Digital Technology and Economic Development: The Case of the Regional Economy of Gauteng Province, South Africa

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New technology and access to the internet has become a basic need in nearly all households across the world. Furthermore, the Covid-19 pandemic has heightened the necessity of having access to technology as it continues to innovate and change the economic and social landscape. Having access to mobile technology has been identified as a key component in not only improving the lives of people but also aiding in the fight against poverty in especially developing countries. However, as poverty is worsened by people's limited access to healthcare, education, market access and general isolation, not having access to mobile technology is only likely to worsen their exclusion from economic activity. As the multidimensionality of poverty is extensively researched, access to internet and mobile technology as a basic human need requires new ways of exploring and understanding this economic deprivation. Hence this study aims to investigate the relationship between poverty, access to mobile technology, unemployment and inequality using a quantitative research approach. The study region is the Gauteng province in South Africa. As research on this topic is limited, especially in developing countries, the findings of this study is unique and important in providing a deeper understanding of the complexity of poverty and how new technology can both create and limit economic development.

Keywords: local economic development, digital technology, poverty, mobile access, regional development

INTRODUCTION

The rapid development of new technology and innovative systems has taken centre stage in economies worldwide. The global Covid-19 pandemic has caused a major shift in the use of digital technologies, altering how people work, learn, communicate, and undertake daily activities (UN, 2023:3). García-Escribano (2020) writes that as the pandemic has led to a mass migration towards the use of digital technology, the importance thereof in promoting socioeconomic inclusion has also been highlighted. However, in saying this, it has also brought about negative effects such as environmental degradation, criminal acts, and malpractice. According to the UN (2021:1), Covid-19 has accentuated how unprepared developing countries are in adopting to a digital world.

Numerous service providers in for instance banking, health care, retail and housing have moved their operations towards a focus on online and internet in fulfilling consumer needs (Anrijs et al., 2023:1). New technology and specifically mobile phones have enabled the delivery of services across numerous economic

and physical barriers that would have normally restricted the reach of economic activity (Haider, 2018:3; Lyons et al., 2020:2). The problem is that many of these services are part of the basic needs required by individuals in societies and thus people who are unable to use or access these technologies run the risk of being excluded (Schou & Pors, 2019:466). As poverty and inequality is driven by people excluded from society, it is important to understand the role of digital technology in ensuring an inclusive and sustainable economy. However, research empirically investigating mobile technology and its link with poverty, unemployment and inequality is particularly scarce. It is for this reason that this study aims to empirically examine the relationship between mobile technology, poverty, unemployment and inequality.

LITERATURE REVIEW

The digital economy, consisting of digital technology, is quite arguably one of the most significant drivers of economic innovation and growth globally (Roessler, 2018:1). The UN (2023:11) writes that people's well-being depend on the availability of digital technology, but that the potential thereof can only be optimised when it is shared throughout the community. In addition, the use of digital technology has an important role to play in sustainability, as it forms part of Goal 9 of the Sustainable Development Goals (SDG's). Target 9.c as part of SDG 9 has the aim of "significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet…" (UN, 2021:17). Regarding technology and its importance in economies, one need only to look at economies such as Hong Kong, China, Singapore and South Korea to see the significant role the adaptation of new technology played in their developmental and production stages (Adeleye &· Eboagu, 2019:32).

In this new age of technologically driven economies, Marler (2018:3498) states that the use of smartphones or mobile technology is more prevalent than that of computers. Aker and Mbiti (2010:207) write that mobile phones allow not only individuals to connect to each other, but also connects to services, markets and information. Adding to this, the use of mobile technology allows for the use of global positioning systems, banking, email, internet and networking to name but a few (Aker & Mbiti, 2010:210; Roessler, 2018:4). The range of economic benefits resulting from mobile technology include increased access to information, improved markets, increased household consumption, improved health, more efficient labour allocation, increased productivity and improved education (Roessler, 2018:5; Lee et al. 2021:40). Across all spheres of the economy, mobile technology has significantly impacted societies, but perhaps the most significant change has been in the sectors of education, agriculture, health and finance. The use of mobile technology in education has enabled the sharing of information and reading material in an easily available and affordable manner (UNESCO, 2014:1). Moreover, Roessler (2018:22) writes that education has been seen to increase the demand for digital inclusion as it educates people regarding the benefits of new technology and enhances their capabilities in order to use these technologies. As many households have access to mobile technology, it is one of more effective ways of increasing literacy rates (Kerstein, 2015). This is because although it cannot teach people how to read, they do increase literacy retention rates. Kerstein (2015) uses an example of a program used in Uganda that aids parents in completing daily reading activities, where the program uses audio messaging to allow illiterate adults to still participate in improving their children's literacy.

Regarding mobile technology's impact on the agricultural industry, Aker and Mbiti (2010:223) writes that farmer's access to market information has been drastically improved and made more efficient. Farmers are now not required to travel extreme distances to gain information and liaise with markets as they are now able to access price and general information quickly with the use of mobile technology (UN, 2021:9). According to the FAO (2017), mobile technology also allows farmers to immediately notify each other of any challenges such as diseases. Looking at how mobile technology has affected the health industry, Kerstein (2015) writes that fieldworkers are able to ascertain, with the use of mobile devices, what the best course of treatment is and whether certain conditions can be treated on hand or requires the patients to go to hospital. During the Covid-19 pandemic, various communications networks waived their fees to allow for free access to health information (UN, 2021:9). In addition, mobile technology is being used in some instances to remind people of taking their medication (Wargny et al., 2018:144). The use of mobile

technology has quickly become one of the main instruments used in conducting financial activities across the world. Roessler (2018:4) surmise that with the use of mobile technology individuals are now able to transfer, withdraw, deposit and pay for services and products. This is often times refereed to as mobile money. In numerous African countries mobile money has revolutionised financial services as it enables small businesses and consumers to transact more cost effectively, easier and safer (Robb, 2015). As a result of measures implemented to promote the use of digital payments during the Covid-19 pandemic, mobile money transactions in Rwanda increased by 85 per cent (UN, 2021:9). The use of mobile banking could also slowly integrate the informal economy into the formal economy and increase financial inclusion.

A study by Vu (2011) found that digital technology could be a strong predictor for economic growth. Similarly, research by Jorgenson and Vu (2021) established that digital technology is a contributor to economic growth in developed and developing countries. Examining 54 African countries, Adeleye and Eboagu (2019) found a positive and statistically significant relationship between digital technology and economic growth. In contrast, a study by Ejemeyovwi and Osabuohien (2020) found a statistically insignificant effect between mobile access and inclusive growth in West Africa. Even more noteworthy is that mobile technology could play a key role in combatting poverty (Kerstein, 2015). Research by Kelikume (2020) found that mobile access has a positive and significant effect on poverty reduction. The author also established a significant and positive relationship with the informal sector, and theory suggest that the informal sector plays a key role in minimising poverty and creating employment opportunities. The significant and positive relationship between poverty and mobile access has also been established in studies by Waema and Miroro (2014) as well as Mbuyisa and Leonard (2017).

Despite the apparent positive effects of digital technology such as mobile access in promoting economic growth and development, it could in some instances be regarded as a double-edged sword. This is because digital technology and mobile access (or a lack thereof) can lead to social exclusion, increased inequality and poverty. Roessler (2018:15) warns that rural communities often have poor infrastructure which could limit their access to this technology. The author also writes that although mobile technology has greatly reduced operating costs, the cost of mobile technology and the internet varies greatly between regions, which could fuel digital inequality. In a similar way, a study by Pearce and Rice (2013) suggests the idea of a "device divide", as marginalised groups are more likely to depend on mobile technology for internet access as they normally do not have access to computers. The author Marler (2018) writes that inequality could be increased as a result of mobile technology. This view is supported by the research of Donner et al. (2011) and Gonzales (2017). Another study point towards the potential challenge of mobile technology in high income countries, where structural inequalities might constrain marginalised groups, making mobile access difficult for these groups (Faith, 2018). García-Escribano (2020) states that marginalised groups in especially rural areas often have limited internet access, therefor inequality within regions might be increased. In addition to the likelihood of increased inequality within regions due to a lack of internet access, García-Escribano (2020) explains that inequality might also increase between regions, as low levels of internet access could lower productivity in developing countries.

Employment opportunities is another factor that could be influenced by access to mobile technology. Marler (2018:3503) writes that having access to mobile technology is beneficial in the findings of employment opportunities and in the initial phase of contacting potential employers. However, the challenge might come from applying for a job opportunity that requires an online resume or application, which might make it considerably difficult for individuals without access to mobile technology. As Donner et al. (2011:574) explain, individuals applying for work are in most instances nowadays required to submit an online application, communicate the acceptance, time of interviews and follow ups. From reviewing these studies, it becomes apparent that the majority of studies researching digital technology and mobile technology as it relates to poverty and inequality has been from an accessibility and range of coverage point of view. Very few studies have explicitly investigated the potential relationship between mobile technology, poverty, inequality and unemployment. Even less studies have focussed on this relationship from a regional perspective. Understanding the links between these variables is imperative, seeing that the role of digital technology and the internet within economies are only intensifying. In a country such as South Africa with 30 per cent of its population living in extreme poverty (World Data Lab, 2023), an unemployment rate of

32.9 per cent (Trading Economics, 2023) and ranking a mere 69th out of 82 countries in terms of its access to technology (WEF, 2020), understanding how these variables are interrelated are imperative in pursuing sustainable and inclusive economic development. Furthermore, gaining a better understanding of how these variables are interconnected within regional economies could aid policymakers in designing and implementing policies that ensure inclusive and sustainable development.

METHODOLOGY

In order to achieve the main objective of this study, which is to investigate the relationship between poverty, access to mobile technology, unemployment and inequality, this study follows a quantitative research approach. The study region is the Gauteng province in South Africa, also known as the economic hub of the country. Data ranging from 1993 to 2022 were obtained from Quantec. After coding the data using Excel, Eviews were used to analyse the data. The variables used are poverty, inequality (measured by the Gini coefficient), unemployment and mobile technology (measured by mobile access). The tests included the use of unit roots for stationarity, correlation, pairwise Granger Causality and Ordinary Least Squares (OLS). The basic OLS equation model as defined by Wooldridge (2013:28) is:

$$\hat{y} = \hat{B}_0 + \hat{B}_1 x_1 + \varepsilon \tag{1}$$

where:
- $\hat{y}$ is the dependent variable
- $\hat{B}_0$ is the intercept
- $\hat{B}_1 x_1$, …, bn are the coefficients of the independent variables x1, x2, …, xn
- ε is the error term

RESULTS AND DISCUSSION

The following section presents the results from the quantitative analysis. The first step was to ensure that all variables were stationary and integrated in same order I(1). Unit root tests were used to establish this. The next step was to conduct a correlation analysis. The correlation analysis aids in explaining the relationship between variables. According to Hassan (2023) a correlation analysis determines the direction and strength of the relationship between variables.

TABLE 1
CORRELATION ANALYSIS

	Poverty	Gini	Mobile access	Unemployment
Poverty	1	-	-	-
Gini	0.3780	1	-	-
Mobile access	0.9861	0.4235	1	-
Unemployment	0.9991	0.3586	0.9892	1

Correlation coefficients ranges from a value of -1 to + 1, with -1 representing a perfect negative relationship and +1 signifies a perfect positive relationship and 0 would signal no relationship (Hassan, 2023). As can be seen from Table 1, all of the variables have a positive relationship. Most significantly, poverty and mobile access have a very strong positive relationship, as does poverty and unemployment. In addition, mobile access and unemployment also indicates a very strong and positive relationship.

TABLE 2
GRANGER CAUSALITY TEST

Null Hypothesis:	F-Statistic	Prob.
GINI does not Granger Cause POVERTY	12.9556	0.0002*
POVERTY does not Granger Cause GINI	2.78369	0.0827
MOBILE_ACCESS does not Granger Cause POVERTY	12.8004	0.0002*
POVERTY does not Granger Cause MOBILE_ACCESS	2.95235	0.0722
UNEMPLOYMENT does not Granger Cause POVERTY	17.9636	2.E-05*
POVERTY does not Granger Cause UNEMPLOYMENT	10.1045	0.0007*
MOBILE_ACCESS does not Granger Cause GINI	2.72966	0.0864
GINI does not Granger Cause MOBILE_ACCESS	4.46987	0.0229*
UNEMPLOYMENT does not Granger Cause GINI	1.66027	0.2121
GINI does not Granger Cause UNEMPLOYMENT	20.0089	9.E-06*
UNEMPLOYMENT does not Granger Cause MOBILE_ACCESS	2.89262	0.0758
MOBILE_ACCESS does not Granger Cause UNEMPLOYMENT	7.97933	0.0023*

*Significant at the 5% level

Table 2 presents the results from the pairwise Granger Causality test. Looking at the results, there is a unidirectional causality between inequality and poverty at the 5%. Suggesting that inequality causes poverty. There is also evidence of causality running from mobile access to poverty at a 5% significance level. In practice this means that a lack of mobile access could indeed lead to higher levels of poverty. Regarding poverty and unemployment, there is a bidirectional causality between the two variables, which means poverty causes unemployment and vice versa. Furthermore, there is causality at the 5% significance levels, running from inequality to mobile access, suggesting that inequality could lead to increased digital exclusion. Interestingly, there is no significant causality from unemployment to inequality, but there is causality from inequality to unemployment at the 5% significance levels. There is a unidirectional causality running from mobile access to unemployment, suggesting that having a lack of access to mobile technology could lead to higher unemployment.

TABLE 3
OLS REGRESSION RESULTS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Poverty	28009699	525197.7	53.33172	0.0000
GINI	-7046850.	1229819.	-5.729990	0.0000
MOBILE_ACCESS	-0.457833	0.114299	-4.005583	0.0005
UNEMPLOYMENT	3.643939	0.074078	49.19026	0.0000

Regarding the results from the OLS regression in Table 3, all of the variables recorded ststaistically significant results. Inequality (Gini) and Poverty have a significant, negative relationship, which is interesting considering it is generally assumed that as poverty increases it is likely that inequality will also increase. This result is therefore in contrast to other studies and further investigation is necessary. Looking at the impact of mobile technology, there is a negative but significant coefficient between mobile access and poverty. The coefficient value of -0.4578 suggest that if mobile access increases by 1 unit then poverty decreases by 0.4578 units. This result is supportive of that of Kelikume (2020) who analysed a panel data set of 42 African countries from 1995 to 2017 and found that an increase in mobile technology and internet

access leads to a reduction in poverty. This is also in line with Marler (2018) who states that mobile technology may contribute to the upliftment of marginalised populations. A study by Roessler (2018) supports this finding as well, as the study explains that poor individuals are less likely to have access to their own mobile technology. Examining the association between digital exclusion and socio-economic conditions in a region in Belgium, Anrijs *et al*. (2023) found that marginalised groups were three to five times more at risk of being excluded than those not in the same conditions. Studies further supporting the evidence of mobile technology's potential in reducing poverty and advancing economic development is that of May and Diga (2015) and Mbuyisa and Leonard (2017). Unemployment and poverty recorded a significant and positive coefficient. The results show that in the study area, if unemployment increases by 1 unit, it will lead to a 3.6439 unit increase in poverty. This result is supported by research of Hoynes (2007) who found that in America, one percentage point increase in unemployment will lead to an increase of between 0.4 to 0.7 percentage points in poverty. Investigating the Niger state in Nigeria, Muhammad and David (2019) found the presence of a significant relationship between poverty and unemployment. The result is also in support of Adelowokan (2019) who found significant and positive links between poverty and unemployment at the conventional level.

CONCLUSION

As the pandemic has increased the global demand for digital technology and online services, this study had study aims to investigate the relationship between poverty, access to mobile technology, unemployment. Results from the quantitative analysis shows the integrate relationships between poverty, inequality, unemployment and the important role that mobile technology plays within the development of regional economies. Most notably was the significant impact of mobile technology on poverty. Results show that access to mobile technology could be used in decreasing poverty, and that a lack thereof could have adverse effects. Mobile technology has brought new possibilities to regional economies and the significant role it occupies in economic development deserves more attention. The significant causality between mobile technology, poverty and unemployment highlights the need for improved digital access and communications infrastructure in the region, in an effort to combat exclusion and inequality. Local governments should therefore look at policies and initiatives that aim at promoting infrastructure, digital inclusion and more affordable mobile and internet devices.

This study has its limitations, which paves the way for future studies. As the availability of data increases, more advanced and precise analysis on the topic is required in order to gain a better understanding of how mobile technology and the internet can be a driver and solution to poverty in South Africa.

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