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A qualitative assessment of the role of mobile phone technology in enhancing motorcycle taxi services in Dar es Salaam, Tanzania

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ABSTRACT

Motorcycle taxis (MCT) have become a popular means of mobility in Sub-Saharan Africa. Information and communication technologies (ICT) have facilitated the revolution of these services. This study assesses the role of technology in the revolution of motorcycle taxis (MCT) services in Dar es Salaam, Tanzania. The study was a qualitative case study with data collected from 35 research participants. This study found that mobile phone technology is increasingly used by MCT drivers and customers to facilitate the provision and consumption of services. The technology has revolutionized the services. Even though smartphones have spread well in the country, analog phones are equally valued as they enable customers and drivers to keep in touch through phone calls and short messages. Despite the significance of the technology, various challenges were observed, including poor digital skills and increasing road accidents.

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Motorcycle taxis; mobile phone technology; innovation; transport

Introduction

The shortage of urban transport supply is a challenge facing several countries in Sub-Saharan Africa (Sietchiping, Permezel, and Ngomsa 2012). The importance of infrastructure in development cannot be overemphasized. Calderón and Servén (2010) discussed infrastructure as one of the key ingredients to economic development in sub-Saharan Africa. The results of a study by Owusu-Manu et al. (2019) on the impact of infrastructure on economic growth have proven and emphasized the need for continuous investments in the sector. Motorcycle taxis (MCT) are widely used in urban and rural transport in Tanzania (Hussein, Mpeti, and Mkoba 2022; Luvunga 2021). In Tanzania, most people use MCT for personal transport and parcel delivery, the reasons for the preference for this mode of transportation include unreliable urban public transport, traffic congestion and rapid urban population growth (Msigwa 2013; Nyaki, Bwire, and Mushule 2020), and its affordability (Luvunga 2021). The MCT sector has experienced rapid growth in

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recent decades in Tanzania and apart from being a quick and affordable solution to mobility, it is a source of employment for many youths (Luvinga 2021; Mbegu and Mjema 2019).

In Tanzania, MCTs are popularly known as *boda boda* (S Kisaalita and Sentongo-Kibalama 2007). The name *boda boda* has spread across East Africa, which mainly refers to the motorized for-profit MCT. The number of motorcycles in Tanzania sharply increased in the 2000s. According to WHO, there were 1.28 million registered motorcycles and three-wheelers in Tanzania by 2016 (WHO 2018). In the same timeline, Tanzania experienced a booming diffusion of modern technologies. Information and communication technology (ICT) significantly contributes to improvements in economic development globally (Aker and Mbiti 2010; Dedrick, Gurbaxani, and Kraemer 2003).

In relation to MCT in Tanzania, mobile phone technology has rapidly improved the services. Specific to Dar es Salaam, MCTs are a means of transport and a source of employment for drivers; at the same time, the owners, who are often not drivers, get an income to run their lives. Informal arrangements in the sub-sector are unregulated and they have increased the number of motorcycles. In Dar es Salaam MCTs are randomly organized, with a few of them registered to park and wait for customers in designated areas. Land Transport Regulatory Authority (LATRA), a government agency, has a mandate to ensure the affordability, safety and quality of public transport services to all consumers, including the low-income, rural dwellers and the disadvantaged (LATRA 2022). With so many motorcycles mobile phones have been instrumental for this transport service's drivers and customers. While customers use mobile phones to access MCT, the drivers use their mobile phones to receive new customers and retain old ones (Auko 2016; Divall et al. 2021; Fidelis Kisusi 2018). In Tanzania, mobile phone technologies used by MCT operators and passengers include various mobile networks, smartphone functionalities and other associated digital services. The smartphone technologies and applications used are ride-hailing services like Uber and Bolt. Communications apps, such as WhatsApp and Telegram, are also commonly used. Studies have concluded that the spread of mobile phone technology in Tanzania has been associated with a positive transformation of the rural and urban development sectors (Sife, Kiondo, and Lyimo-Macha 2010). Although the role of ICT in development has been significantly researched, there are limited scientific studies on the role of mobile phone technology on MCT. Kisusi (2018) and Divall et al. (2021) touched on the subject; however, a focused and thorough study of Dar es Salaam is missing. Given the fact that Dar es Salaam, the business city of Tanzania is projected to become a megacity by 2030 (Hill et al. 2014) there is a need to study the role of mobile phone technology in the MCT sector in the city. This study contributes to filling this research gap and will support the urban planning of this upcoming megacity.

The objective of this study is to explore the role of mobile phone technology in enhancing the motorcycle taxi service. This study was conducted in Dar es Salaam, using semi-structured interviews targeting MCT drivers and customers. Specifically, this study analyzes the practices, successes and challenges in using information and communication technology in mobile phone devices to navigate the motorcycle taxi service for customers and as an income-generating business to drivers. It proposes recommendations based on the findings. The paper is divided into five sections:

Introduction; Literature Review and Theoretical Framework; Materials and Methods; Results; Discussion and Conclusion.

Literature review

Informal public transport is dominant in Sub-Saharan Africa in general (Booyesen, Andersen, and Zeeman 2013) and Tanzania in particular (Jacobsen 2023; Mfinanga and Madinda 2016). A study by Alimo et al. (2022) investigated the increasing demand and formal regulation of MCT in Ghana, with a sample of 1489 users, the results showed a 70% continuous use intention, while 78% supported a decentralized formal regulatory framework for MCT. These findings are a summary that represents a high demand for MCT in Sub-Saharan Africa. In Tanzania, the public transport sector comprises minibuses and vans, Bus Rapid Transit (BRT), ferries, commuter trains, non-motorized transport (NMT) and taxis. Taxis are an important means of local transport in Tanzania, 'they play an important role in bridging the gap between basic public transport modes and private cars by offering commuters a choice to have door-to-door services' (Haque, Chin, and Debnath 2013). Taxis include cars, three wheelers (Bajaj) and two wheelers (boda-boda). With the advancement of technology, traditional taxis are in rigid competition with the ridesharing taxes operated by various companies, including Uber, Bolt and Faras.

Motorcycles as a mode of transport has been in Tanzania for about two decades and serves in the mobility of passengers and goods. The booming of the MCT in Dar es Salaam cannot be separated from the increase in the importation of affordable motorcycles from China in the early 2000s and thereafter from India (Olvera et al. 2012; Porter 2016). MCT has become a great source of informal employment and income generation for both the riders and owners of motorcycles (Collord 2023). The first wave of MCT arrived in Dar es Salaam in the year 2010s (Olvera et al. 2012). The number of motorcycles increased almost twice between 2015 and 2021, accounting for two-thirds of all vehicle fleets in Tanzania (URT 2019, 2021).

Mobile phone technology and motorcycle taxis

Several studies have been conducted on mobile phone technology in relation to taxi services. Many were focused on ride-hailing (Cochran 2022; Hill et al. 2021; Nguyen-Phuoc et al. 2020; Shamim et al. 2021; Tang et al. 2020; Weng et al. 2017), others on how mobile phone use results in accidents (Darçın and Alkan 2015; Kitua, Kabalimu, and Muindi 2019; Nguyen et al. 2016; Vera-López et al. 2013) and other studies looking at mobile phones and taxis in relation to other development sectors (Divall et al. 2021; Overå 2006; Porter 2016). Porter (2016) found that mobile phone technology is a facilitator of MCT. Customers use the services for themselves or to transport their parcels from one point to another, significantly reducing physical travel (Divall et al. 2021). However, the caution of safety issues associated with mobile phone use is that new customers might acquire some drivers for illicit motives, including robbery and several accidents happen due to phone use while riding (Divall et al. 2021; Luambano 2020).

Despite major decisions to upscale the transport system in Dar es Salaam, decentralized modes of transport such as MCT remain relevant. Rapid urbanization calls for

strategic planning in the system (Appelhans and Magina 2021). Urban transport planning needs a proper incorporation of technology. However, technology applications come with challenges such as fraud and cybercrime, thus regulatory challenges which affect the system in a wider range need urgent actions. According to Dumba (2017), there exists a regulation loop, and the failure to recognize and connect the relationship between poor driver behavior and policy leads to difficulty in restructuring and formalizing the informal sector.

Theoretical framework

The research question, ‘How does the adoption of mobile phone technology influence the effectiveness and accessibility of Motorcycle Taxi (MCT) services?’ aims to explore the role of mobile phone technology in enhancing MCT services. This study is guided by the diffusion of innovation theory by Everett Rogers 1962. The theory explains how and at what rate new ideas and technology spread through culture. The theory assists in analyzing how mobile phone technology is adopted by motorcycle taxi drivers, and customers and its impact on the services. This framework will support in analyzing how the components of the diffusion of innovation theory interrelate and impact the effectiveness and accessibility of MCT services via mobile phone technology.

The introduction of mobile phone technology in MCT services represents an innovation. It involves new ways of delivering communication and telecommunication services. According to Rogers (2003), diffusion refers to ‘the process in which an innovation is communicated through certain channels over time among the members of a social system’ (E. Rogers 2003). He further points out that diffusion has four main components: innovation, communication and channel, time, and the social system (E. M. Rogers 1983; E. Rogers 2003; E. M. Rogers, Singhal, and Quinlan 2014). After the new technology is communicated, individuals often evaluate it, and five attributes determine its adoption: relative advantage, compatibility, complexity, trialability and observability (E. M. Rogers 1983). These five attributes are interrelated and determine the adoption rate of a specific technology. Mobile phone technology can be used to elaborate on the five attributes that determine its adoption.

Innovation characteristics: **Relative advantage:** The extent to which an innovation is perceived as better than the predictor thus in relation to this study it is the act of using mobile technology to facilitate MCT services. In this study, mobile phone technology has the relative advantage of providing quick and convenient accessibility to MCT that adds value to the service. Mobile phone technology offers significant improvements over traditional communication, such as increased mobility, convenience, and additional features like internet access. **Compatibility:** is the degree of consistency with the adopters’ values and experiences. In relation to this study, mobile phone technology conforms to the urban norms of rushing to daily livelihood activities, whereas the technology saves time and connects customers to a mode of transport that is simple as opposed to other complex forms of public transport. **Complexity:** It is the extent to which the innovation is perceived as challenging to understand and use. The perceived difficulty of understanding and using mobile phone technology. **Trialability:** is the ease of experimenting with the innovation, whereas observability is the extent to which the innovation is visible to others. In this study, mobile phone technology is easy to experiment with.

Observability: The extent to which the benefits of mobile phone technology are visible to others. In the case of this study, it is easily observable and emulated.

Interconnectedness and impact of effectiveness and accessibility: **Effectiveness:** Mobile phone technology enhances the effectiveness of MCT services by improving communication speed, reliability, and functionality. **Accessibility:** Mobile phone technology increases the accessibility of MCT services by making them more available and easier to use for a broader population.

By examining the innovation characteristics this framework allows for a comprehensive analysis of the factors driving the adoption of mobile phone technology and its impact on MCT services. In this study, the authors use the diffusion of innovation theory to explain the adoption of mobile phone technology as a medium for enhancing MCT services. However, the authors acknowledge the limitations of the theory, for instance, viewing technology as a static process and viewing adopters as universal and homogeneous (Lyytinen and Damsgaard 2001). Despite these weaknesses, the theory is use by offering insights into the adoption process.

Materials and methods

Data collection

This study was carried out in Dar es Salaam specifically in Kinondoni municipality. The areas covered were Namanga, Kijitonyama, and Kimara. The authors selected Dar es Salaam because of its status as a national business hub and its larger share of MCTs compared to other regions. This study employed a qualitative approach to understand the role of mobile phone technology in the accessibility and effectiveness of MCT services. In this approach, a researcher studies subjects in their natural setting trying to interpret phenomena of the meanings brought by people to the said things. Data are represented in interviews, conversations and other memos (Denzin and Lincoln 2011). An ethnographic research method was seen as fit for this research (see Fetterman 2019; Naidoo 2012). Between October 2021 and May 2024, the authors collected data through individual semi-structured interviews. Thirty-five research participants including drivers and customers were conveniently sampled based on their willingness to share their experiences and views, of those 15 were drivers and 20 were customers. To ensure inclusivity, the Swahili language was used, and collected data were transcribed and later translated into English. The data were typed into a computer and saved. Secondly, the authors were also able to try the service several times for delivery of parcels. In the end, the collected qualitative data were analyzed thematically. Creswell et al. (2003)

The semi-structured interviews consisted of 5 questions for each interviewee as follows:

Customers

- Q1. Do you have a mobile phone? Smartphone or analog?
- Q2. How has technology changed the way you access MCT services?
- Q3. What is the effect of mobile phone technology on MCT services?

Q4. How has your income and life changed after using technology for MCT services?

Q5. What are the challenges of using technology for MCT services? other challenges?

Drivers

Q1. Do you have a mobile phone? Smartphone or analog?

Q2. Do you use technology to improve your service delivery? How?

Q3. What is the effect of mobile phone technology on MCT services?

Q4. How has your income and life changed after using technology for MCT services?

Q5. What are the challenges of using technology for MCT services? other challenges?

Data analysis

The analysis of this study followed an explorative qualitative analysis method in the form of a thematic analysis inspired by Kiger and Varpio (2020). This approach allows a researcher to explore and interpret the meaning, patterns and themes in qualitative data. It supports an in-depth understanding of human behavior and studied phenomena and it gives contextual insights, through participants' behaviors and perspectives this method captures the experiences of individuals. (Akinyode and Khan 2018). An inductive thematic analysis was employed for this study, in this analysis themes emerged naturally from the data through categorization (Voelker and Reel 2015).

Interview data were coded manually to allow for a deeper engagement with the data (Williams and Moser 2019). The analysis process was influenced by the 6 stages of the thematic process by (Braun and Clarke 2006). First, the researcher familiarizes with the data, through transcribing, reading data and noting down initial ideas to get a deep understanding of its content and to generate insights. The objective was to understand how the adoption of mobile phone technology influences the effectiveness and accessibility of MCT services? Through the process patterns and relationships emerged and helped to start the preliminary process of answering the research question. After the first stage, interesting insights directly related to the research question were identified from the data set. The extracts fell into initial three categories: (i) Accessibility of MCT services (ii) Effectiveness of MCT services (iii) Social-economic impact. Using open coding insights were coded and related codes were then grouped using axial coding. The insights were mapped and themes were developed through selective coding where overarching themes that encompassed multiple categories were identified. Findings were documented, presenting themes with supporting quotes. Coded data were reviewed to identify patterns and insights. Then the researchers looked for connections between different themes and how they relate to the research question.

Results

Services provided by MCT include transporting people especially those in a rush and also transporting goods and parcels. The latter has been largely contributed by the rise

of online business. The authors also found that MCTs are sometimes sent to do different issues, such as shopping. Like in other cities, in Dar es Salaam, people use ride-hailing applications to order taxi services. Some drivers use smartphones, but others still use analog phones. Out of 20 MCT customers who were interviewed, 18 were using smartphones and only 2 were using analog mobile phones. All customer interviewees with smartphones were using ride-hailing apps to request MCT services and also social media, including WhatsApp and Telegram. More than half of the interviewed customers were using calls and SMS for communication with service providers. On the other hand, out of 15 drivers interviewed, only 3 were using analog mobile phones, and the rest were using smartphones. More than half of the interviewed drivers are registered with ride-hailing apps where they get access to customers. Out of all only 7 use SMS and calls to communicate with their customers and fellow drivers. During data collection, the dominant applications were Bolt, Uber, and Faras. According to respondents, not everyone uses the ride-hailing applications, and even those who use them still rely heavily on phone book lists, SMS, and WhatsApp to connect and interact between drivers and passengers. Those drivers who park to wait for customers do not make as much money as those who are always on the move to follow customers where they have requested rides.

The results of the thematic analysis for the interview data revealed three themes in the drivers and customers' answers to the questions. This section presents the findings of this study within the context of the themes; (i) Accessibility of MCT services (ii) Effectiveness of MCT services (iii) Social-economic impact. These themes provide a comprehensive framework for analyzing how mobile phone technology adoption impacts the effectiveness and accessibility of MCT services. The themes will help to structure the analysis, identify key factors, and draw meaningful conclusions.

The characteristics of the first theme entail the following features

Inclusivity: Access to MCT services among marginalized or underserved communities.

With the spread of mobile phones, even marginalized groups like people who cannot afford smartphones are enjoying the benefits of technology when it comes to access to customers using their analog phones.

I use SMS and direct calls to communicate with customers and also with other drivers with whom we share information on locations where there is more business at a particular time.
MCT driver (Field data, April 2024)

Affordability: Cost of mobile services and devices and their impact on accessibility.

The costs of mobile services and devices are very high, this affects the ability to own phones or to keep those operating. However, there are Chinese devices available, and even though their durability is another issue, they are affordable for many.

I have an analog phone, I cannot afford a smartphone, even though I wish to. Even with my analog phone the costs of mobile services are too high and this affects my ability to do business smoothly. MCL driver (Field data, April 2024)

Coverage analysis: Geographic coverage of mobile networks and their expansion.

Tanzania is well covered when it comes to mobile networks; however, some areas especially remote villages are still having challenges with either the networks or the strength of the signals, thus affecting communication when either service providers or customers are in such areas.

Sometimes it is difficult, a driver would take you to a location, but reaching them in order for them to pick you up can be problematic, due to weak mobile networks in certain areas. MCT customer (Field data, May 2024)

The characteristics of the second theme entail the following features

User satisfaction: Customer satisfaction levels with MCT services and their correlation with mobile phone technology adoption.

This feature had the most response. This study found that mobile phone technology contributed to the enhancement and rapid growth of motorcycle taxi services as a business by bringing services to peoples' fingertips. This was validated by a respondent as follows:

These new applications, like Bolt and Uber, have made transport easy. I can call any taxi whenever I want. Mobile phones are now everything, without which you cannot even easily commute. Earlier, we usually relied on calling or texting to get taxi. However, with the advent of apps, it doesn't mean that we have abandoned the old ways – in my case, I use apps and conventional calls depending on the nature and sensitivity of my trip. For instance, when going to the bank, I prefer the drivers I am familiar with as opposed to those from the apps. MCT customer (Field data, February 2022)

Furthermore, the authors discovered that some people prefer to call their MCT drivers on their contact list. Some noted that the drivers one knows are sometimes cheaper and do not require much detail since they already know their customers' usual locations, like office and home. Some customers would send an SMS to request an MCT.

Before mobile phones, people used to wait for any taxi or daladala. Currently, most request MCT using their mobile phones through ride-hailing apps or personal phonebook contact lists. If an MCT driver does not have a mobile phone, they will lose opportunities and work at a loss. Even if the non-app MCT drivers take a customer from point A to point B, they would not have the advantage of getting e-customers in real time as opposed to their counterparts. Such drivers who park in one place can survive without a smartphone, but they lose some money-making opportunities. MCT Customer (Field data, June, 2022)

Mobile phones make work more accessible and efficient; without one, it's challenging. Smartphones help drivers in getting customer locations. A customer might not be home or at the office where they usually are, so being able to get exact locations through a smartphone is useful. MCT customer, (Field data, June 2022)

As a businesswoman, it is much easier now when I have a parcel to send. Before, I used to go by myself, but now I save time and handle other matters. I use MCT a lot for delivery, I can just call MCT, they take a parcel and the recipient's phone number. Since I advertise online, when I get an order, I send a message to the lady working at my shop; she packs it and gives it to MCT. I send the number of the customer where the parcel is to be delivered. I will get confirmation from the customer upon receiving the parcel. MCT customer (Field data, March 2022)

Incorporation of mobile phone technology to MCT has made lives more convenient, fast and easier. MCT Customer (Field data May 2024)

Service utilization: How the use of MCT services has changed with increased mobile phone technology adoption.

I think people are using these services more frequently than before. MCT customer (Field data, May 2024)

Service quality: Analysis of call quality, data speeds, and reliability of mobile networks.

The quality of mobile networks in some areas, especially remote villages is a challenge. MCT customer (Field data, April 2024)

The characteristics of the third theme entails the following feature

Economic development: The role of mobile phone technology in economic activities.

Technology has contributed highly to the rapid growth and expansion of MCT services with new and quicker services. Many youths have gotten employment through MCT and people's incomes have increased. Out of 20 customers, 18 thought that the effect of mobile phone technology on MCT services is more accessibility and effectiveness while at least half of the respondents added that the service is quicker and more convenient. On how their income and life have changed after starting to use technology for MCT all respondents said the effect is positive with some of them adding that it was very positive, they are happy and satisfied.

I stay longer at my shop, I do not stress about transport to come to work and go home, also to distribute parcels faster and thus sell more. MCT driver (Field data May 2024)

I can move around faster and thus able to do more business per day, this has changed my income and life for the better. MCT driver (Field data March 2022 and May 2024)

Almost all 15 drivers connected the effect of technology to MCT services with an increase in their customers and hence better business. Others associated mobile phone technology with access to information where they would learn more things that support the expansion of their business. Also, almost all drivers mentioned how their income has increased and how life has changed for the better after starting this business, especially when adopting mobile phone technology.

mobile phone technology has allowed me to gain more knowledge, and follow through social media where there are bigger events in order for me to go and target customers. It has eased communication with other drivers which supports the growth of business.

Despite the usefulness of smartphones in the previous discussions, some respondents had a different view that they are not a panacea for an MCT driver to earn income.

Having a smartphone is an added advantage, but I don't think it's indispensable for this business; SMS and calls can work well. I think those without smartphones make more money than the ones waiting for requests. There is a huge wave of MCT customers. Sometimes, having a phone is unnecessary; the most important is having an MCT. MCT driver (Field data, January 2022)

Challenges of adopting mobile phone technology

Of the challenges, associated with the use of mobile phone technology, digital map reading is the biggest. Adding to the challenge is the lack of English language skills which affects the ability to access information including learning and understanding maps since default map directions are provided in English. Consequently, some drivers must stop several times to look at maps to establish locations. Some drivers acknowledged that sometimes maps might be complex and complicated to read, which at times negatively affects the number of passengers one gets in a day. To explain this, one respondent admitted:

It can be very annoying when one requests a ride and gets a call where they have to explain their location, and the driver doesn't understand the map. Sometimes, drivers cancel the request because of not being able to locate the customer. MCT customer (Field data, March 2022)

Discussion

Despite the expansion of the service, MCT remains an informal transport in many countries, especially in Sub-Saharan Africa (Olvera et al. 2016). In line with our findings, the role of mobile phone technology in improving MCT services has been asserted by various studies (Auko 2016; Bishop et al. 2018; Divall et al. 2021; Kisusi 2018; Murithi, Gichunge, and Cherono 2022). The authors employed the five attributes by (E. M. Rogers 1983) to analyze the data collected. According to Rogers (1983) and in relation to this study these attributes determine the adoption rate of mobile phone technology.

Effectiveness

MCT offers various services ranging from transporting passengers and good, delivering parcels, and even assisting in shopping.

Because people are busy sometimes, one option is to rely on MCT services; for instance, one driver might have several customers who entrust them with their shopping; they give them a list of needs, the drivers would purchase and deliver. Also, some drivers have regular customers who run an online business; they would send the drivers to deliver the parcels to their customers. MCT driver (Field data, March 2024)

The above quotation affirms what several studies (Auko 2016; Divall et al. 2021; Jenkins, Peters, and Richards 2020; Kisusi 2018) concluded in relation to what MCT does. Auko (2016) and Jenkins, Peters, and Richards (2020), for example, reveal that, among other things, MCT has been the best option for door-to-door delivery and shuttling passengers from one point to another. Divall et al. (2021) and (Inoue 2019) reveal that the MCT is a popular means of transportation because most of the roads are in poor condition, which makes it difficult for commercial four-wheel public transport to operate, especially in rural and peri-urban areas. Further, in relation to the diffusion of innovation theory, based on the findings, MCT is adopted over other means of transport due to two-fold reasons identified by Rogers (1983; 2003): relative advantage and compatibility with adopters' values and experiences. With traffic experiences in urban centers and the need to commute fast during rush hours, adopters opt for MCT. Respondents confirmed using MCT due to its affordability, convenience, and fast navigation through congested traffic;

this makes MCT helpful when in a hurry. The findings of this study corroborate what similar studies (Auko 2016; Divall et al. 2021; Ehebrecht, Heinrichs, and Lenz 2018; Inoue 2019) reported on preference for MCT due to their capability to navigate through traffic congestion. However, this is not without costs as MCT navigation through traffic has been associated with violation of traffic regulations (Luambano 2020) and increasing accidents that have been resulting in permanent disabilities or fatalities (Murithi, Gichunge, and Cherono 2022; World Health Organization 2018).

Other studies, including Auko (2016) and Ehebrecht, Heinrichs, and Lenz (2018), also report on the significance of MCT in providing courier and delivery services. Auko (2016) shows how the MCTs have been instrumental in the food business in Nairobi, Kenya, in delivering food. The role of mobile phone technology in this regard has been necessary because the driver usually keeps in touch with the recipients until packages are delivered. In relation to the diffusion of innovation theory, based on the findings, the MCT is adopted over other means of transport due to one reason identified by Rogers (1983; 2003): **Observability**: The extent to which the benefits of mobile phone technology are visible to others. In the case of this study, the convenience and effectiveness of MCT services is easily observable and emulated.

Accessibility

Most MCT customers who were interviewed were using smartphones, and all of those were using ride-hailing apps to request MCT services and also social media, including WhatsApp and Telegram. Apart from that SMS and direct calls were also popular among respondents. In the case of drivers, more than half were registered with ride-hailing apps. The mobile phone technology has the relative advantage of providing quick and convenient accessibility to MCT that adds value to the service. In relation to the diffusion of innovation theory, based on the findings, mobile phone technology is adopted among MCT drivers and customers due to one reason identified by Rogers (1983; 2003): **Trialability**: The extent to which mobile phone technology can be experimented with on a limited basis. Higher trialability of mobile phone technology positively influences its adoption for MCT services.

Economic development

MCT business has given thousands of young people employment (Bishop and Courtright 2022; Olvera et al. 2012) and hence income. Our findings reveal that those drivers parking and waiting for customers do not make as much money as those who are always on the move to follow customers where they have requested rides. This argument contravenes Bishop and Courtright's (2022) finding that app-based MCT drivers earn almost a third more than those relying on conventional ways of locating customers. Based on the authors' observations, for those stationed at regular stops without smartphones and ride-hailing apps, their earnings depend significantly on their customer care and customer base.

Challenges

Conversely, Divall et al. (2021) and Nguyen-Phuoc et al. (2020) are among the studies that have also cited the negative impacts of mobile technology on MCT, such as causing

accidents because of drivers using mobile phones while driving. Luambano (2020) shows that MCTs have sometimes been involved in kidnapping, armed robbery and theft. However, mobile phone technology has also increased the safety of the MCT through tracking services and easy identification of drivers and customers through information for the app-based taxis (Murithi, Gichunge, and Cherono 2022). Another challenge is poor digital and English language skills that affect the ability of drivers to learn different skills and understand navigation instructions. In relation to the diffusion of innovation theory, based on the findings, one reason identified by Rogers (1983; 2003) is complexity. In this case, mobile phone technology is considered as difficult to use. Respondents' views on regulatory deficit echo what various studies (Auko 2016; Bishop et al. 2018; Bishop and Courtright 2022; Kisusi 2018; Luambano 2020; Olvera et al. 2012; Olvera et al. 2016) have reported in Sub Saharan Africa. With the boom in the importation of low-cost motorcycles into the African continent and the challenge of unemployment, the number of youths turning to the MCT sub-sector is increasing at an alarming rate. MCT drivers' compliance with laws and regulations is deficient, as most lack professional training on driving and road safety (Bishop et al. 2018).

Limitations of the study

Extensive data collection, analysis and fieldwork in the middle of the COVID-19 pandemic caused a lot of stress to the researchers. This affected the quality of the interviews and data. However, the researchers managed to start the study through telephonic interviews and when the time was right the researchers went to the field to validate and update data through interviews. Further, the researchers did another telephonic follow-up of more than half of the interviewees for a final revision of the study between March and May 2024. As a qualitative case study, this research was limited in sample size and geographical coverage; thus, the findings do not necessarily represent most of the population of MCT customers and drivers in Dar es Salaam let alone Tanzania. Future research could focus on a more comparative study including Dar es Salaam, Mwanza, Dodoma, Mbeya, Arusha and Zanzibar to get a better representation of the situation in the country. Focusing on rural areas where the penetration of technology is limited as compared to urban centers will increase the understanding of the bigger picture including areas where the majority of Tanzania's population live which will encourage inclusivity.

Conclusion

In this paper, the authors affirm what other studies reported on the role of mobile phone technology on MCT. With the above findings and discussion, this study concludes that mobile phone technology has contributed to a great extent to the improvement and expansion of MCT services in urban centers. Most customers and drivers reported that mobile phone technology increased efficiency, and convenience and brought a positive impact to their lives through an increase in income. Despite severe challenges like accidents, robbery and poor digital skills, MCTs continue to gain popularity. In relation to these findings, the authors propose a number of steps to improve the situation. First and foremost, more efforts should be focused on the formalization of the sub-sector. The government and relevant MCT stakeholders should collaborate and strengthen the way

the sector is regulated, by enforcing laws and policies to increase road safety and personal security. Also, a strong emphasis on digital skills among MCT drivers is recommended and the use of Swahili language in technology apps should also be given priority to promote inclusivity. Cooperation between government authorities and other ecosystem players is needed to make sure that technology is inclusively incorporated into relevant systems and that all stakeholders including drivers are well empowered to be able to use and enjoy the benefits that come with digital transformation.

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Authorship contribution statement

Emma Nkonoki: conceptualization, data collection, and writing the original draft. Did a major revision including the second round of data collection, data analysis, and rewriting all sections for resubmission and lastly handled the final minor revision. **Vedasto Hamza:** rewrote subsequent drafts of the original draft including methodology, literature review and editing before both major and final revisions.

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