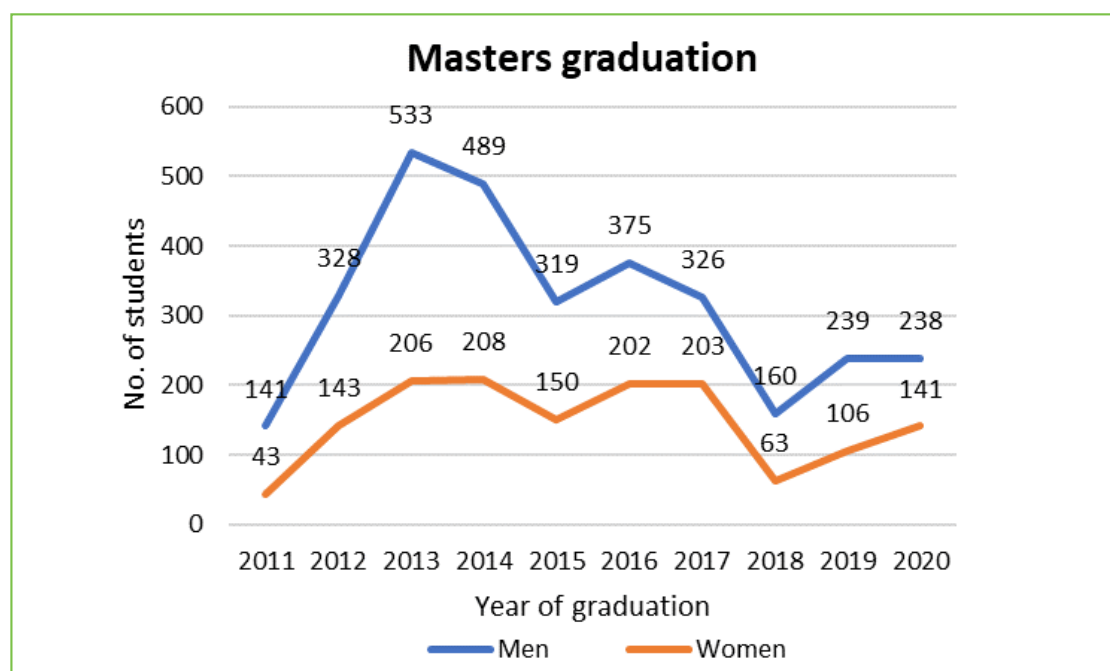


Figure 4: Masters' graduation trends in Tanzania

Graduation data of PhD students in Tanzania followed a similar trend as the enrollment. Six institutions shared their data that indicated that about 674 men graduated against 182 women in STEM programs.

Universities and Colleges Sampled in Tanzania	Total Number of Students Graduating with Stem PhD Degree	Total Number of Women Students Graduating with Stem PhD Degree	Proportion of Women Students Graduating with Stem PhD Degree
64	647	170	25.2%

Table 3: Proportion of women graduating with PhD degrees

University and Colleges Sampled in Tanzania	Total Number of Students Enrolled with Stem Masters' Degree	Total Number of Women Students Enrolled with Stem Masters' Degree	Proportion of Women Students Enrolled with Stem Master's Degree
5	1392	3747	26.9%

Table 4: Proportion of women enrolled with STEM Master's degree

Universities and Colleges Sampled in Tanzania	Total Number of Students Graduating with Stem Masters' Degree	Total Number of Women Students Graduating with Stem Masters' Degree	Proportion of Women Students Graduating With Stem Master's Degree
6	4613	1465	31.7%

*Table 5: Proportion of female Students graduating with STEM Master's degree*

Presentation of analysis done on data related to graduation revealed that from 2011 to 2020, about 504 men against 170 women had graduated in PhD in STEM programs; while about 3148 men against 1465 women had graduated with Master' degree in STEM programs. Further analysis was conducted to show variations in terms of graduation across different disciplines such as agriculture, engineering, health and welfare, science and other unspecified STEM programs. These findings already reveal disparities among men and women when it comes to graduation rates.

Data on faculty members data collected from four universities that shared data with the research team, the number of women faculty members across various STEM programs was 264 against 724 academic staff which translated to 36.5% of women faculty teaching STEM masters and PhD courses in Tanzania as displayed in the table below;

Universities and Colleges Sampled in Tanzania	Total Staff	Total Number of Women Faculty	Proportion of Women Stem Academic Staff
3	724	264	36.5%

*Table 6: Proportion of women STEM academic Staff*

Miss Leah also highlighted the importance of having more women graduates and those pursuing careers in STEM. It is of a paramount importance to have more researchers who can uplift the status of publication in Africa. There were still limited research outputs from Africa in general and East Africa in particular. Improving women participation would help to broaden the research pool from East Africa. It was therefore important to have a framework for improving women participation in STEM. This study had been at the forefront in bringing about the highly important framework to inform policy and practice in higher education institutions in East Africa.

## 6. Scoping Review



**Dr. Anne Khisa**

Dr. Anne Khisa presented this part of the research. She was keen to present the nitty-gritty of the process of literature review and documentary analysis using various methods and key words to come up with the scope of literature in this field of investigation. The process involved narrowing down findings at global, regional, and country levels. Dr. Khisa pointed out that different databases such as AJOL, EMERALD and JSTOR were involved in the search process. Search terms used in the scoping review included: (Supervisor\* AND (Mentor\* OR Guidance\* OR advisor\*) AND (STEM OR Science OR technology OR engineering OR mathematics) among others to ensure that all possible publications are included in the study. A total of 2,989 journal articles were identified through electronic databases searching

and 60 policy documents were identified via a topical search for policy documents. Finally, 44 articles were fully screened in terms of their title, abstract, and full text and only 6 were included in the final analysis. All 60 policy documents were met the criteria and were included in the study.

The 6 articles included in the study gave a clear picture of girls' and women's' Participation in STEM enrollment, graduation, and careers in Tanzania as well as women involvement in supervision and mentorship in postgraduate studies. Studies done by Babalola et al. (2021); Liani et al. (2021); Madara et al. (2016); Mukhwana et al. (2020) highlighted factors promoting or inhibiting girls and women participation in STEM. Inhibiting factors included negative perceptions of female students about STEM, socio-cultural drivers, inequitable scientific career progression among female and male researchers, retrogressive organizational cultures, among various other challenges. Conversely, factors promoting pursuit of STEM training careers included but not limited to being empathetic, having determination, being visionary, having discipline, self-belief, patience, being humble, respectful, and supportive, had helped Early Career Researchers (ECRs) in becoming effective leaders. The use of technology to enhance access to opportunities by women; and employing web technology would further help alleviate some of the difficulties faced by some women who face constraints to participate in scientific-mobility oriented activities.

Confidence, pride and vision among women; presence of mentors and role models, as well as supervision; flexibility of work schedule; availability of funding for research & innovation; opportunities for leadership development; giving hiring preference to under-represented group members, and existence of pregnancy leave & childcare policies further promoted women's participation in STEM training and careers.

However, there were factors that inhibited STEM training careers, and these included:

- Male dominance.
- Many responsibilities that women had, both at work and at home.
- Non-cooperation from older women.
- Discouragement whereby career advisers had even tried to discourage pupils from studying Engineering, saying plainly that STEM subjects are inherently “too tough for females”, and “there is no need to stress yourself” and that these are careers were for boys.
- Normative scientific career progression that was structured around the idea of spending extra time at work which renders women time poor due to the familial and societal expectations.
- Unequal gender division of labor within the family and informal rules of gendered social norms, values and stereotypes in society.
- Conformity to societal values, which stress the centrality of marriage and motherhood for women.
- Additional time demands for language minority research scientists further amplifying the time pressure for francophone women; and Women who prioritized their career clock explained that their relationships have suffered.

In a nutshell, the articles indicated that the major barriers in STEM careers for women was mainly centered on societal expectations and family responsibilities. Women were also discouraged from pursuing STEM programs and were at the center of most family responsibilities in their marriages. On the other hand, availability of funding or scholarships, creating opportunities for leadership, giving preference to women in hiring and having gender policies were highlighted to be significant in women representation in STEM. It was also pointed out that mentorship and role models played a crucial role in encouraging young women to pursue STEM programs and helped to fight negative stereotypes, and that the role of supervision was very important in excelling in STEM even though it did not come out prominently as a facilitator to success, as compared to mentorship or role modelling.

Results of the scoping review showed that 2,989 journal articles were identified through electronic databases searching and about 60 policy documents were reviewed. The journal articles were screened and subjected to a priori-defined eligibility criteria. A total of 44 articles met the eligibility criteria and after full screening of titles, abstracts, and full text only 6 articles were included in the analysis. The articles gave a clear picture of girls and women participation in STEM enrollment, graduation, and careers in Tanzania as well as women involvement in supervision and mentorship in postgraduate studies.

Results of the scoping review showed that 2,989 journal articles were identified through electronic databases searching and about 60 policy documents were reviewed. The journal articles were screened and subjected to a priori-identified eligibility criteria. A total of 44 articles met the eligibility criteria and after title, abstract, and full text review, only 6 articles were included in the final analysis. Generally, the articles gave a clear picture of girls and women participation in STEM enrollment, graduation, and careers in Tanzania as well as women involvement in supervision and mentorship in postgraduate studies.

## 7. Qualitative Findings

The presentation of the qualitative findings was made by Dr. Anne Khisa. The presentation focused on the results obtained through qualitative data analysis. The objectives of qualitative research were to explore factors that contribute to or hinder equal participation of women in STEM related postgraduate training and careers in Tanzania; and to develop a comprehensive framework for optimal engagement of women in STEM related post-graduate training and careers in East Africa.

The research used mixed methods whereby both students and faculty members were interviewed to gain insights and refine the research questions through exploratory qualitative interviews, complemented by an initial review of policies related to training, recruitment, promotion, and retention of women in STEM. It used purposive sampling to select respondents and various data collection methods were used to examine the experiences of women in STEM graduate studies and careers, including primary data obtained through Online survey, in-depth interviews, and focus group discussions as well as secondary data that included policy documents and existing data sets.

The Online survey was also used targeting both men and women postgraduate students pursuing STEM courses at master's, PhD and postdoctoral programs. In addition, career faculty and researchers working in STEM departments in universities and research institutions were invited to participate. The use of various methods allowed triangulation of results and increased validity and reliability of instruments and data respectively.

Data collected was recorded, verbatim transcribed and analyses carried out using thematic methods that included coding and use of QSR Nvivo 11 software. This analysis produced

results on factors that interact with gender to affect gender equality in STEM training and characteristics of a desirable supervision and mentorship framework. The results were further synthesized to produce a framework on ways to improve the participation of women in STEM graduate programs in East Africa. Thereafter, a framework to enhance the participation and experiences of women in STEM-related post-graduate training and career advancement was drafted and proposed to the stakeholders for validation.

Qualitative findings revealed the status of gender equality in STEM-related post-graduate training and careers, and showed that disparities existed at graduate and post-graduate level. There were also gender disparities among faculty and research careers, depending on STEM disciplines. Resilience and innate motivation to succeed were considered to be key contributing factors to women succeeding in STEM careers, especially in leadership.

Factors that promoted girls and women participation in STEM included flexible time and study schedules; presence of gender equality units / centres; parental and family support to girls in STEM; mentorship and leadership programs and changing perceptions and gender stereotypes. Factors that hinder girls and women participation in STEM graduate studies and careers include construction of STEM and gender stereotypes; small pool of women & girls in STEM basic education levels; lack of women mentors and role models; discrimination; inequitable platforms for competition in career progression; lack of employment opportunities and gender blind or gender-neutral scholarships.

In a nutshell, these factors were broadly classified as individual, institutional, structural/ systemic, as well as intrinsic and extrinsic factors.

## 8. Questions and Answers

After the presentation of findings, researchers opened the floor to stakeholders to air their views and suggestions concerning the findings presented to them. Stakeholders inquired about the subjects included and clustered in STEM where data were obtained from. They also asked whether there is possibility of adding more universities in the study especially the State University of Zanzibar (SUZA); Dar es Salaam Institute of Technology (DIT) and Mbeya University of Science and Technology (MUST). They also made a query on factors contributing to low enrollment and graduation.

The stakeholders recommended a comprehensive approach to analyzing trends, which involves several key steps. Firstly, they suggested conducting correlation analyses to identify any relationships between different variables. Secondly, they proposed examining annual changes over time to understand the trajectory of trends. Thirdly, they emphasized the importance of making comparisons between different datasets to gain insights into variations and patterns. Additionally, they highlighted the significance of these analyses in uncovering meaningful trends and implications.

Furthermore, the stakeholders advised integrating gender units into the data gathering process to ensure gender-sensitive data collection and analysis. They recommended utilizing resources such as the Tanzania Commission for Universities (TCU) and the National Council for Technical and Vocational Education and Training (NACTVET) websites to access relevant information and datasets. Additionally, they suggested consulting with specific university directorates to obtain graduation data, and accessing resources such as graduation ceremonies booklets and university facts and figures booklets. Moreover, the stakeholders stressed the importance of

proactive engagement with institutions to acquire comprehensive datasets. They underscored the need to reach out to universities and colleges directly to gather complete and accurate data for the final analysis. Overall, the stakeholders emphasized a thorough and systematic approach to data analysis, ensuring inclusivity, accuracy, and completeness in the final dataset.

The researchers thanked the stakeholders for their valuable contributions and agreed to follow their suggestions in preparing the final data set and analysis. The questions raised were responded to and stakeholders were satisfied by the conceptual, methodological and analysis used by the researchers. Some insights were also given that there were some scholarships which existed targeting only women but they no longer exist. There was also another insight that some students quit their studies because of supervision, social problems, kids at home, and jobs which are not flexible.

Testimonies were also given from senior women professors like Prof Verdiana Massanja, the first woman Mathematics PhD holder in East Africa, who spent 34 years teaching Mathematics in the University of Dar-es-Salaam and more years teaching in the University of Rwanda. Furthermore, Prof. Esther Mwaikambo testified that she was the first woman holder of Medical Degree in Tanzania.

## 9. Supervision and Mentorship Framework

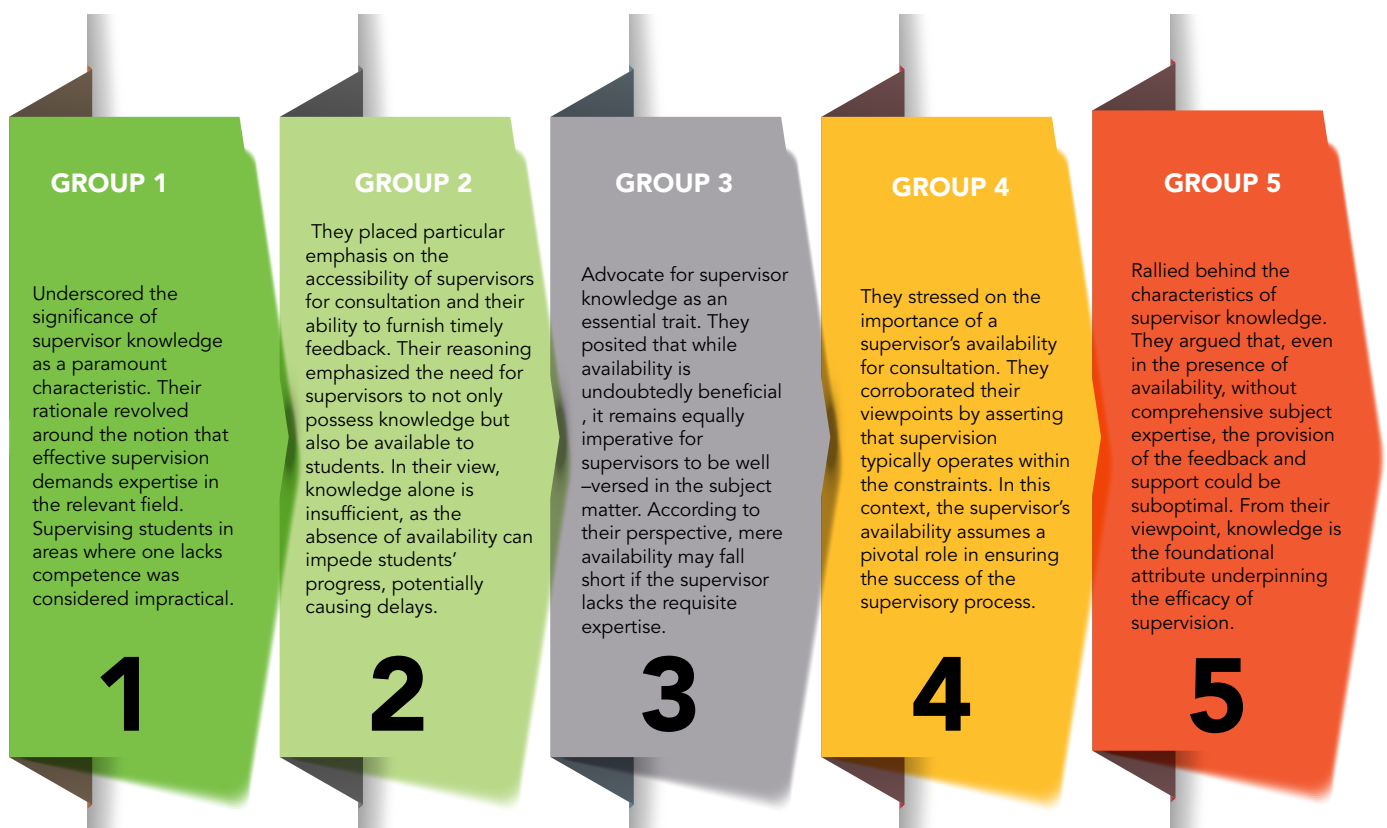
This session was led by Dr. Dieudonne Uwizeye from the University of Rwanda where he began by introducing the supervision and mentorship framework as a tool to address gender disparity in STEM fields. Stakeholders were divided into break out rooms aimed at validating the framework.

Stakeholders ranked in priority the desirable characteristics of supervision relationships, according to the level of their importance and there after listed in priority the desirable characteristics of mentorship relationship according to the level of their importance. The stakeholders thereafter shared their views on separating or merging mentorship and supervision during training of postgraduate students in STEM; and whether mentors should be paid. Stakeholders were also asked to discuss whether mentorship should be formal and how it can be formalized.

### 9.1.Characteristics of Supervision

In the context of identifying crucial supervision attributes, stakeholders articulated their preferences regarding the ideal qualities of supervisors. The stakeholders were organized into different groups where they reviewed ten characteristics and ranked the most important characteristic. They later worked on ranking all the ten characteristics from the most important one to the least.

Figure 5: Group discussion findings on supervision



The table below presents a breakdown of key characteristics deemed essential for effective supervision in STEM postgraduate training. Each characteristic listed in the table is accompanied by a rationale explaining its significance in the context of student supervision. These characteristics encompass various aspects, including the supervisor's expertise, availability, and supportiveness, as well as the resources and environment provided for student research. Understanding and prioritizing these characteristics can contribute to fostering a conducive learning environment and facilitating students' academic and personal growth.

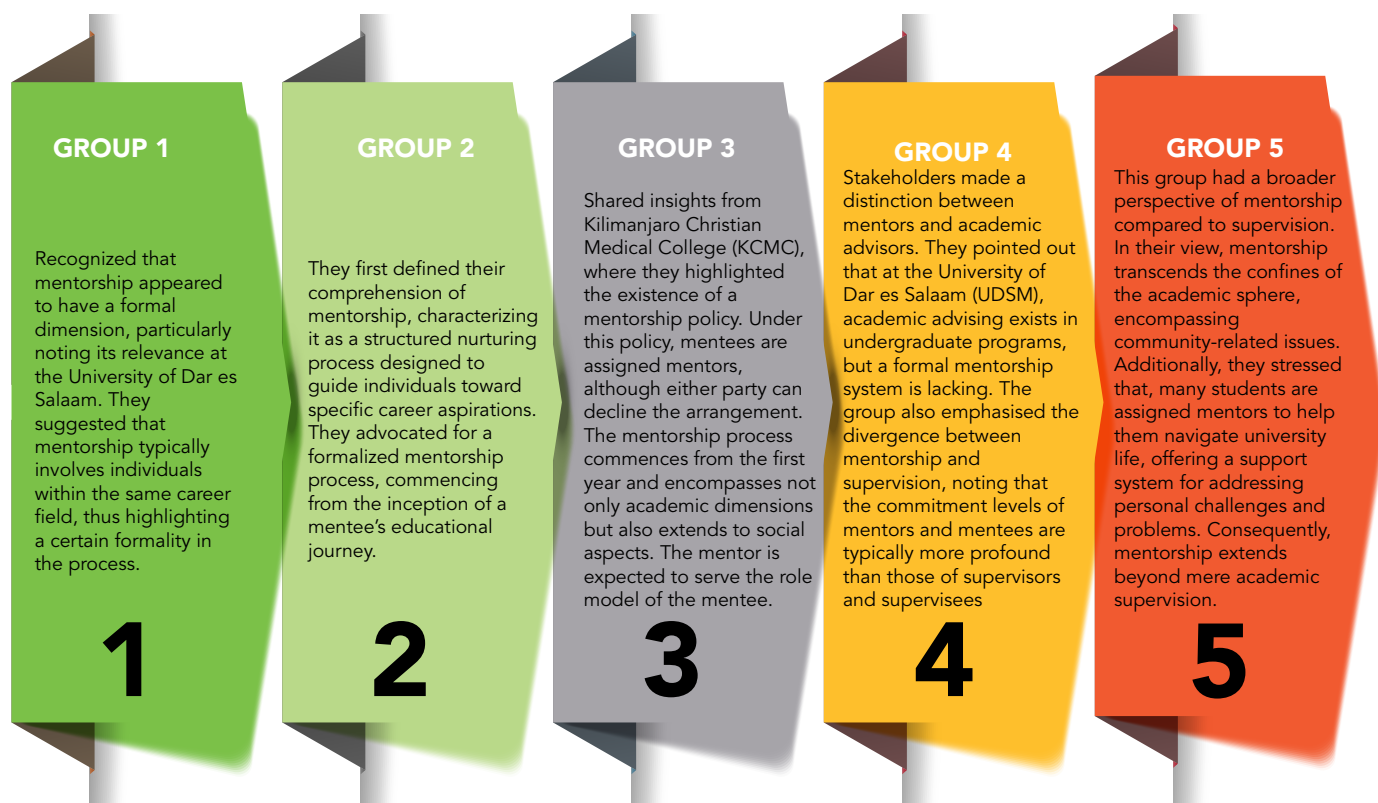
*Table 7: Desirable characteristics for supervision*

	<b>Characteristic</b>	<b>Reason of ranking</b>
1.	<b>Knowledgeable</b>	The supervisor needs to have in-depth knowledge of the subject matter in order to provide valuable input, guidance, and direction to the student. A knowledgeable supervisor can help the student navigate complex research and make informed decisions.
2.	<b>Available for consultation and provides feedback</b>	Timely availability for consultation and regular feedback are crucial for students to complete their studies on schedule.
3.	<b>Limit supervisory ratio to improve quality of experiences</b>	A lower supervisory ratio was highly ranked because it allows supervisors to dedicate more time and attention to individual students. Fewer students per supervisor means that each student receives more personalized and in-depth guidance, resulting in a higher quality research experience.
4.	<b>Options and large pool from which to choose a supervisor</b>	Having a wide selection of potential supervisors is important for students to either select or to be aligned with someone whose expertise aligns with their research interests.
5.	<b>Equipped laboratories and Lab teams</b>	Access to well-equipped laboratories and lab teams is essential to ensure that experiments can be conducted efficiently and that research progress is not hindered by a lack of resources or infrastructure.
6.	<b>Has tracking mechanisms</b>	Supervisors with tracking mechanisms can effectively monitor and assess a student's progress. This characteristic ensures that students stay on track, meet milestones, and have the necessary support to address any issues that may arise during their studies.
7.	<b>Supportive feedback</b>	Providing supportive feedback helps students improve their work, boosts their confidence, and encourages them to perform at their best. Constructive criticism and positive reinforcement are vital for a student's academic and personal growth.
8.	<b>Timelines</b>	Meeting timelines is critical in academia. Supervisors who prioritize timely progress help students stay focused and accountable, ensuring that tasks are completed on schedule and research objectives are achieved.
9.	<b>Gender sensitive supervision</b>	Supervisors who are sensitive to gender issues and offer equal support to all students, regardless of their gender, create an inclusive and equitable learning environment. This characteristic ensures that every student receives fair and unbiased supervision.
10.	<b>Caring and concerned</b>	A caring and concerned supervisor can make a significant difference in a student's academic journey. They provide support not only in the Academic realm but also help students navigate personal challenges, ensuring their well-being and success.

### 9.1.1. Concerning Mentorship

In the plenary sessions, stakeholders had the opportunity to discuss and agree on various aspects of the framework by articulating their perspectives and substantiating their choices. The stakeholders, categorized into different groups, offered distinct observations as follows:

Figure 6: Group discussion findings of mentorship



The following table outlines key desirable characteristics identified as crucial for effective mentorship in STEM postgraduate training. Mentorship plays a pivotal role in nurturing the academic and professional growth of mentees, providing guidance, support, and opportunities for skill development. Each characteristic listed in the table is accompanied by a rationale explaining its significance in fostering successful mentor-mentee relationships and promoting the advancement of mentees, particularly women, in STEM disciplines. These characteristics encompass various dimensions, including the mentor's training, commitment, accessibility, and ability to provide strategic guidance. Understanding and prioritizing these characteristics can contribute to the establishment of robust mentorship programs that empower mentees to thrive in their academic and career pursuits.

Table 8: Desirable characteristics for mentorship

	<b>Characteristics</b>	<b>Reasons for ranking</b>
1.	<b>Trained (but with the right attitude and commitment)</b>	This characteristic tops the list because a mentor should possess the necessary training, coupled with the right attitude and unwavering commitment. It encompasses all other attributes, forming the foundation for effective mentorship.
2.	<b>Mentorship in Schools and Universities</b>	The inclusion of mentorship at the grassroots level in schools and universities is considered of paramount importance. It lays the foundation for mentoring, ensuring that mentorship becomes an integral part of the educational journey.
3.	<b>Large Number of Mentors</b>	Having a substantial pool of mentors is crucial for accommodating the needs of a diverse mentee population and ensuring that mentorship is readily accessible to all who seek it.
4.	<b>Committed to Women's Progression in STEM</b>	Commitment to advancing women's careers in STEM is highly valued, provided that it is backed by appropriate training. A dedicated mentor can be instrumental in addressing gender disparities in these fields.
5.	<b>Advisory and Strategic</b>	The mentor should be equipped with strategies for effective mentoring. This highlights the importance of mentor training programs that teach mentors how to provide advisory and strategic guidance.
6.	<b>Offers Training in Leadership</b>	Mentorship should include leadership training to equip mentors with the necessary leadership skills. This is essential to empower mentees with the tools they need to excel in their chosen fields.
7.	<b>Mentor is Available and Approachable</b>	An accessible and approachable mentor is vital for mentees to feel comfortable discussing their concerns, seeking guidance, and building a productive mentor-mentee relationship.
8.	<b>Sufficient Time Commitments</b>	Adequate time commitments from mentors are essential to ensure a smooth mentorship process. Mentors should allocate the necessary time and attention to foster mentee growth.
9.	<b>Dynamic</b>	Mentorship should be dynamic and up-to-date, keeping pace with the latest developments and flexibility. This characteristic ensures that mentorship remains relevant and aligned with the state of the art.

### 9.1.2. Reflection On Group Presentations

Stakeholders had the opportunity to engage in discussions concerning the mentorship and supervision framework aimed at enhancing the participation of girls and women in STEM programs. These deliberations revolved around the feasibility of implementing effective, gender-sensitive mentorship practices to nurture and support girls and women pursuing STEM graduate studies and careers. Seasoned professors and doctors shared their experiences in providing mentorship and supervision to young students and emerging scholars. They observed that, up to this point, mentorship has been primarily voluntary, and they proposed making it mandatory with accompanying incentives. This shift in approach was seen as a means to enhance the efficiency and effectiveness of initiatives designed to bolster the capabilities of women students and professionals in STEM fields.

Additionally, stakeholders recognized a fundamental distinction between supervision and mentorship. Supervision is typically framed within contractual agreements and specific guidelines, whereas mentorship is characterized by informal, mutually guided relationships focused on problem-solving. This contrast highlighted the need for measurable indicators to monitor the success of mentoring efforts. Such indicators would help gauge the level of interpersonal support and guidance inherent in mentorship, in contrast to the more structured and rule-based nature of supervision.

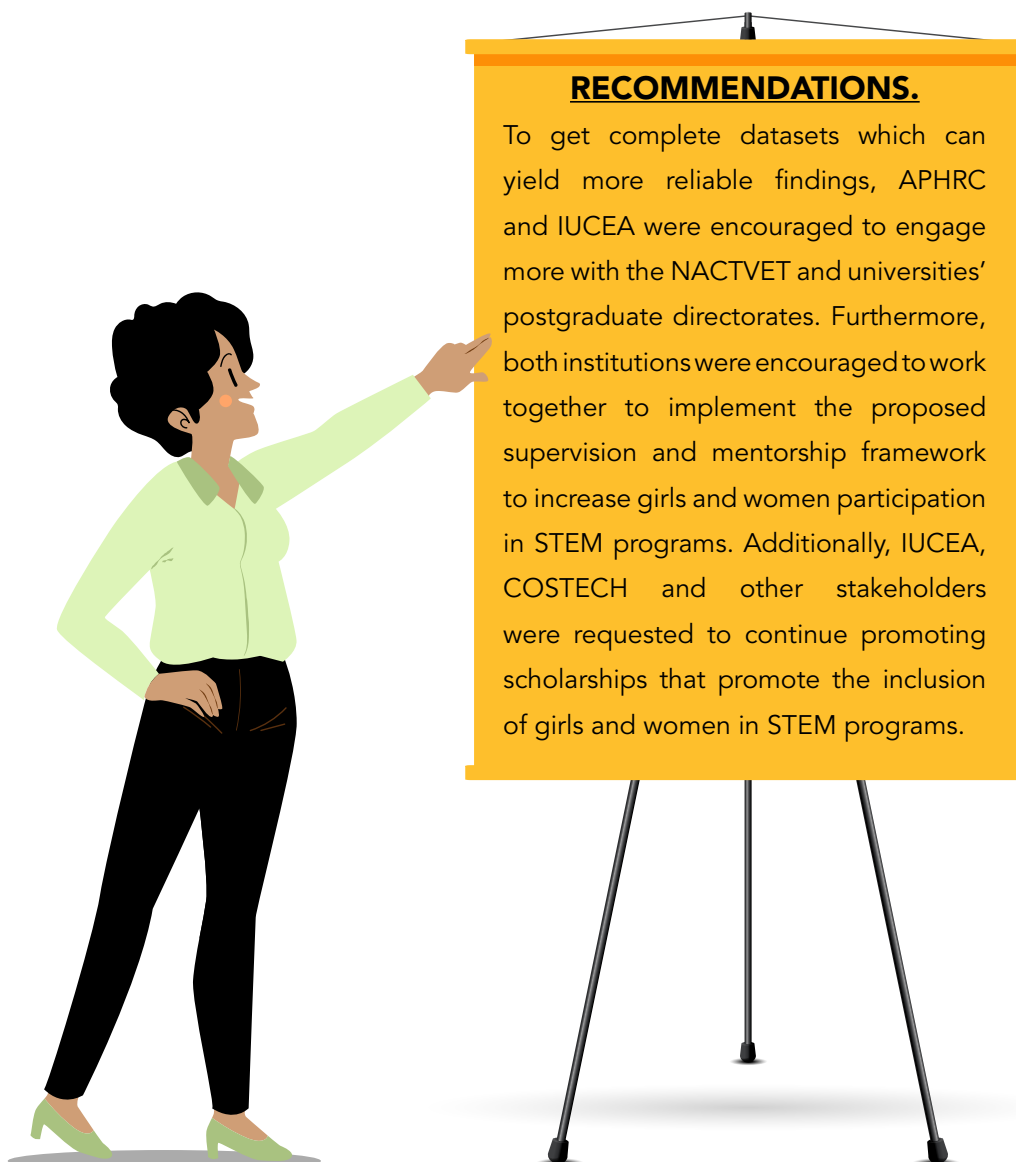
Given that mentorship is rooted in relationships and not bound by academic mandates, stakeholders underscored the necessity of instituting policies to formalize and integrate mentorship within STEM education. This structural approach would offer increased guidance and support to

STEM graduate students and professionals as they progress in their careers. In parallel, they recommended offering additional incentives to supervisors and discouraging them from viewing supervision as just another facet of their regular workload. A culture emphasizing empowerment-oriented supervision was suggested, with the aim of cultivating a future generation of well-prepared researchers engaged in numerous research projects.

## 10. Recommendations

The data validation meeting in Tanzania was an opportunity for stakeholders to contribute to the research process and to own the results of the study. It was also a way of engaging stakeholders to influence decision-making in their institutions so that management of higher education institutions can become more sensitive to gender mainstreaming in STEM programs.

The stakeholders took time to provide recommendations to APHRC and IUCEA. Both institutions were encouraged to engage more with the Tanzania Commission for Universities, the National Council for Technical and Vocational Education and Training (NACTVET), and postgraduate directorates in universities to get complete datasets and more reliable findings. APHRC and IUCEA were also encouraged to work together to implement the proposed supervision and mentorship framework to increase girls' and women's participation in STEM programs. IUCEA and COSTECH in collaboration with other stakeholders were requested to continue promoting scholarships that promote the inclusion of girls and women in STEM programs.



## 11. Closing Remarks



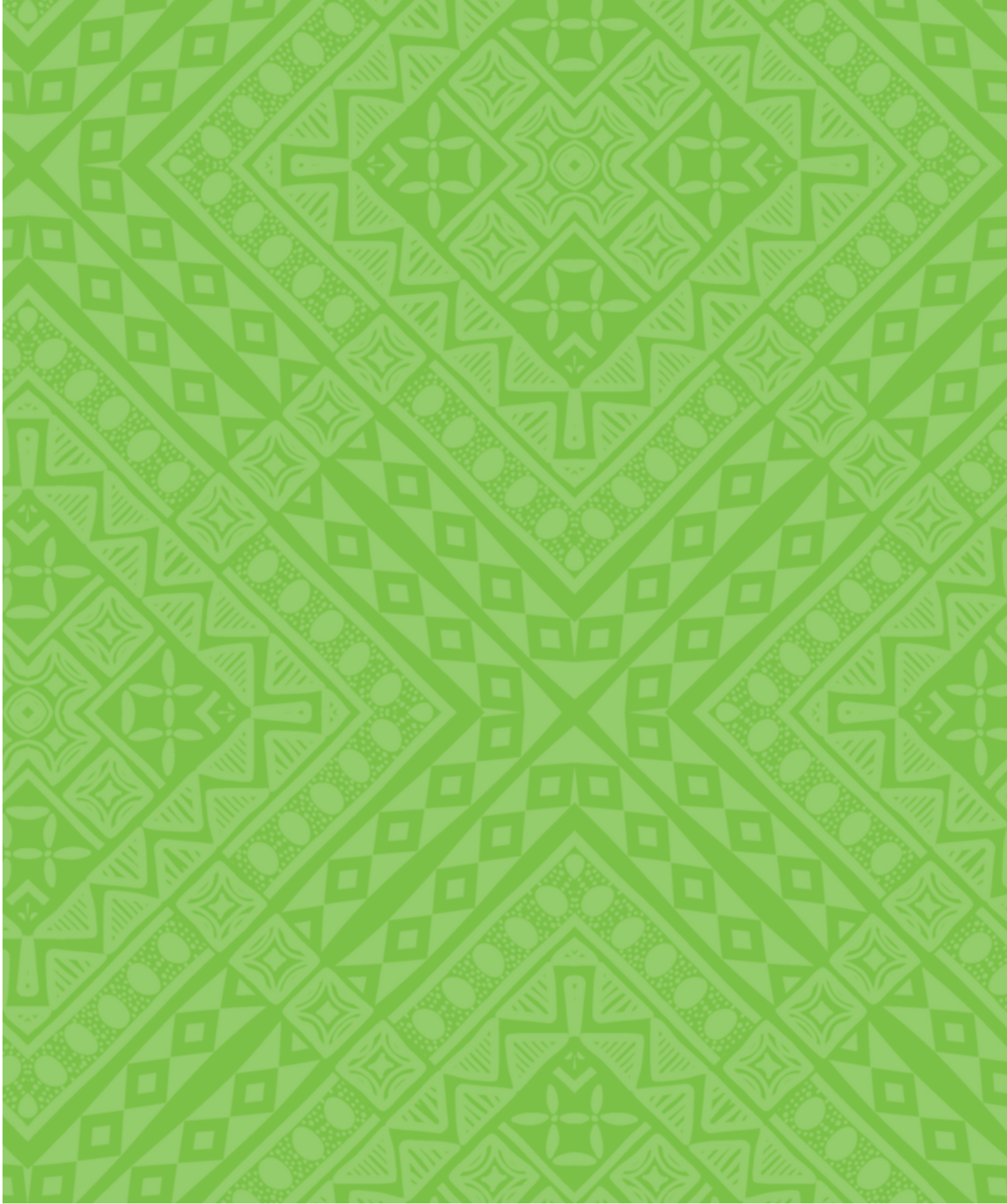
**Dr. Ali Makame Ussi**

policies and political considerations were instrumental in achieving this goal. Dr. Ussi concluded by emphasizing that the discussion on this topic was an ongoing process, and the workshop represented a postponement rather than a conclusion. Further input and collaboration would be essential for the preparation of the final report.

Dr. Ali Makame Ussi, the Deputy Vice Chancellor for Academics, Research, and Consultancy at the State University of Zanzibar, conveyed his closing remarks at the workshop. He expressed his gratitude to the stakeholders for the successful validation of the findings and achieving the workshop's objectives. Dr. Ussi recognized the workshop as a valuable opportunity for mutual learning and sharing insights on various aspects of the study, emphasizing that learning is an ongoing and continuous process.

Dr. Ussi highlighted that gender identity, whether as a man or a woman, is not solely determined by biology but is deeply influenced by cultural perspectives, norms, and values. The study underscored the need to address and reform these social systems to enhance the participation of women in STEM fields and reduce gender disparities.

He stressed that closing the gender gap in STEM can be accomplished through the adoption of the proposed framework and by encouraging each individual to contribute through the initiation of small and medium-sized projects that address issues of inequality and underrepresentation. Additionally, reforming



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