Global Perspectives: Exploring Disruptive Technology Challenges for Consumers in Sub-Saharan Africa

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Abstract:

The Base of Pyramid markets in Sub-Saharan Africa face challenges such as poverty, poor infrastructure, illiteracy, and government corruption. This paper examines and presents an analytical review of the difficulties among consumers in Sub-Saharan Africa using academic institutions in Kenya to illustrate disruptive technology. Sub-Saharan Africa is faced with practical challenges with disruptive technology. Qualitative analysis is conducted among a sample from Kenya to assess the validity of challenges faced in academia. The authors use stratified sampling to select the local population and reach higher precision with a response rate of 85%. The qualitative analysis findings confirm a positive relationship between smart devices and network reliability, online teaching, online grade book, and virtual learning. The authors conclude that network reliability is the most challenging, especially for higher education institutions moving forward with adopting mobile learning. There exists a research gap in the literature on the Sub-Saharan Context. The challenges of disruptive technology and academia within Sub-Saharan Africa were limited to Kenya. Further research by practitioners and scholars can explore the challenges of disruptive technology in Sub-Saharan Africa.

Keywords:

challenges; disruptive technology; developing economies; Academia; Sub-Saharan Africa; Kenya

I. Introduction

There are 4.5 billion people around the globe that are considered the Base of the Pyramid (BOP) who live on less than $3.35 per day; the home of BOP belongs to Africans, Asians, and Latin Americans (World Bank Group, 2019; World Resource Institute (2007). The BOP consists of the poorest economic groups in a country. The people in BOP share significant unmet needs, including physiological needs; safety and security; proper infrastructure in every sector, including transportation, education, and health care (Praceus, 2014). The estimated consumer market of the BOP reaches $5 trillion (World Resources Institute, 2007). The BOP market analysis urges businesses and governments to consider creative thinking on products and services that will meet the BOP market needs (Bitzer & Hamann, 2015; Jaiswal & Gupta, 2015).

Taking a market-based approach to poverty reduction requires the assistance of Non-Governmental Organizations (NGOs), Foreign Direct Investment (FDI), governments, and local markets. In the absence of legitimate political leadership in Sub-Saharan Africa, the only hope for locals to move out of extreme poverty is utilizing NGO programs (Burchardt & Swidler, 2020; Hickey, Lavers, Niño-Zarazúa, & Seekings, 2018; Nkansah-Dwamena, 2021; Rakodi, 2016). The International Finance Corporation (IFC), which is part of the World Bank

Group, continuously works with the private sector and supports Sub-Saharan Africa; for example, $4.7 billion was spent in 2017 to help in the infrastructure, education, renewable energy, and healthcare in 30 countries (Fan et al., 2021; International Finance Corporation (IFC), 2019; Sy & Gutman, 2015). This is evidence that NGOs are needed to promote and lead investment with core functions that include management of assets, advise, mobilizing capital, and fostering new business ventures in the local markets (Anyanwu, J. C., & Anyanwu, J. C., 2017; Gnych et al., 2020; Hain & Jurowetzki, 2018; Hemson, Meyer, & Maphunye, Meyer, 2015; Meyer, 2015).

Despite all these advances, most individuals around the globe are under financial constraints and cannot afford a smart device with an internet connection without assistance from projects such as Google or Facebook; these businesses see an opportunity in African nations, and consumers rely on them to utilize the technology to the devices optimal level (Chakravorti, & Chaturvedi, 2019; McKay & Steinhauser, 2018). According to Internet World Stats (2018), Africa comprises10% of internet users worldwide. The availability of affordable internet access could help the rural African regions gain access to information that can assist technology-aided tools for business, such as intelligent farming where crops are monitored, and predictions of the farmer's crops are made in real-time, thus helping tackle the extreme poverty levels (McKay. & Steinhauser, 2018). Access to the Internet would also provide the full benefit of the disruptive technology that allows social connections around the globe to access and enjoy things such as streaming movies, educational classes, and even listening to music on the go, something familiar in our society today.

1.1 Background

Sub-Saharan Africa is home to 1.1 billion people; the United Nations estimates this number will rise to 1.8 billion by 2050 (Statista, 2019; World Bank, 2019). Sub-Saharan Africa is considered the poorest nation, ranking 27th out of 28th most impoverished countries in the world (World Economic Forum, 2019; World Bank, 2019). The numbers of people in extreme poverty in Sub-Saharan Africa are alarming. According to the latest data from World Bank, the number of people in poverty rose from 278 million in 1990 to 413 million in 2015 (World Bank, 2019). On average, extreme global poverty fell a percentage point per year from 1990 to 2015; however, based on World Bank's 2030 promising research, poverty in Sub-Saharan Africa will remain double-digit (Bicaba, Brixiová, & Ncube, 2017).

Visionary political leadership is essential to transforming Sub-Saharan Africa into the 21st century. Transparency International (2018) ranked Sub-Saharan Africa at 32 out of 100 (Figure 1) of the most corrupt countries in the world based on the Corruption Perception Index (CPI). The CPI utilizes a scale of 0 to 100, with 0 being the most corrupt country and 100 being the cleanest country; there is strong evidence that countries with autocratic leadership characteristics don't score higher than 50 points. Political corruption is a challenge in Sub-Saharan Africa, with leadership still set in non-democratic government leadership (Transparency International, 2018).

Figure 1. *Sub-Saharan Africa CPI Score*
Source: Transparency International (2018)

Only 16% of the 1.1 billion people with a formal wage work; it's estimated that by 2050 there will be 789 million laborers in Sub-Saharan Africa (International Labor Force Office, 2017; World Bank, 2019). An abundant amount of exploited resources can be effectively utilized by entrepreneurial companies that can benefit from investing in the Sub-Saharan African markets and work to improve the local's standard of living. There is evidence that Sub-Saharan Africa has the potential to continue leapfrogging into the 21st century with areas that are untapped for progress in all aspects of life. Sub-Saharan Africa, previously referenced as a poverty-stricken region, is now acting as a focus group and testing ground for leapfrogging innovative technologies that are making headway with startups, multinational businesses, and educators all jumping on board to capitalize on the potential market.

II. Review of Literature

The BOP markets in Sub-Saharan Africa and many emerging economies share similar challenges, such as poverty, poor infrastructure, illiteracy, and government corruption (Addison et al., 2017; Arora, 2016). Technological breakthroughs are primarily needed in emerging markets to alleviate poverty and simplify the locals' lives (West, 2015). Examples of the technological breakthroughs, also termed disruptive innovation, including online Shopping with Amazon as the leading industry, Uber disrupting the taxi transportation industry, iPhone taking over the majority of market share and pushing Blackberry, Nokia, and Motorola on a downward trend (Cusumano, Yoffie, & Gawer, 2020). In addition, Tesla has sustainable automotive choices that force others like Volkswagen, Ford, Chrysler, and Chevy to change their ways and roll out sustainable cars (Nieuwenhuis, 2018). These examples of modern-day disruptions would be essential in Sub-Saharan Africa to provide sources of employment, such as driving for Uber.

Sub-Saharan Africa, associated initially with natural resources such as minerals, gas, and oil, is now an attraction for technological companies, retailers, and others eager to capitalize on the high population to drive the growth of their market shares (Sackeyfio, 2018). Despite the challenges that might face technological companies in emerging economies, they chose to be the first movers to

capture market opportunities and help the locals solve many of their problems (Bartlett & Ghoshal, 2015). In the next section, we will concentrate on local consumers' benefits and challenges.

2.1 Smart Device: Mobile Disruption in Sub-Saharan Africa

Disruptive mobile devices contribute to breaking down the digital divide and enhancing global communication (Bryen & Moolman, 2015; Dolan, 2016). Nations worldwide, such as North American consumers, cancel their home phones to eliminate extraneous bills since smartphones are more convenient and can take the place of a home phone due to unlimited and long-distance calling plans (Baron, 2020; Masinde, 2019). In comparison, the rural areas in emerging and third-world nations in Africa do not have the option of having a home phone due to a lack of phone line infrastructure (Nandi et al., 2016).

Although the significant innovations mentioned above, there lie challenges around the globe regarding the lack of affordable internet connection in Sub-Saharan African homes because the broadband connections are confined to urban areas, and the use of the available prepaid plans isn't reasonable for the rural residents (Mothobi & Grzybowski, 2017; Wasserman, 2018). Another challenge is the type of devices open to African residents. The affordable older technology usually does not include intelligent machines that can connect to the Internet (the older generation doesn't mind this option). More importantly, the smart devices desired by working adults and youth are costly for most residents to afford (Prasad & Samikannu, 2018; Porter et al., 2015).

Hypothesis 1: There will be a positive relationship between smart devices and network reliability
Hypothesis 2: There will be a positive relationship between smart devices and online teaching
Hypothesis 3: There will be a positive relationship between smart devices and online grade book
Hypothesis 4: There will be no positive relationship between smart devices and virtual collaboration
Hypothesis 5: There will be no positive relationship between smart devices and self-directed learning

2.2 Network Reliability: Disruptive Innovation and Academia

African nations still lag in adopting technology in their classrooms, especially in remote villages. At the same time, developed countries such as North America, Europe, and Australia, among others, are in the postmature stage of integrating technology in their academic institutions, where advanced technologies help facilitate teaching and learning and include an avenue to interact with the student population (Atherton et al., 2017; Mallya, & Lakshminarayanan, 2017). Africa is not keeping pace and is faced with multiple challenges, especially concerning distance learning. (Mukuni, 2019). Technological advancements are yet to disrupt African nations on a scale we experience in North America. Still, other African countries, such as South Africa, have adopted some technologies in their academic institutions (Rambe & Moeti, 2017). For instance, in South Africa, the introduction of learning platforms for student collaboration, integration of media in the classrooms, and the use of Dropbox, among others, were found to be difficult for faculty members that had never used any form of technology in their years of teaching (Ciampa, 2017; Mbatha, 2015).

Another innovative disruption is the use of E-textbooks. Students in developed nations such as North America prefer the use of e-books to hardcopy due to easy access and the convenience of accessing the book at their fingertips at any moment in time (D'Ambra, Wilson, & Akter, 2019; Stevenson & Michaud, 2018). However, this doesn't apply to South African students introduced to foreign innovation, thus contributing to distaste for using E-books due to their perceived value and usability expectation (Gelderblom, Matthee, Hattingh, & Weilbach, 2019). These disruptive learning innovations are at their infancy stages in most rural areas of Africa and require training for students and faculty to bring them to speed on the learning platforms (Fisher, Bushko, & White, 2017; Kaliisa & Picard, 2017).
Hypothesis 6: There will be a positive relationship between network reliability and online teaching

Hypothesis 7: There will be a positive relationship between network reliability and online grade book

Hypothesis 8: There will be a negative relationship between network reliability and virtual collaboration

Hypothesis 9: There will be a negative relationship between network reliability and self-directed learning.

III. Research Methods

3.1 Sample

A quantitative approach utilizing SPSS software allowed for this research analysis using a sample of 427 residents within Nairobi, Nakuru, Kisii, Keroka, and Manga regions within Kenya - Sub-Saharan Africa. The use of stratified sampling was utilized to select the local population and to reach greater precision. A total of 500 questionnaires were circulated, and 427 were returned, giving us a response rate of 85%. This research was conducted between March 2019 and February 2020. The population in the study was carefully selected to help understand the effect of technological disruption challenges in academic institutions. The questionnaire contained a statement explaining the purpose of the research and our commitment to the participant's confidentiality. The questionnaire was printed in English, and the language barrier was considered for the residents who don't speak or read English. Rigorous back-translation was conducted from English to Swahili and the local native language Ekegusii. These translations were necessary to accommodate the residents. The 427 responses are 102 from Nairobi, 100 from Nakuru, 95 from Kisii, 70 from Keroka, and 60 from Manga, all located in Kenya in Sub-Saharan Africa. These locations were considered to facilitate our data distribution and capture challenges faced by urban and rural populations and the challenges associated with disruptive innovation in their daily lives and academia.

3.2 Instrument

The demographic questionnaire collected participants' age, gender, and education. The disruptive innovation questionnaire contained 20 items related to the academic utilization of E-learning. The questionnaire consisted of challenges faced by consumers and their interaction with disruptive technology on existing literature with declarations based on a Likert five-point scale starting from 1 = strongly agree to 5 = strongly disagree). The research instrument was validated by a panel of 13 experts involved with academia and consumer electronics in Kenya. These questions were modified with the recommendations provided by the experts and tested on a sample of (n = 40) participants in Nairobi, Kenya.

IV. Discussion

4.1 Results

The 427 total participants in the study were categorized as 138 (32.3%) male participants and 289 (67.7%) female participants with descriptive as shown in Table 1

Table 1. Sample Characteristics

		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Male	138	32.3	32.3	32.3
	Female	289	67.7	67.7	100
Age	18-29	283	66.3	66.3	66.3
	30-39	64	15	15	81.3
	40-49	30	7	7	88.3
	50-59	35	8.2	8.2	96.5

	60-above	15	3.5	3.5	100
Resident	Student	271	63.5	63.5	63.5
	Faculty	71	16.6	16.6	80.1
	Retired	10	2.3	2.3	82.4
	Non-working	75	17.6	17.6	100
	Total	427	100	100	

a. Correlation

A Pearson correlation of the study variables was conducted to examine a relationship between ownership of smart devices, network reliability, online teaching, online grading, virtual collaboration, and self-directed learning.

The correlations in Table 2 satisfy Hypothesis 1, 2, and 3 and confirm that there is a positive relationship smart device and network reliability (r (425) = .42, $p<0.01$), smart devices and online teaching (r (425) = .18, $p<0.01$), smart device and online gradebook (r (425) = .18, $p<0.01$). To satisfy Hypothesis 4 and 5; the results confirmed that there was significant relationship between smart device and virtual collaboration (r (425) = 1.0, $p<0.01$) and smart device and self-directed learning (r (425) = 1.0, $p<0.01$). To satisfy Hypothesis 6 and Hypothesis 7; table 2 shows that there's a significant relationship between network reliability and online teaching (r (425) = .24, $p<0.01$) and network reliability and online gradebook (r (425) = .24, $p<0.01$). For Hypothesis 8 and Hypothesis 9; table 2 shows that there is significant negative relationship between network reliability and virtual collaboration r (425) = -.36, $p<0.01$) and self-directed learning r (425) = -.36, $p<0.01$).

Table 2. Means, standard deviations, and correlations of variables (N 427)

	Variable	Mean	SD	1	2	3	4	5	6
1	Smart Device	4	1.566	1					
2	Network Reliability	3.96	0.937	.419**	1				
3	Online Teaching	3.1	0.757	.180**	.241**	1			
4	Online Gradebook	3.1	0.757	.180**	.241**	1.000**	1		
5	Virtual Collaboration	3.96	0.848	0.009	-.363**	-.148**	-.148**	1	
6	Self -Directed Learning	3.96	0.848	0.009	-.363**	-.148**	-.148**	1.000**	1

b. Regression Analysis

To further understand the relationships of our variables, we conducted multiple regression analyses to capture the challenges faced by Sub-Saharan Africa with the disruption of technology. Table 3 shows the results of our regression. About Hypothesis 1 to 5, we tested each predictor at alpha=.05 the online grade book had a sig. ($p<.000$) while self-directed learning had no significance ($p=.453$). The two predictors that were excluded include virtual collaboration and online teaching. Secondly, for Hypothesis 6 to 9, the predictors online grading sig ($p<.000$) and self-directed learning at ($p<000$)) and removal of variables online teaching and virtual collaboration.

Table 3. Regression Results of the Study Variables

Predictors	β	p-value
Smart Device		
Online grade book	0.19	0.000***
Self-Directed learning	0.04	0.453
Network Reliability		
Online grade book	0.19	0.000***
Self-Directed learning	-0.33	0.000***

Note: Significant at: *p<0.05 and ** p<0.01

Table 4. Summary of Research Findings

Hypothesis	Findings
Hypothesis 1: There will be a positive relationship between smart devices and network reliability	Supported
Hypothesis 2: There will be a positive relationship between smart devices and online teaching	Supported
Hypothesis 3: There will be a positive relationship between smart devices and online grade book	Supported
Hypothesis 4: There will be no positive relationship between smart devices and virtual collaboration	Supported
Hypothesis 5: There will be no positive relationship between smart devices and self-directed learning	Partially Supported
Hypothesis 6: There will be a positive relationship between network reliability and online teaching	Partially Supported
Hypothesis 7: There will be a positive relationship between network reliability and online grade book	Supported
Hypothesis 8: There will be a negative relationship between network reliability and virtual collaboration	Partially Supported

Hypothesis 9: There will be a negative relationship between network reliability

4.2 Discussion

This study aimed to examine the challenges among consumers in Sub-Saharan Africa with a specific focus on Kenya. As hypothesized and displayed in Table 4, there was a positive relationship between smart devices and network reliability, online teaching, online grade book, and virtual learning. Our research, with its supported findings, also supports existing research where having access to smart devices and reliable networks are common challenges among African nations that also include a lack of affordable internet-capable smart devices and dedicated infrastructure (Bankole & Assefa, 2017; Kaliisa & Picard, 2017; Motala & Padayachee, 2018). The results show that network reliability is the most challenging, especially for the higher education institutions that are moving forward with adopting mobile learning; we tend to argue that mobile learning is accessible, but this isn't accurate when there is a lack of accessibility to smart devices and a reliable network that doesn't face constant interruptions.

Our research findings were partially supported regarding network reliability and variables such as self-directed learning, online teaching, and virtual collaboration. Existing research confirms that self-directed learning can be poorly supported with podcasts, wiki sites, other forms of blogs, and sources that aren't considered credible (Quinn, 2018; Sun, Rosson, & Carroll, 2019). On the other hand, network reliability positively correlated with completing the online grade book and self-directed learning. When students and faculty have a reliable network, they can engage in professional education and thus be successful in mastering the course content. Research shows that when teachers integrate learning objectives into professionally developed content that includes interactive videos, the student's mastery of the content via self-directed learning produces substantial results (Bakhshi, 2019; Smithwick et al., 2018). According to Oluwatobi et al. (2015) and Porter et al. (2016), disruptive technologies have brought many advantages, from the ease of communication research and online libraries. Still, the challenges faced by participants in Sus-Saharan Africa are evident. They need an intervention that includes access to a reliable network and affordable smart devices if the residents and academic institutions benefit from the disruptive technology.

Implications

There are several implications for academic institutions, network development teams, and local government based on the results of our study. Our results confirm Sub-Saharan African residents' challenges regarding technological disruptions and academic institutions. Our results demonstrate that smart devices are necessary to access technological advances that benefit educational institutions from online teaching, grade book, collaboration, and self-directed learning. The government needs to partner with network development teams to enhance the network via infrastructure construction and-subsiding costs for internet-accessible smart devices for students and teachers in academic institutions. To develop an effective network that supports educational institutions without disruptions by power outages, the government and network development teams should go beyond supporting single sectors and work to create more extensive magnitude networks that can handle the growing demand for online learning.

Research has shown the increasing cost of having a reliable network that can support the demand within Sub-Saharan Africa, and the evaluation of the financial status would be essential in determining the effective way to provide the needed network connection (Evans, 2018; Lee & Callaway, 2018). Despite the challenges faced by Sub-Saharan Africans in accessing the increased demand for online learning, Kenya is faced with a lack of a reliable network and would require full efforts to ensure that a strong network is available for academic institutions (Dlamini & Snyman, 2017; Gledhill et al., 2017; Kaliisa & Picard, 2017). If a company intends to invest in Kenya, it should be aware of the lack of a reliable network, and its efforts should address the inadequate infrastructure. It would be logical for the government and network development teams to map a plan to design a strong network that can support academia and the general public.

V. Conclusion

This research study examined disruptive technology and its challenge to consumers in Sub-Saharan Africa. Disruptive innovation in African nations and as we emphasize that disruptive innovation isn't a negative connotation. In Africa, the word disruptive means something is harmful, thus causing it to be disorderly. However, when speaking in technical terms, disruptive innovation is needed. Knowledge is power and can elevate one from poverty. The World Bank reports that 90% of children from Sub-Saharan Africa lack essential reading and math skills, but with digitization, students across the globe will have access to online education, which increases their chances of better opportunities (World Bank, 2018; Meltzer, 2015). The conclusion of our research supports the goal of lessening the digital divide and allowing for innovative companies such as Facebook, Amazon, eBay, and Google, among others, to capitalize on the global consumer market with 2.3 billion internet users

that are projected to grow to over 4 billion by 2020 (Meltzer, 2015). With its flow of information and data, the Internet has allowed for innovative ventures and provided industries with opportunities to reach consumers in emerging markets, manage their operations and global supply chain and interact with consumers in real time while effectively reducing transaction costs (Meltzer, 2015). The internet infrastructure is the heart of successful ventures, and it's essential to penetrate the global market. Many challenges face technological companies that try to penetrate emerging markets especially gaining access and permission from the local government and gaining the local's trust.

Limitations and Further Research Opportunities

This research represented an investigation of disruptive technology and the challenges faced by consumers in Sub-Saharan Africa. While our findings discuss fundamental challenges regarding network reliability and access to smart devices to utilize within academia, there are other limitations that we should mention. Our research generalized the results, and the limited sample may not represent the entire academic sector in Sub-Saharan Africa, specifically in Kenya. Thus, the findings can't be applied to educational institutions not part of this research study. Moreover, a more extensive regional and geographic research sampling that includes other locales in Sub-Saharan Africa would provide insight into the technological challenges participants face in academia. Future research should partake in collecting data from different sectors and including larger sample sizes to validate the finding of our study. Besides, the instrument used to test our study are subject to robust validity and reliability. Thus, our research did add important implications to be considered by the government, network development teams, and academic institutions.

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