

Gendered Perspectives on the Digital Divide, IT Education, and Workforce Participation in Kenya

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Abstract—The purpose of this study was to examine gendered perspectives on the digital divide, motivations for engaging in information technology (IT) education, and expectations regarding IT workforce participation in Kenya. Researchers interviewed 32 women and 31 men matriculating in an undergraduate IT-focused program at a Kenyan university. Interviewees reported that IT careers demand technical expertise, and a strong educational background in technology and business. However, their ability to meet these demands was hindered by significant national challenges such as restrictive IT policies, inadequate access to technology and educational resources, and a limited number of local firms that demonstrate the ability to manage advanced technology and IT workers. Women were particularly concerned about gender discrimination in the workplace. These findings imply that IT education and workforce entry require a complex mix of digital technologies, organizational capacity building, gender equity, and IT policy remedies.

Index Terms—Education, employment, information technology.

I. INTRODUCTION

TRADITIONALLY, gender research in information systems (IS) has focused on factors that contribute to the underrepresentation of women in the information technology (IT) workforce and educational programs. More recently, gender has been integrated into the study of diverse social issues such as the digital divide, social exclusion, and underserved populations throughout the world.

In this paper, the authors contribute to this emerging body of research by presenting a study that examined undergraduate students enrolled in an IT-focused program in a Kenyan university. The purpose of the study was to understand and explain gendered perspectives in three topical areas: 1) the digital divide; 2) motivations for enrolling in IT-focused education program; and 3) career expectations upon completion of the program. To gain insights into these three topical areas, the researchers conducted interviews with 32 female and 31 male students. The methodology that guided these interviews as well as the findings and their implications for IT education are presented. First,

however, this study will be situated in the extant literature on gender in IT education, gender in the IT workforce, and the digital divide.

II. LITERATURE REVIEW

A. Gender in IT Education

Although many women begin their college matriculation process in science, technology, engineering and mathematics (STEM), those in IT-focused disciplines such as IS and computer science often renounce the field before graduating, or fail to persist in academic or corporate positions in the field upon graduation. For example, in a study of U.S. female college students, Weinberger [1] reports that one-third of the respondents anticipated that the IT workplace would not be welcoming, while 20% reported incongruence between personality and career fit. In addition, the women reported that the IT field would not offer them the ability to balance work and family responsibilities.

According to a report published by the Information Technology Association of America (ITAA) [2], the IT field demands technical expertise and requires a strong educational background in mathematics, science, and technology. Degrees in computer science, engineering, and related fields are among the most common requirements for IT jobs. In the United States, however, the numbers of women earning undergraduate degrees in computer science and engineering are significantly less than might be expected from their representation in the population. This underrepresentation can be partially explained by the following impediments that many women face in their STEM educational and career paths:

- 1) a lack of role models and networking opportunities;
- 2) an education gap, coupled with the digital gap
- 3) a lack of access to a technology-related career;
- 4) a lack of commitment from industry and academe;
- 5) the perception of IT as a white male career.

Despite these challenges, formal STEM training and access to technology resources can be found at the elementary and secondary levels, and in institutions of higher education. The availability of formal STEM education in sub-Saharan Africa, however, may be more challenging due to infrastructure and economic development issues. Mazzoni [3] ascertained that, if sub-Saharan African nations are to stay abreast of advanced technologies, they must establish solid engineering curricula with strong academe/industry collaborations and focus on re-tooling educational systems. Mbarika [3] and Mazzoni [4] state that regional issues, particularly those of workforce development, remain central if substantial progress is to be made.

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B. Gender in the IT Workforce

Once their formal education is completed, women continue to face unique challenges in the IT workforce. Prior research on gender and the IT workforce has examined these challenges from two standpoints—gender comparison and social structures. Gender comparison studies highlight ways in which women are disadvantaged relative to men. For instance, in a study of gender differences in job performance evaluations, and the impacts of these differences on career advancement prospects, Igbaria, and Baroudi [5] found that female IT professionals received lower average job performance ratings and thus less career advancement than did their male peers. In a similar study, Igbaria and Chidambaram [6] examined career success in terms of human capital and found that, on average, women were younger and less experienced than were men, worked in lower-level positions, and received lower salaries than did men even when age, work experience and job levels were controlled. Goss and Gupta [7] found that regardless of education, age, marital status, industry, occupation, or Internet usage, women earn less than men. Earning power and anticipated rewards of IT careers continue to elude women [8].

Adam, Howcroft, and Richardson [9] note, however, that gender comparison studies are generally based on psychological models that obstruct consideration of social structures (for example, the longstanding relative advantages men have gained through employment in the highest levels of organizations) that enable or obstruct individual choices. Consequently, social structures play an important explanatory role and should not be normalized through statistical controls for income, occupation, and educational level.

To gain understanding of social structures that shape IT work, Woodfield [10] posed the question: “Would an increase in the number of women working in the IT profession generate an attendant shift in the nature of systems development work?” Using interview data elicited from IT workers, she examined the commonsense discourses used to represent male and female workers’ social and technical skills. She concludes that although both types of skills are highly complex, male workers and their competencies are often privileged. Therefore, increasing the number of women undertaking IT work will not automatically lead to a shift in the qualitative nature of IT work and the contexts within which IS are produced. In another study, Panteli and colleagues [11] examined the specific jobs that women occupied in the IT industry in the United Kingdom. These researchers found that women were reasonably represented in the administrative and support functions, but were less well represented in the more technical functions such as programming and in management positions. Hence, the sexual division of labor was alive and well, and some of this gender imbalance was due to traditionally-held masculine views of work roles.

C. The Digital Divide

Gender disparities in IT education and workforce participation are two facets of the digital divide. The digital divide is broadly defined as the “differential capabilities of entire social [or regional] groups to access and utilize electronic forms of knowledge” [12], segregating the “haves” from the “have-nots”

in the information society. With the growing pervasiveness of IT, both developed and developing countries are exploring ways in which to alleviate the digital divide and derive benefits from these technologies.

The digital divide in sub-Saharan Africa is evidenced in three ways. First, an international digital divide persists between developed and developing countries and continents [12]. This divide is exemplified, for example, when comparing IT in sub-Saharan Africa with Western countries like the United States and the United Kingdom. While the United States and the United Kingdom have been enjoying Internet connectivity for more than two decades, Eritrea had its first Internet connection in 2000. Similarly, while the United States boasts of more than 60 telephone lines per 100 people, many countries in sub-Saharan Africa still provide less than one line per 100 people [13]. In a plea at the World Summit on the Information Society, former United Nations Secretary General, Kofi Annan [14], called for the U.S. information community to use its innovative dynamism to bridge the digital divide that threatens to marginalize development prospects. Subsequently, the United Nations approved \$6 million for the “Internet Initiative” in Africa and a further \$11.5 million for IT projects under the banner of “Harnessing Information Technology for Development.”

A second form of digital divide is the intracontinental divide in Africa. While the more developed Northern and Southern regions of Africa are able to develop and grasp contemporary technologies, as well as other economic development advances, the same is not true of sub-Saharan Africa. For example, while South Africa enjoys a teledensity of over 10 telephones per 100 people, the sub-Saharan Africa region still barely has a teledensity of one per 100 people [15].

The third form of digital divide is the “within-country” differences in IT access and use among different social groups within a single country. In Kenya, for instance, women have played the traditional “stay-at-home mom” role which, without minimizing its importance, has disenfranchised the Kenyan woman seeking a college education and career in STEM-related disciplines. However, this is changing as more women engage in IT education as well as IT-related careers [16]. In the United States, educational inequities are highly correlated with race, ethnicity and socioeconomic status. These differences in educational outcomes contribute to the creation of a lost cohort of potentially skilled, knowledge workers—particularly among lower income Black adults [17], [18] and Black youths [19]–[21].

III. METHODOLOGY

To understand how IT education, workforce participation, and the digital divide are interpreted by students, structured interviews were conducted with all of the students (32 women and 31 men) completing their final year of study in the Bachelor of Business Information Technology (BBIT) program at a Kenyan university. The BBIT program brings together computer science and business management, which prepares students to implement IT-based solutions in complex business environments. The total student population at the university was 3500 including 1500 full-time students. Of these full-time students, 313 were enrolled in the BBIT program (63 fourth-year, 70 third-year, 90 second-year, and 90 first-year).

TABLE I
RESEARCH THEMES AND QUESTIONS*

Themes	Sample Interview Questions
Digital Divide	In your own words, what is the digital divide? Some people say that the divide has been bridged since we have provided people with computer and Internet access and training. Do you agree? Why or why not?
Motivation for IT education	In your opinion, why do women participate in this IT program? What is at stake if you do not learn about IT?
Expectations for IT workforce participation	In what ways did the training meet and/or fail to meet your expectations? How will you use your IT skills to improve your quality of life? As you move forward to leverage the IT skills that you've gained, what challenges do you face?

* The genesis of the full set themes and representative questions are detailed in a prior paper [16] which focuses on the female respondents. This paper focuses on the subset included in Table I.

All interviewees were enrolled in the Social Impacts of IT course which was being taught by the fourth author of this paper. This course covers IT in the human context, and includes topics such as ethics, privacy, and organizational change. All interviewees are of Kenyan nationality, graduates from secondary schools, 20–22 years of age, and mostly single. Students primarily finance their education through work, loans and scholarships. Most students have completed or are currently engaged in an internship with a company.

Interview questions were used to elicit students' interpretations of the digital divide, and IT education and workforce participation. These questions are summarized in Table I. The interview questions were highly structured, with each informant receiving exactly the same questions in the same order. Each informant was instructed to reply to the questions by anonymously writing his or her response in a booklet. The contents of the handwritten response booklets were then transcribed using word processing software. This transcription process resulted in approximately 130 pages of typed texts.

The data analysis began with two researchers independently reading and coding five interview texts. Weekly meetings were held to develop a shared understanding of the emerging codes. Once a stable set of codes was established, this coding scheme was used to analyze the remaining interviews. Once all of the interviews were coded, text fragments with similar codes were grouped together to create high-level themes that were common across interviews. During this phase of focused coding and clustering, the entire research team met to share perceptions about the data, build consensus on the analysis, and present a credible account of the research.

IV. FINDINGS

The results of these findings are summarized in Table II and further detailed in this section.

A. The Digital Divide

The questions about the digital divide were designed to elicit students' understanding of the important role that IT may play in development efforts in Kenya. The majority of informants (87%) stated that the digital divide persists at the individual,

national, and global levels. At the individual level, men and women saw the divide as the difference between "*computer-literate and computer-illiterate people*," "*those who have easy access to technology and those who don't*," and "*those who have some IT skills and those who don't*."

Male students, however, offered additional dimensions. For instance, age was used in defining the digital divide: "*The gaping disparities between generations in different parts of the world with regard to their knowledge of IT, the technologies they use, legislation in place and the general understanding of IT issues among the general population*." Cost was also mentioned: "*Computers can be acquired more cheaply but they are not free. You still need to have money to access them*." Differences in the computing capabilities of technical artifacts also contribute to the digital divide: "*Even if we have been provided with computers to bridge this gap, those computers are of lower technology. Let's say Pentium Ones which have virtually ceased to exist. Thus, we can't say that the bridge has been narrowed*."

At the national level, informants expressed the digital divide as an urban/rural divide: "*Yes, we at this learning institution have been provided that [IT] but all of this is mainly concentrated in the major towns. The rural areas have been left far behind such that the average for the country is quite low compared to that of the developed nations. Thus, we cannot say it has been bridged based on the numbers/statistics of the cities*."

At the global level, men and women equally noted digital divides between nations. One woman laments: "*It will be hard to catch up with the West. In fact, it will be impossible. This is because IT works in levels. You move from one level to the next. And since IT is always changing, by the time we move to another level, the industrialized countries will be yet at another level*."

B. Motivations for Participation

Both men and women who participated in this IT educational program did so largely because they perceived the field as new and exciting with many job prospects: "*Not many people in Kenya have this sort of information [and] this is because currently in Kenya there is lack of professionals in this field*." IT jobs were also seen as well-paying: "*IT programs have proved*

TABLE II
SUMMARY OF FINDINGS

	Responses
Digital Divide	<p>Exists:</p> <ul style="list-style-type: none"> • Disparities in IT literacy, skills and access gaps at individual, national, and global levels • Disparities based on age, cost, technology capabilities, awareness (males only) <p>Does not exist:</p> <ul style="list-style-type: none"> • Access adequate
Motivations for IT Education	<ul style="list-style-type: none"> • Novelty of IT work / few IT professionals • Well paying IT careers • National labor market expanding • Global job market (male only) • IT jobs risky with high return (male only) • Entrepreneurship (female only) • Gender equity
Expectations for IT Workforce	<p>Expectations:</p> <ul style="list-style-type: none"> • Employers demanding more IT skills • Competitiveness in the job market is increasing as more people obtain IT skills • Gain all-around business and IT knowledge, and professional credentials to gain competitive advantage over other job seekers <p>Challenges:</p> <ul style="list-style-type: none"> • High cost of technology stymies development in IT sector • National and organizational IT policy still developing • Gender bias during hiring (female only) • Low IT awareness in society (female only)

to be better-paying careers than other technical careers in the country. This is due to the wide usage of IT in various sectors such as in banking. This provides a good basis for the women to work in a different sector while applying their IT knowledge.”

Entrepreneurship and gender equity were two motivators, however, that were voiced consistently, but only by women. “I want to be a business person in the future. I want to own my own business in Kenya so I need business and management skills. However, I also realize the role of IT in today’s society. I wanted to know how to link the two—business and IT -and how I can use the two to develop my ideas of a business that I hope to start.” A male informant supported the view that IT could facilitate entrepreneurship for women. “Women can use IT to improve their [women’s] standard of living. For example, they can use the Internet to facilitate marketing for products, such as self-help groups to market their *ciandos*¹ ‘that has a considerable market in countries such as Japan.’” Women felt that they could use IT to step outside of prevailing gender norms.

“Due to the empowerment of women in recent years, more and more parents are becoming interested in the girl child and encouraging her to become active in society. More and more women want to play an active role in their society and in the world, and this being the information age, women want to be involved in the IT sector (not to be left behind their male counterpart).”

¹The *ciandos* are very popular hand woven African female handbags, primarily produced by the Kikuyu women of Kenya. More recently, just as many African creative ideas have been “stolen” by other non-African nations, it has been reported that this native Kenyan artifact has been “patented” by Malaysia—to the dismay and heartache of many Kenyans and Africans.

Some men supported this view of IT as enabling gender equality.

“Most women participate in this program to fill the vacuum created by the domination of male counterparts in the field of IT. They have realized that they too are capable and, given the same conditions to operate in, they too will excel. Women have also endeavored to participate in this program so as to be informed of the various technological changes. Since women form the major part of the social fabric, they have to be well informed so as to foster development.”

C. Career Expectations

All informants expressed career expectations that centered on strong technical and business acumen. “I expected to emerge as an IT expert with knowledge of the foundations and development of technology. I expected to be up-to-date on the technology trend and be able to manage information systems, develop them, code, implement, manage, and have IT at my fingertips.” Technical skills were seen as mandatory in the job market and in everyday life: “IT is becoming a basic need for people in their various careers and day to day life. Not having some knowledge of IT means difficulty in even accomplishing simple tasks such as using an ATM. Not having the basics of IT could close doors to jobs that are not essentially about IT.” Moreover, employers are demanding IT skills and credentials.

“Every employer is currently demanding that you have basic IT skills. And as many more people study IT, this demand is increasing and it is no longer surprising to be asked to have additional networking skills even for us graduates (to be). Employers are asking for additional professional

qualifications, e.g., Oracle, Cisco, etc. Thus, currently it is actually a requirement to possess IT skills in any meaningful job that you apply for. So its either you learn IT or risk your future.”

Women used the metaphor of a pioneer to describe their experiences as new entrants into the IT workforce: “*Since we are pioneers of this course, most organizations and companies out there really don’t understand what this course entails and according to them they don’t know what positions we can hold in their companies.*” Two women went further to raise gender discrimination as a concern: “*There is a problem that because I am a woman, employers may not think that they should give me a job working in IT, so I may never fully get to use all that I have learned to do, work that I want to do.*”

V. DISCUSSION

The Kenyan undergraduate students in this study offered their perspectives on IT education and workforce participation, and the digital divide. In terms of IT education and employment, both men and women identified a common set of challenges, which include limited exposure to seasoned IT professionals and limited access to technology resources that provide opportunities for hands-on learning. Consequently, although IT careers were seen as lucrative and plentiful, students felt that their technical skills were not sufficiently developed to make them highly competitive job candidates. Many of these perceived barriers differ from those found in studies conducted in developed countries, and suggest the need for strengthening university-industry ties and providing more advanced IT resources and training for instructors and students.

When discussing the digital divide, students situated their individual educational outcomes in the broader social structures. In doing so, they expressed dualistic thinking that presented binary opposites such as Western/African nations, skilled/unskilled, presence/absence of IT, old/young, advanced/behind, urban/rural, and new/old technology. These binary categories largely mirror those found in the digital divide discourse of Western nations. Perhaps this is because both developed and developing nations must contend with systemic inequities associated with human differences based on geographic location, gender, race, ethnicity, and socioeconomic class. To produce compassionate IT professionals equipped with the analytic and technical skills to develop solutions that facilitate development and redress the digital divide, IT education programs should include course modules and learning activities that raise students’ awareness of ethics, social responsibility and civic engagement.

There is evidence, for instance, that globalization has given women in developing regions greater opportunities to partake in formal education and work in STEM-related disciplines. Morgan, Heeks, and Arun [22] reported that the United Nations placed access to IT as the third most important issue facing women globally, after poverty and violence against women. Access to IT and its potential role in reducing the income gap between men and women has also been documented in teleeducation initiatives in sub-Saharan African nations, such as Cameroon, Tanzania, and Botswana [23]. Hafkin and Taggart [24] in their gender study of IT and women in

developing countries recommended that progress in access to IT must be met with advances in public policy, infrastructure, and education for women. Liu and Wilson [25] identified a myriad of reasons for pursuing IT skills, among them improved employment opportunities, self-confidence, career prospects, and entrepreneurial opportunities. These factors have largely been confirmed in the current study, which further supports the pressing need to recruit more women into STEM-related educational programs.

Recruiting more sub-Saharan African women into the IT workforce may also help to counter the so-called “brain drain.” According to the International Organization for Migration [26], Africa has been losing 20 000 professionals each year since 1990. This continuous outflow of skilled labor contributes to a widening gap in science and technology between Africa and other continents, and is one of the greatest obstacles to Africa’s development. On the one hand, men in the current study took a global view of the job market and considered emigration as a viable career option. Women, on the other hand, tended to consider self-employment in Kenya because entrepreneurship enables them to have careers in the formal economy while avoiding the perceived gender biases of hiring firms. These gendered views on employment suggest that societal structures, rather than intrinsic differences based on biological sex, influence women’s perceptions and experiences differently than those of their male counterparts [9]. IT and development policies that support microfinance and preferred vendor programs for female-owned businesses would help women seeking to start their own companies.

VI. CONCLUSION

This study examined gender perspectives on the digital divide and IT workforce and education in Kenya. Through interviews with 32 female and 31 male students enrolled at a four-year university in Kenya, the authors found that students advocated for IT skills and competencies to enhance the economic development of the nation and to further their individual careers. However, their narratives revealed the unique challenges to deriving value from IT in Kenya. To overcome these challenges, national policies are needed to facilitate the growth of the IT sector and promote gender equity, and the capacity of organizations to leverage and develop the IT workforce.

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