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Gender Imperatives of International Research Collaboration in a Small Research System: A Case Study on Research from Uganda

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ABSTRACT: The nexus of gender and development has become a recurring theme in international development practice and theory. Increasingly, gender matters are taking centre-stage in the global development discourse as issues relating to gender justice are redefining contemporary development debates. Various development leitmotifs are currently being shaped by narratives about how gender is recasting traditional growth patterns in the developing world. Over the last twenty years, specific policy reforms in many developing countries have highlighted issues of gender-mainstreaming and gender-inclusive growth as a yardstick for development. Gender has become a compound term with a plethora of meanings (Cornwall, 2007). Terms like the "Gender dividend" are becoming more mainstreamed in contemporary development literature. The structural changes in the global political economy are continuously readjusting to recognize the value-add or contribution of gender to the economy. Whereas the broader definition of gender encapsulates the various norms, cultures and other forms of social behavior, this research problematizes the role of gender in international research collaboration. While several studies (including Publication 1) have found that gender is a significant predictor of a researcher's participation in IRC, this study set out: To establish how the features of a research team determine the likelihood of a researcher being male and female; To characterize the role of gender in shaping research teams involved in internationally collaborative research. Using Feature Analysis to model the influence of research features on the gender of the research, a binary logistic regression was undertaken with a gradient boosting model to increase precision. In addition, text-mining analysis, machine learning and natural language processing were also used to examine the role of gender in research teams of research projects registered at Uganda National Council of Science and Technology. The results indicate that the researcher's role is the most influential factor (38.1%), followed by the gender of the lead researcher (23.5%), estimated budget (7.7%), nationality (Ugandan) (7.1%), and age (5.3%). These factors strongly influence the gender composition of research teams, suggesting that the assigned role, gender itself, financial resources, nationality, and age play significant roles in determining the gender of the lead researcher. Other factors such as professional experience, project duration, field of research, and qualifications also have some influence, although to a lesser extent. These findings emphasize the importance of considering these factors when promoting gender diversity and equality in research projects. The research concludes that in order to make IRC teams more gender inclusive, a critical appraisal of other factors needs to be undertaken. Gender-inclusive policies should make further considerations on how research teams are constructed (or led) and the intersectionality that informs those choices. This broader outlook will make IRC more inclusive.

KEYWORD: Gender, Research, Collaboration, Researcher Role.

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Introduction

The duality of Gender and Development continues to define contemporary patterns of economic change in the developing world. Beginning with the Beijing Platform for Action (BPfA) that was signed by 189 governments, there was a commitment to human development centered on women's advancement and the realization of gender equality worldwide (Habib *et al*, 2020). Today, the term 'gender' is often misconstrued to refer to whole range of constructs that define the interaction between the sexes and the underlying imperatives that shape their social co-interaction. One of the earliest definitions of the term 'gender' was made by Whitehead who noted that the relations between men and women are socially constituted and not derived from simple biology. Whitehead referred to gender as the sum-total of the social relations between men and women which can be derived from biological differences (Whitehead, 1979). Other scholars have simply defined gender as *"a socially imposed and internalized lens through which individuals perceive and respond to the world".* Ultimately, gender underlines the different roles for men and women including their inherent responsibilities and rights that vary by culture and that are subject to change over time. Although gender is often misunderstood as being the promotion of women only, its informed by the relationships between men and women, their roles, access to and control over resources, division of labour, interests and needs (Bravo-Baumann, 2000).

As such, the concept of gender equality and empowerment has been evolving with several achievements registered at national and international levels. However, a lot still needs to be done to change the long-held perceptions around gender and its potential contribution to development. Moser (1989) notes that gender differences are shaped by ideological, historical, religious, ethnic, economic and cultural determinants and that gender differs from place to place although hit could reflect mostly on the subordination of women. The ground-breaking work of Boserup (1970) highlighted the importance of women in the agricultural economy and posited a positive correlation between the role that women played in agricultural production and their status vis vis men. During the 1950s and 1960s, the concept of women and development became mainstreamed as an inclusive term that signified a movement whose long-term goal was the wellbeing of society.

Women and International Research Collaboration

Women and International Research Collaboration remain two distinctly diametrically opposite terms. This is largely because women have generally existed at the fringes of contemporary research policy. According to data from the UNESCO Institute of Statistic, less than 30% of the world's researchers are women. And yet, the participation of women in IRC has the potential to increase their contribution to the new and emerging challenges affecting different countries. This is because IRC enables women to have greater influence over the research problems own livelihoods and equips them with critical skills that enable them to contribute to society better (UNCTAD, 2011). Gender equity in IRC provides opportunities for women to influence R&D agendas within academia and other research institutions. This withstanding, the translation of scientific human capital for women remains low (Glover & Fielding, 1999) with women still remaining marginalized in specific development domains of IRC. In Uganda, women make up only 28% of the workforce in science, technology, engineering and mathematics (STEM) and remain "left behind" in the rapidly evolving and highest-paid jobs of the future, like computer science and engineering. Globally, less than a third of the world's researchers are women (UNESCO, 2020). This limited participation of women in research invariably reflects on the nature of their participation in IRC. Some studies have noted that women are less likely to engage in IRC owing to certain embedded gender stereotypes that dictate how IRC teams are derived and constructed.

This is further reflected in the role that women play in research management within research institutions and academia. For instance, a study has shown that in the field of biomedicine, women account for nearly 60% of

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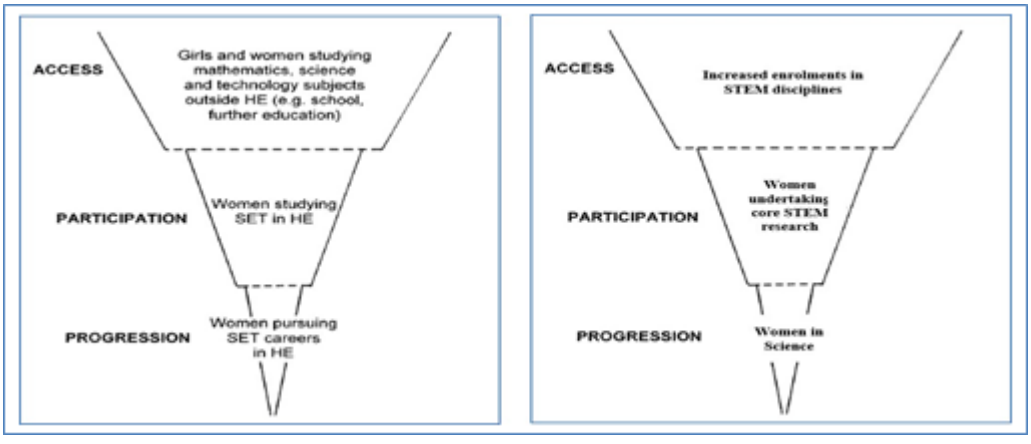
life sciences and health doctorates although their presence in senior academic positions is not adequately different (Sheltzer, 2014). As shown in Panel (a), progression of girls and women studying Science, Engineering and Technology (SET) subjects is characterized by a funnel metaphor adapted from Matyas & Dix (1992). A similar pattern is reflected on the participation of women in IRC (Panel (b)). This shows that women progression in IRC is a function of the constructed social behavior of the global research system. In Africa, this funnel shape is narrower at the top since only a few women ever get to pursue core science careers and therefore engage in IRC. The Opportunity Cost of such a choice is often more than offset than the potential benefit arising from a science careers. As a result, there are limited number of role models of women in IRC and the cycle is repeated. This cyclical reality of women in IRC could also be reinforced by policy action and/or institutional reforms. The latter interventions can only resolve the challenges of access and participation. The key reforms callfor structural reforms that encourages progression across the different levels. By actively supporting progression and providing the necessary support mechanisms (and reward systems), more young women are likely to remain in IRC.

Figure 12: Two Funnels of Women Progression



***Panel (a)* by Matyas & Dix (1992).** ***Panel (b)* by author**

Why gender participation in IRC remains a challenge within nascent research systems. According UNESCO, only 35% of STEM students in higher education globally are women with only 3% of female students in higher education choosing information and communication technologies (ICT) studies. To increase the participation of women in IRC, it would be necessary to promote women role models in STI, allow flexible working conditions, and support women's recruitment, retention, advancement and leadership in this area. According to UNESCO (2021) women scientists are increasingly becoming research leaders and yet they persistently represent about a third of researchers globally. Moreover, their work continues to go unnoticed and often unrewarded[13]. For instance, only 3 % of Nobel Prizes that have been rewarded in science have been given to women while only 11% of senior research roles are held by women in progressive European societies. As the world hurtles towards a future threatened by climate change and resource scarcity, the global scientific community must lose no time in recognizing and promoting women scientists' achievements.

Gender roles in Research teams

Gender representation in research teams has been a topic of concern, with persistent disparities observed across various fields. While gender disparity does not exclusively refer to women, it often manifests as underrepresentation of women (Xu et al., 2019; Shanahan et al., 2019). These disparities limit the diversity of perspectives and impede the full utilization of human capital in scientific endeavors. Research studies consistently highlight the underrepresentation of women in scientific research. These disparities can be attributed to social and cultural biases, stereotyping, and gendered expectations that discourage women and

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underrepresented genders from pursuing careers in research (Boniol et al., 2019). Gender roles in research teams can be influenced by a variety of factors, including societal norms, institutional practices, and individual dynamics. While several studies have focused on the role of gender on scientific research teams and have had a major focus on bibliometric data, there is limited evidence on how women on research teams act and interact in shaping research outcomes (Love et al, 2022). Most available work in this area has mainly focused on quantitative approaches like bibliometric (e.g. Lee, 2005) that show "presence" rather than "participation". The current trend however is to focus on the underlying perceptions that inform or shape gender derivatives on research teams. These qualitative factors can provide insight into how mentoring is undertaken, how research problems are designed and how culture and stereotype define the roles that women play on research teams. Reardon (2022) notes that such ingrained biases ultimately define collaboration.

In Uganda, limited research has been undertaken on research teams and the gender imperatives that shape them. In most of the research work undertaken, the focus has been on how many women are involved in research and not on the specific role that they play. The predictors for gender-equality in research have generally been on the surface and not delved into the substantive and definitive phenomena that shape and define the state of play in research teams. Bozeman *et al*. (2013) notes that research collaboration has often been appreciated from a bibliometric standpoint, but that much more qualitative research is needed about the meaning of collaboration and the more informal side of collaboration, including mentoring and ingrained biases, and balancing collaborations (Reardon, 2022). In most developing countries, patriarchal biases and other social constructs tend to determine how notions on gender play out within these teams. Further, many of these studies about women on teams were conducted with undergraduate students within curricular settings, not with real-world scientific teams. Fundamentally, to understand gender patterns in scientific collaborations, qualitative and mixed methods research approaches are needed that study the process of scientific team development and not just team outcomes.

Factors Contributing to Gender Disparities in research

Researcher characteristics play a crucial role in understanding gender disparities within research teams. Qualifications, such as highest educational attainment and areas of expertise, have been identified as key factors influencing gender representation. Studies have shown that women and underrepresented genders may face barriers in accessing higher educational opportunities in certain fields, contributing to their underrepresentation in research (Blickenstaff, 2005; Ely, Ibarra, & Kolb, 2011). Additionally, roles within research teams, including leadership positions and decision-making roles, often show gender imbalances, with women being underrepresented in positions of authority (Mason, Wolfinger, & Goulden, 2013). Research project characteristics also play a significant role in understanding gender disparities within the research community. Collaboration status is an essential aspect to consider, as it impacts the opportunities for networking, knowledge exchange, and career advancement. Gender disparities in collaboration patterns have been observed, with women and underrepresented genders experiencing barriers to forming collaborative partnerships. Field of research is another critical factor, as certain fields traditionally attract more male researchers than female researchers, leading to gender disparities. Research type, such as basic or applied research, can also influence gender disparities, as certain types of research may be perceived as more prestigious or provide better career prospects (Etzkowitz et al., 2014).

By examining these project characteristics, the policy brief aims to uncover patterns and trends that contribute to gender disparities and inform strategies for fostering gender equality in research projects. Considerations around the funding, nationality, coverage, and duration of research projects as potential factors contributing to gender disparities. The availability and allocation of research funding can impact the opportunities available to researchers, and biases within funding systems may disadvantage women and underrepresented genders (Löfström & Parding, 2018). Nationality can also intersect with gender disparities,

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as international research collaborations and mobility may be influenced by factors such as visa regulations, cultural norms, and biases (European Commission, 2019). Additionally, the geographical coverage and duration of research projects may have implications for gender representation, as certain regions or time frames may exhibit different levels of gender inclusivity. Understanding these project characteristics will provide insights into how systemic factors can perpetuate or mitigate gender disparities in research.

Implications of Gender Disparities in research

Gender disparities in research have profound implications for the scientific community and society. The exclusion of diverse perspectives and talents limits the potential for creativity, innovation, and the generation of new knowledge. Wennerås and Wold (1997) argue that gender disparities in research teams restrict the range of ideas, perspectives, and approaches, which can hinder the ability to address complex societal challenges effectively. When certain genders are underrepresented in given research areas, their unique experiences, insights, and expertise are often overlooked, leading to missed opportunities for groundbreaking discoveries and advancements in various fields. Nielsen et al. (2017) further emphasize that diverse research teams are more likely to produce innovative and impactful outcomes, as they draw on a wider range of experiences, knowledge, and problem-solving approaches.

The lack of gender diversity in research teams also has implications for the development of aspiring researchers. Else-Quest et al. (2013) highlight the importance of role models in inspiring and encouraging individuals from underrepresented genders to pursue careers in research. Therefore, gender disparities in research teams not only perpetuate existing inequalities but also hinder the development of a diverse and inclusive pipeline of researchers for the future.

Approach and Methodology

The methodology employed aims to comprehensively analyze the influence of researchers' and project characteristics on gender composition in research teams. It utilizes a combination of quantitative and qualitative methods, including descriptive statistical analysis and machine learning techniques. The following sections provide a detailed explanation of each method used in this study. To comprehensively examine the influence of researchers and project characteristics on gender, a rigorous approach encompassing various analytical approaches was adopted. That is, Exploratory Data Analysis, machine learning and natural language processing. The research projects' dataset used in this study was acquired from the registration database of the National Council of Science and Technology. The dataset consists of information on various researchers' characteristics, project details, including their title and objectives. Before conducting the analysis, the dataset underwent preprocessing to ensure data quality and consistency. This involved data cleaning, removing duplicates, handling missing values, coding and standardizing variables. Initially, univariate, and bivariate analyses were conducted to gain preliminary insights into the relationships between individual variables and gender. Descriptive statistical analysis was performed to gain insights into the distribution and characteristics of researchers and projects. This analysis involved calculating measures such as frequencies, percentages, means, and standard deviations. It provided an overview of gender distribution among researchers, highest qualifications, roles, collaboration status, field of research, and research types. The results of this analysis helped identify initial patterns and trends related to gender disparities in research teams.

To identify the key features influencing the gender composition of research teams. A supervised machine learning algorithm of a binary logistic gradient boosted model was employed. This algorithm combines the principles of logistic regression and gradient boosting to perform binary classification tasks, enabling to determine the gender of researchers on the project team. The machine learning component of the analysis involved the utilization of a binary logistic gradient boosting model in R. This model is a powerful algorithm

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that combines the principles of logistic regression and gradient boosting to perform binary classification tasks.

The model was trained on a preprocessed dataset of researcher and project characteristics, enabling it to learn the complex relationships between researcher and project characteristics and their association with gender composition of research teams. The model iteratively optimized its performance by minimizing the loss function, enhancing its accuracy in predicting the factors influencing the gender composition. By training the model on the dataset, we aimed to identify the key features that have the most significant impact on determining the gender of researchers. The model employed an ensemble of decision trees and iteratively optimized the predictions by minimizing the loss function. Through this iterative process, the model effectively learned the complex relationships between researcher and project characteristics and their association with gender. The machine learning component of the analysis involved the utilization of a binary logistic gradient boosting model in R. This model is a powerful algorithm that combines the principles of logistic regression and gradient boosting to perform binary classification tasks. By training the model on the dataset, we aimed to identify the key features that have the most significant impact on determining the gender of researchers.

The binary logistic gradient boosting model is represented in equation 1 below.

$P\ (X) = \frac{1}{1+e^{-F(X)}}$ ..... $Equation\ 1$

Where:

$P\ (X)$ = probability of a researcher being a female.

$F\ (X)$ = the predictor function, which combines the predictions from multiple

The predictor function is represented as represented as in Equation 2 below.

$F\ (X) = \sum_{m-1}^{M} \gamma_m h_m(X)$ .....$Equation\ 2$

Where.

M is the total number of decision trees in the model

γ_m represents the contribution of each decision tree to the final prediction.

$h_m(X)$ represents the prediction of the mth decision tree, which is based on a set of splitting rules determined during the model training process.

In our analysis, we utilized the popular machine learning libraries in R, including the "caret" package for data preparation and model training, and the "xgboost" package for implementing the binary logistic gradient boosting model. These packages provide a comprehensive set of tools and functions for preprocessing the dataset, splitting it into training and testing sets, and training the model with appropriate hyper parameters. To assess the model's performance and interpret the results, we employed various evaluation metrics, such as accuracy, precision, and recall. These metrics allowed us to measure the model's ability to correctly classify the gender of researchers based on the given features. Summarization and Visualization techniques were also employed to provide visual insights into the factors contributing to gender disparities. These included feature importance plots, to visually represent the model's predictive power and the relative importance of different variables in determining gender composition. By employing machine learning techniques and visualizations, we aimed to gain a deeper understanding of the factors influencing gender disparities in research teams and provide evidence-based insights to inform policy recommendations for promoting gender equality in research allocation and resource distribution.

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Results

Descriptive Statistical Analysis Results

Univariate Analysis

The analysis of the data showcased a noticeable discrepancy in the distribution of researchers based on gender. The results indicate that 54.9% of the researchers identified as male, while the remaining 45.1% were female. These figures highlight a clear gender disparity within the research community, emphasizing the need for concerted efforts to foster gender equality and promote inclusivity in research endeavors. The analysis of the highest qualifications among the research participants presented an interesting usual pattern. The data highlighted that most researchers held advanced degrees (PhDs (45.05%); Masters (43.88%)). On the other hand, a smaller proportion of researchers reported holding

Overall, 21.7% (924) of the researchers held the position of Lead Researcher, while 78.3% (3340) were classified as Secondary Researchers. Thus, there are four research team members per each research Principle Investigator. The findings indicated that the majority (80.37%) of the researchers, engaged in collaborative research. In this study, research was considered collaborative if at least one member of the research team was from another nationality. Among the different Fields of Science, Social Sciences accounted for the highest percentage at 45.76%. Other fields of science included Health Sciences (41.21%), Natural Sciences (5.46%,) Agricultural Sciences (4.32%), Information Sciences (1.62), Engineering Sciences (1.06%) and Physical Sciences (0.59%).

Table 8: Summary of Univariate Analysis

Statistic	***Age Of Lead Researcher***	***Coverage (Districts)***	***Estimated budget (US dollars)***	***Professional Experience Of Lead Researcher***	***Duration (months)***	***Publications for (Lead Researcher)***
Mean	43	7	1,702,772	9	22	6
Median	42	2	41,094	6	12	7
Variance	105.4455	347.3536	554168817258040	67.6243	392.1809	37.3376
Kurtosis	0.0290	29.7440	400.1854	3.3303	4.7357	91.5619
Skewness	0.3146	5.3500	19.6386	1.7485	1.7974	6.3921
Minimum	19	1	18	0	1	0
Maximum	76	134	490420000	46	120	100

Source: Primary Data

As shown, the mean age of lead researchers was revealed to be 43 years, with a median age of 42. The data exhibited a variance of 105.4455, indicating a relatively wide spread of ages among the researchers. Furthermore, there is a slight tendency towards higher ages (skewness = 0.3146).

The mean estimated budget was found to be $1,702,772, However, the median estimated budget was substantially lower at $41,094, highlighting a significant disparity and spread. The data shows that the mean professional experience of the lead researcher was 9 years and that the average duration of the research projects was 22 months.

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Field of Research by Gender

Table 9: Association of Gender and field of research.

Percentage	Gender		
Field Of Research	**Female**	**Male**	**Total**
Social Sciences	23.8%	22.0%	45.8%
Health Sciences	17.1%	24.1%	41.2%
Natural Sciences	1.9%	3.5%	5.5%
Agricultural Sciences	1.1%	3.3%	4.3%
Information Sciences	0.6%	1.0%	1.6%
Engineering Sciences	0.3%	0.8%	1.1%
Physical Sciences	0.3%	0.3%	0.6%
Total	**45.1%**	**54.9%**	**100.0%**

Source: Primary Data

Gender disparities still persist in the participation across the different fields of research. Across all fields, males accounted for 54.9% of the total participants, while females represented 45.1%. Notably, in traditionally male-dominated fields such as Agricultural Sciences and Engineering Sciences, the percentage of female participants was significantly lower than that of males. For instance, females constituted only 1.1% and 0.3% in Agricultural Sciences and Engineering Sciences, respectively, compared to 3.3% and 0.8% for males. Conversely, in fields like Health Sciences and Social Sciences, where female representation was relatively higher, gender disparities were still evident. Although females constituted 17.1% and 23.8% in Health Sciences and Social Sciences, respectively, males still accounted for a larger proportion at 24.1% and 22.0%, respectively. These findings suggest the existence of gender disparities within the research community and emphasize the need for continued efforts to promote gender equality and inclusivity in research, particularly in fields where women are underrepresented.

Role of Researcher by Gender

Table 10: Association of Gender and Research Role

		Role of the Researcher		
Gender	**Percentage**	**Lead Researcher**	**Secondary Researcher (Research team members)**	**Total**
	Female	10.1%	34.9%	45.1%
	Male	11.6%	43.4%	54.9%
	Total	**21.7%**	**78.3%**	**100.0%**

Source: Primary data

The data indicates that among the lead researchers, 10.1% are female, while 11.6% are male, resulting in a total representation of 21.7%. On the other hand, among the secondary researchers, the percentage of Males is significantly higher too at 43.4%, compared to 34.9% of females, contributing to a total representation of 78.3%. These percentages shed light on the gender distribution within the research teams, highlighting a notable gender disparity. The implications of this gender imbalance underscore the need for strategies to promote gender diversity in research projects, ensuring equitable opportunities for all researchers. Addressing this disparity can lead to enriched perspectives, enhanced collaboration, and ultimately contribute to more comprehensive and well- rounded research outcomes.

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Collaboration Status by Gender

Table 11: Proportion of Female and Males by Collaborative Status

Proportion	Collaboration Status		
Gender of Researcher	**Collaborative**	**Non-collaborative**	**Total**
Female	37.7%	7.3%	45.1%
Male	42.7%	12.3%	54.9%
Total	**80.4%**	**19.6%**	**100.0%**

Source: Primary data

As shown, most (80.4%) of the researchers are engaged in collaborative research while only 7.3% of female researchers were engaged in non-collaborative research projects. Among the female researchers, 37.7% were engaged in collaborative projects, whereas 7.3% were involved in non-collaborative projects. This indicates a higher likelihood of females to participate in collaborative research projects compared to non-collaborative ones. This finding suggests that collaborative projects may provide a more inclusive and supportive environment for female researchers, potentially offering greater opportunities for networking, knowledge sharing, and mentorship. The results emphasize the importance of promoting and facilitating collaborative research efforts and encouraging non collaborative research projects to take up more females for a more balanced and diverse research landscape, fostering innovation and advancing scientific knowledge.

Budget, Coverage, duration and Professional experience by Gender

Table 12: Characteristics for Female and Male-led Research Projects

Average	Female Led	Male Led	Percentage difference
Estimated budget (USD)	317,416	1,688,705	81.2%
Lead Researcher Age (years)	40.9	43.5	5.9%
Coverage (Districts)	5.5	6.0	8.3%
Lead Professional Experience (years)	7.2	8.7	17.2%
Duration (months)	17.3	20.4	15.1%

Source: Primary Data

As shown, the estimated budget of female-led research projects were 81.2% lower than male- led projects which had a substantially higher average budget of USD 1,688,705. Similarly, male-led research projects had a longer (15.1 % more) duration (in months) projects led by female researchers.

Important and Significant Features towards gender composition of research teams

Degree of Importance towards determining sex of the researcher

The feature analysis provides insights into how different characteristics of a research project contribute to the gender of the researcher. The purpose of the modelling was to examine the influence of project and researcher characteristics on the gender of the researcher. By conducting a binary logistic regression analysis with a gradient boosting model to increase precision to identify the factors that significantly affect the likelihood of a researcher being female or male.

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Table 13: The most influential factors to gender of the researcher, an xgboost model results

Feature	Overall Importance	Relative Importance
Researcher Role	38.1%	100.0%
Gender Of Lead Researcher	23.5%	61.7%
Estimated budget (USD)	7.7%	20.1%
Nationality Ugandan	7.1%	18.6%
Age Of Lead Researcher	5.3%	13.9%
Professional Experience of Lead Researcher	3.3%	8.8%
Duration (Months)	2.9%	7.6%
Field of Research – social sciences	2.7%	7.0%
Lead Researcher Number of publications	2.3%	6.1%
Coverage (Districts)	2.2%	5.8%
Highest Qualifications - PhD	1.0%	2.6%
Research type	0.8%	2.0%
Highest Qualifications - Masters	0.8%	2.0%
Collaborative Status – non collaborative	0.5%	1.4%
Nationality British	0.4%	1.0%
Field of Research – health sciences	0.3%	0.9%
Field of Research – natural sciences	0.3%	0.9%

Source: Primary Data

The results indicate that the researcher's role is the most influential factor (38.1%), followed by the gender of the lead researcher (23.5%), estimated budget (7.7%), nationality (Ugandan) (7.1%), and age (5.3%). These factors strongly influence the gender composition of research teams, suggesting that the assigned role, gender itself, financial resources, nationality, and age play significant roles in determining the gender of the lead researcher. Other factors such as professional experience, project duration, field of research, and qualifications also have some influence, although to a lesser extent. These findings emphasize the importance of considering these factors when promoting gender diversity and equality in research projects.

Most Significant Features

Table 14: Significant Factors Influencing the Gender of Researchers: A Binary Logistic Regression Analysis output

Feature	Estimate	Std. Error	z value	Pr (>|z|)
Nationality – Ugandan	-1.163	0.093	-12.458	0.000
`Gender of Lead Researcher`	-1.250	0.074	-17.001	0.000
`Field of Research – social sciences`	0.723	0.208	3.475	0.001
Nationality – South African	-0.996	0.383	-2.602	0.009
`Estimated budget (USD)`	0.000	0.000	2.585	0.010
`Professional Experience of Lead Researcher`	-0.015	0.006	-2.493	0.013
`Age of Lead Researcher`	0.013	0.005	2.401	0.016
Nationality – Tanzanian	-1.378	0.580	-2.378	0.017
Nationality – Swiss	-0.921	0.409	-2.250	0.025
Nationality – British	-0.308	0.145	-2.129	0.033
Nationality – Kenyan	-0.664	0.324	-2.051	0.040

Source: Primary Data

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a. Nationality – Ugandan

The nationality of the researcher played a significant role. Being Ugandan was associated with a decrease in the odds of being a female researcher (estimate = -1.163, $p < 0.001$). This corroborates Frame & Carpenter (1979) who found that the IRC on scientific papers occurs is closely tied to the nationality of scientists. This suggests that Ugandan researchers were more likely to be male compared to their female counterparts.

b. Gender of Lead Researcher

The gender of the lead researcher had a substantial impact on the gender composition of the research team. Female lead researchers were significantly less likely to have female team members, as indicated by the negative coefficient (estimate = -1.250, $p < 0.001$). This finding suggests a gender imbalance in research teams, with male researchers being more prevalent.

c. Field of Research

Field of Research - Social Sciences: Researchers in the social sciences had higher odds of being female (estimate = 0.723, $p = 0.001$). This finding implies that the social sciences field has a relatively higher representation of female researchers compared to other areas of research.

d. Estimated Budget (USD)

The estimated budget had a positive association with the likelihood of a researcher being female (estimate = 0.000, $p = 0.010$). This implies that research projects with higher budgets were more likely to have female researchers.

e. Professional Experience of Lead Researcher:

The professional experience of the lead researcher had a small but significant negative effect on the odds of a research team member being a female researcher (estimate = -0.015, $p = 0.013$). This suggests that more experienced lead researchers were more likely to include a male researcher on their teams.

f. Age of Lead Researcher:

Similarly, the age of the lead researcher had a small but significant positive effect on the odds of being a female researcher (estimate = 0.013, $p = 0.016$). This indicates that younger lead researchers were more likely to have a female member on their research team.

4.0. Discussion

The analysis of the research data has provided valuable insights into the gender composition, qualifications, roles, collaboration status, fields of research, and project characteristics within the research community. The findings underscore the existence of gender disparities within research and provides insights into the underlying factors influencing the gender composition of research teams. The results confirm previous research findings that gender disparities still persist, especially in nascent research system. As shown, these embedded disparities are also evident in the fields of science even though various policy reforms towards affirmative action have been undertaken. Male-led projects exhibit higher average budgets and longer durations compared to female-led projects. This research budget-inequality is characteristic of structural and institutional contradictions that result in female-led research projects attracting less budgets. This could further be attributed to the collaborative-potential of female-led projects, the nature, duration and coverage of such projects and the propensity of female PIs to assemble big research teams. Other significant factors include estimated budget, nationality, age of the lead researcher, professional experience, and field of research. These factors should be taken into consideration when implementing strategies to promote gender diversity and equality in research projects. By acknowledging and addressing these factors, we can create a

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more inclusive and supportive research environment that values and leverages the diverse talents and perspectives of all researchers.

5.0. Conclusion

The central focus of the paper was to highlight predominant issues pertaining to gender in research in Uganda. These findings highlight the presence of gender disparities within research project characteristics of budget and duration of the project. Understanding these differences is crucial for creating a more inclusive and equitable research environment, promoting diversity and equal opportunities for all researchers, regardless of their gender. Increased allocations towards those fields of science with limited gender participation needs to be undertaken. Review of institutional research policies to adequately reflect gender participating in research teams can increase the opportunities for further inclusion of women in research teams. Supporting mentorship regimes within research teams can also facilitate increased participation of female early career researchers in research teams. By also providing more incentives towards gender-balanced research team can enhance the intentionality of establishing research teams that are more inclusive and equitable. Encouraging research teams in specific disciplines to actively seek gender diversity or reviewing policy frameworks to increase gender embeddedness in research teams can increase women visibility and enhance their collective contribution to research activity. There is need to conduct additional research to explore the underlying causes and factors contributing to the gender disparities in specific research areas. This will facilitate further evaluation on each research area and institution and allowing collaboration with relevant stakeholders, such as funding agencies, academic institutions, and professional societies which is crucial for the successful implementation of the recommendations.

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