Vol. 8 No. 1

May 2023

Contextual Factors Influencing the Performance of Mobile Services in Monitoring the Delivery of Public Health Services

Fredrick Mutungi

Department of Computer Science, Faculty of Computing and Informatics, Mbarara University of Science and Technology, Uganda & Department of Computer Studies, Faculty of Science & Education, Busitema University, Uganda

frema1997@gmail.com

ORCID ID: 0000-0002-2986-801X

Abstract

Rationale of Study – This paper established contextual factors affecting the performance of mobile services for monitoring the delivery of public health services in Uganda.

Methodology – The study adopted a survey type of descriptive research design. A questionnaire was used to collect data, which were analyzed using crosstabs. The study population included Village Health Team (VHT) members and key informants from selected districts, with a sample size of 368 VHTs, 97 health facilities, and 62 key informants.

Findings – The study revealed that user and task characteristics, as well as motivational, physical, technical, social, and organizational factors, all affect the performance of mobile services for monitoring the delivery of public health services.

Implications – The study emphasizes the need to consider the specific task requirements and context when designing mobile services to optimize performance. The implication is that developers and implementers of mobile services for monitoring the delivery of public health services in developing countries should consider the unique challenges and constraints of the local context when designing mobile technology to ensure that it is relevant, effective, and appropriate for the specific use case.

Originality – The study identified contextual factors that impact the performance of mobile services for monitoring public health services in Uganda. By considering user and task characteristics and motivational, physical, technical, social, and organizational factors, the study recommends designing context-specific solutions to improve health outcomes in developing countries. This research contributes to the existing literature on mHealth and guides practitioners and policymakers working to improve public health services in similar contexts.

Keywords

Mobile services, public health delivery, contextual factors, mobile monitoring, Uganda

Citation: Mutungi, F. (2023). Contextual Factors Influencing the Performance of Mobile Services in Monitoring the Delivery of Public Health Services. *Regional Journal of Information and Knowledge Management*, 8 (1),104-122.

Published by the

Regional Institute of Information and Knowledge Management

P.O. Box 24358 – 00100 – Nairobi, Kenya

1 Introduction

According to Sánchez et al. (2011), a mobile service is a set of intangible activities that occur when customers interact with systems or employees of service providers using mobile devices and a mobile telecommunications network. Lee and Hsieh (2009) add that mobile services cover a range of activities such as mobile email, SMS/MMS services, downloading content, reserving tickets, and accessing mobile TV. Mobile services enable users to make purchases, request services, access news, and information, and pay bills using mobile communication devices such as PDAs, laptops, and cellular phones (Siau & Shen, 2003). Mobile services also have much potential for mobile government. Mobile services can enhance the e-government concept by allowing constituents to access government services through mobile devices (Siau & Shen, 2003).

Mobile services are important in e-government because they can provide information to customers and partners regardless of their location and at the right time. This is particularly relevant in developing countries with limited traditional internet infrastructure, making mobile technologies based on wireless technology more suitable (Siau & Shen, 2003). Therefore, mobile technologies have great potential to improve public health service delivery monitoring, known as MD-PHS, and support decision-making and analytics, as stated by Steele et al. (2020).

However, mobile services applications must be designed to suit the unique contexts they are to be used. Systems are sometimes introduced in a rushed manner, with little consideration for the context in which they are to be used. There may need to be more enabling infrastructure. Skills, language issues, institutional systems and policies, internet access, and equipment should be considered, especially in developing countries (Steele et al., 2020). Olu et al. (2019) expressed similar concerns about the limitations of mobile technologies, which include issues such as inadequate management of multiple pilot projects, fragmented and ineffective systems, insufficient understanding and awareness of digital systems, inadequate infrastructure such as unstable power supply and poor connectivity, and a lack of compatibility among various digital health systems.

As a result, MD-PHS by mobile technology remains a significant challenge in the public health sector. Examples of mobile technologies that have failed to monitor the delivery of PHS include EpiHandy in Uganda and South Africa (Mechael et al., 2010), Community Health Information Tracking System (CHITS) in the Philippines (Ongkeko et al., 2016) and Dokoza System in South Africa (Bhatnagar, 2014; Mechael et al., 2010).

These failures have been attributed to a lack of funds and understanding of the local landscape (existing players and solutions, policies, local settings and practices), failure to engage local people, and non-alignment of mHealth programs with the local and national priorities (Lemaire, 2011). Similar causes of mobile technology failures were echoed by Steele et al. (2020), who noted little consideration for the context into which the technology is being introduced; insufficient enabling infrastructure and other factors such as skills, language issues, and internet access affect mobile technology performance.

Generally, Asif and Krogstie (2013) attribute the failure of these mobile technology initiatives to the exclusion of contextual factors in the different technology adoption models, much as research highlights the significance of its adoption. Similarly, Heeks (2007) noted that contextual collision between the context of design and the context of use is a frequent source of failure of ICT interventions.

The significance of the context in the use and success of mobile services is increasingly being acknowledged in research, particularly in areas such as healthcare, sales, and learning technologies (Liang & Yeh, 2011; Pal et al., 2019). It has also been suggested that contextual factors for mobile service applications differ across different situations (Pal et al., 2019). Thus, this study aims to identify the contextual factors that affect the performance of mobile services in monitoring the delivery of public health services.

The structure of the remaining sections in this paper is as follows: Section 2 will explain the research, Section 3 will consist of a literature review, Section 4 will detail the research methodology, Section 5 will present the findings of the study, Section 6 will discuss the limitations and implications of the research, and finally, Section 7 will provide a conclusion and suggest areas for future research.

2 Research Rationale

The use of mobile services in monitoring the delivery of public health services has great potential to improve healthcare delivery, especially in developing countries where traditional wired internet infrastructure is limited. However, the success of these mobile technology initiatives has been limited by several contextual factors that need to be adequately addressed. Thus, the study aims to investigate and analyze the contextual factors that impact mobile services' effectiveness in monitoring public health service delivery. By identifying these factors, this research will contribute to developing mobile service interventions tailored to specific contexts, leading to more effective healthcare delivery. Additionally, this study will add to the body of literature on the importance of

contextual factors in mobile service usage, adoption, and performance, informing future research on mobile services in the public health sector.

3 Literature Review

Literature findings indicate that the performance of existing mobile services for MD-PHS is affected by several factors: These factors are organized into six groups by the contextual factors affecting the performance of general mobile services. These groups are explained below.

User characteristics

Li and Luximon (2018) emphasize the importance of considering user characteristics when designing technology-based tasks. Maguire (2001) suggests that a stakeholder analysis should be conducted to identify user characteristics such as knowledge, skill, experience, education, training, physical attributes, and motor and sensory capabilities. O'Connor and O'Donoghue (2015) highlight the need to consider users' cognitive factors, such as self-beliefs and ability, when developing mobile technology systems. These factors are critical in developing countries, where education limitations and a lack of English language skills may challenge technology adoption.

User Motivation

Motivation is a critical contextual factor that impacts the adoption and usage of technology in public health monitoring. Research has identified user motivation as essential for technology adoption and usage, and users tend to select technology based on their needs (Salehan et al., 2017). Salehan et al. (2017) suggest that user motivation is a general characteristic that drives actions to fulfill a need or want. The dimensions of user motivation include content gratification, process gratification, and social gratification, and are influenced by psychological, behavioral, economic, and social factors (Barabee & Depow, 2002; Kim et al., 2019; Salehan et al., 2017).

Task characteristics

Task characteristics are a crucial context factor that impacts the performance of public health monitoring systems. Researchers such as Maguire (2001) and Schmidt et al. (1999) have identified the importance of considering task characteristics when designing systems. Maguire highlights the frequency and duration of the task, while Schmidt et al. emphasize spontaneous activity, engaged tasks, and general goals as critical task characteristics. The findings suggest that task characteristics influencing technology

performance vary depending on the task and context. Therefore, it is crucial to consider task characteristics when designing mobile services for maximum performance.

Physical factors

Ebo et al. (2012) identified that rural and remote areas in developing countries where public health facilities are situated face challenges related to the physical environment, such as heat, dust, and humidity. These factors can threaten mobile devices by shorting circuits, impeding airflow and heat dissipation, leading to condensation, corrosion, and mold growth, causing electrical issues and reducing the lifespan of mobile devices.

Technical factors

The lack of consistent and affordable electricity and battery life are significant challenges for the adoption and use of mobile services for health informatics, particularly in rural areas (Bhutkar et al., 2009; Ebo et al., 2012). The literature indicates that SMS-based mobile services need to be improved in capturing data effectively, leading to incomplete data (Bexelius et al., 2009). Limited access to wireless telecommunication infrastructure affects the performance of mobile services for monitoring the delivery of public health services, particularly in rural and poor settings of developing countries (Hammond, 2020; Hammond et al., 2020).

Social and organizational factors

Social and organizational environmental factors that affect PMS for monitoring public health services include the shortage of human resources (Patil, 2011), cultural factors such as limited access to mobile phones for females (Hammond et al., 2020), and the need for a better understanding of context and culture to develop effective interventions (Skaria, 2013). Security, safety, and privacy are critical factors affecting users' willingness to use mHealth products and services and financial costs (Hammond et al., 2020). Other user-related factors include perceived ease of use and medical staff resistance to technology adoption (Hammond, 2020).

The literature highlights several contextual factors that can impact the performance of mobile services for monitoring the delivery of public health services. These include user characteristics, user motivation, task characteristics, physical factors, and technical factors. For the adequate performance of these services, these contextual factors must be considered when designing them, especially in developing countries where educational limitations, physical environment, and limited infrastructure can pose significant challenges.

4 Theoretical Framework

The purpose of reviewing theories is to assess the models and theories that impact the performance of mobile services. The main goal is to identify how Information Systems research theories support contextual factors affecting mobile service performance.

Task-Technology Fit (TTF)

The Task-Technology Fit (TTF) framework is a well-established theoretical framework that investigates the alignment between the functionality of technology and the tasks it aims to support. The Framework emphasizes matching technology to user abilities for better performance and outcomes. However, some critics argue that the TTF model overlooks important psychological and situational factors, such as the role of top management, trust, and team member responsibilities. According to Tripathi et al. (2023), these factors can substantially affect technology implementation, which may ultimately determine its success or failure. The Framework covers technical, user, and task characteristics. However, it does not address other important contextual factors, such as motivating mobile service users to use the service, establishing physical environment characteristics, and creating social and organizational environment characteristics (Agarwal et al., 2000; Appel-Meulenbroek & Danivska, 2021; D'Ambra et al., 2013; Goodhue & Thompson, 1995).

Technology to Performance Chain (TPC)

Goodhue and Thompson developed the Technology Acceptance Model (TPC) to help organizations understand and use Information Technology more effectively. The model proposes that task-technology fit is a function of task, technology, and individual characteristics, which directly and indirectly influence performance via precursors of utilization, such as expected consequences of use, attitude towards use, social norms, habit, and facilitating conditions. Utilization is also proposed to influence performance. While the TPC covers most of the contextual factors, such as some characteristics of the technical environment, user and task characteristics, and establishing social and organizational environment characteristics, it does not cover physical factors, motivation, and some technical factors like the availability of power and internet (Goodhue & Thompson, 1995; McGill & Klobas, 2009).

Technology Acceptance Model (TAM)

TAM is a theory within information systems that aims to clarify how users adopt and utilize technology. According to this model, users' decisions on when and how they use new technology are driven by their perception of its perceived usefulness (PU) and

perceived ease of use (PEOU) (Davis, 1989). The core of the TAM model lies in two fundamental beliefs: Perceived Usefulness and Perceived Ease of Use. These beliefs address the fundamental psychological needs crucial for users' self-motivation using information systems (Peters et al., 2018). Therefore, TAM only covers motivational factors.

Stimulus Theoretical Framework (STF)

Lai developed the Stimulus Theoretical Framework (STF) to extend the Technology Acceptance Model by including security and design factors in the context of the single-platform E-payment System. The Framework covers technical environment and motivation factors but does not address user and task characteristics or social, organizational, and physical environment characteristics (Lai, 2016, 2017). The STF proposes that designers create services that are easy to use, beneficial to users, and cater to motivational values like entertainment, low cost, attractiveness, and user interaction.

Motivation-Participation-Performance Framework (MPPF)

The Motivation-Participation-Performance Framework (MPPF) proposed by Roberts et al. (2006) is based on the general social theory of motivation and performance. The Framework explains how different motivations of an individual's behavior influence performance. However, the MPPF framework must be applied to specific domains, such as mobile services for MD-PHS, to explain how context-specific motivations and characteristics combine to influence performance. The Framework emphasizes the importance of designing a service that caters to users' aesthetic pleasure and combines it with their knowledge, skills, and abilities. The MPPF model covers only motivation and user characteristics and does not address other critical contextual factors (Roberts et al., 2006; Salehan et al., 2017).

WHO Framework for Categorization of digital health indicators

The Performance of the Routine Information System Management (PRISM) conceptual framework, along with its tools, was used by the WHO to develop a framework for categorizing digital technology performance indicators for HealthHealth, which includes technical, organizational, and behavioral factors that impact the performance of health information systems (WHO, 2016). The WHO framework covers the characteristics of the technical, user, social, and organizational environments.

The six theories and models were used to identify, analyze and support the contextual factors affecting the performance of mobile services for MD-PHS. Each theory offers a

unique perspective on the factors influencing technology acceptance and use, ranging from user characteristics, technical environment, and social and organizational environment to motivation factors. Considering these theories, the review offers a more comprehensive understanding of the factors impacting mobile service performance.

All six theories provide a well-rounded view of the various contextual factors influencing technology acceptance and use, allowing for a more holistic approach to analyzing mobile service performance. Each theory focuses on different factors and variables, enabling researchers and practitioners to assess mobile service performance from multiple angles. The theories address different aspects of mobile service performance but overlap and share some commonalities. For example, TTF and TPC emphasize the importance of task-technology fit, while TAM and STF focus more on the user's perceived usefulness and ease of use. The MPPF emphasizes the importance of motivation in influencing user behavior. At the same time, the WHO framework takes a broader approach and considers technical, organizational, and behavioral factors that impact the performance of health information systems. At least each of the contextual factors affecting the performance of mobile services for MD-PHS established from literature is backed up by a theory in Information systems research.

5 Research Methodology

This study used a qualitative approach based on an interpretative stance. This approach was appropriate for exploring complex and dynamic issues that are difficult to measure quantitatively. It allowed for an in-depth understanding of the contextual factors affecting the performance of mobile services for MD-PHS in Uganda. The study incorporated a case study design which enabled the investigation of the phenomenon in its natural setting and within the broader context of health service delivery in Uganda. It allowed for collection of rich and detailed data from various sources, including Village Health Team (VHT) members, key stakeholders, and health facilities.

The population comprised VHT members and critical stakeholders from selected districts. The multistage cluster sampling procedure was used to determine the final health facilities (HFs) sample to participate in the study. The total sample size was 368 VHTs, 97 HFs, and 62 key informants. The study utilized two primary sources of evidence for data collection: a review of relevant literature and surveys. The systematic literature review method was appropriate for synthesizing and analyzing existing research on contextual factors that influence the performance of mobile services for monitoring

public health services delivery. Using multistage cluster sampling, surveys gathered quantitative data from selected VHT members, key stakeholders, and health facilities. This method allowed for the data collection on social demographics and hypothetical factor variables, which were then analyzed using univariate and bivariate analysis to generate information on contextual factors that influence the performance of MD-PHS.

Data was analyzed at different levels, including univariate and bivariate analysis, to generate information on social demographics and hypothetical factor variables. The analysis helped to identify key concepts, themes, and gaps in the existing research, which were then used to develop research questions and hypotheses for the survey research strategy. The validity and reliability of the study were ensured by using rigorous data collection methods and by conducting the study in a natural setting. The systematic literature review method ensured the study's validity by synthesizing and analyzing existing research. In contrast, the survey research strategy ensured reliability by testing and confirming contextual factors that influence the performance of MD-PHS.

6 Research Findings

This section presents results from a survey administered to 425 respondents. The purpose of the survey was to test, confirm and complement established contextual factors affecting the performance of mobile services for MD-PHS, given that they were obtained from various literature sources whose validity could not be guaranteed. The contextual factors guided the design of a survey questionnaire based on a Likert scale of 5 (1 = strongly disagree; 2 = disagree; 3 = undecided; 4 = agree; 5 = strongly agree and 1= Extremely suitable, 2= very suitable, 3= moderately suitable, 4= slightly suitable, 5= not suitable at all).

Demographics of the Survey

Out of the 425 respondents, in terms of gender, 68% of the group identified as female, while 32% identified as male. In terms of region, the most significant proportion of the group (45.7%) is from the Eastern region, followed by the Central region (37.7%) and the Western region (16.6%). In terms of designation, the most significant proportion of the group (85.4%) identified as VHT (presumably Village Health Teams), while the minor proportion identified as District Officers (0.7%). Lastly, in terms of monthly income, the most significant proportion of the group (80.9%) reported earning between 0-300,000, while only a tiny percentage (7.1%) reported earning 1,000,001 and above.

Table 1: Demographics of the Survey

Demographics		**Frequency**	**Percent (%)**
Gender	Female	289	68.0
	Male	136	32.0
Region	Central	160	37.7
	Eastern	194	45.7
	Western	71	16.6
Designation	Administrators/ In charge	19	4.5
	HIA and biostatisticians	28	6.6
	Health officers	11	2.6
	VHT	363	85.4
	District officers	3	0.7
	others	1	0.2
Monthly income	0-300,000	344	80.9
	300,000-600,000	36	8.5
	600,001-1,000,000	15	3.5
	1,000,001 and above	30	7.1

The extent to which user characteristics affect PMS for MD-PHS

Study findings show that the majority of respondents (91.3%) agree that their level of education affects the use of mobile services. Additionally, 70.1% agree that their experience with mobile services affects their usage, and 79% agree that their attitude toward mobile services affects their use. In comparison, 72% agree that they do not use mobile services because they are in English. These findings suggest that language barriers, education level, and prior experience with mobile services can significantly determine individuals' use of mobile services for health-related purposes.

Table 2: User characteristics

User characteristics (n=425)	Agree	Disagree	Undecided	Total
My level of education affects the use of mobile services	91.3	5.9	2.8	100

I do not use mobile services because they are in English	72.0	13.4	14.6	100
My experience with mobile services affects mobile service use.	70.1	16	13.9	100
Attitude toward mobile services use	79	15.6	5.4	100

The extent to which task-related factors affect PMS for MD-PHS

Most respondents agree that task characteristics affect the performance of mobile services for MD-PHS, but these results may vary depending on the specific context and task being performed. Additionally, other factors such as usability and accessibility may also impact the suitability of mobile technology for different tasks. Table 3 shows that 78% of respondents agree that mobile technology is suitable for highly time-sensitive tasks, 74% agree that it is suitable for complex tasks, 76% agree that it is suitable for repetitive tasks, 72% agree that it is suitable for monitoring tasks where it reduces cost, and 74% agree that it is suitable for tasks where confidentiality and security are assured.

Table 3: Task-related factors (425)

The use of mobile technology is well suited for the following:	Suitable	Slightly	Not at all	Total
Tasks that are highly time sensitive	78%	17%	5%	100%
Tasks where it can reduce task complexity.	74%	18%	8%	100%
Repetitive tasks	76%	12%	12%	100%
Where users think that it will reduce the cost of executing the task.	72%	15%	13%	100%
Where users need confidentiality and security.	74%	16%	10%	100%

The extent to which technical factors affect PMS for MD-PHS

Table 4 indicates that 94.8 percent of respondents agree that access to power for charging their mobile device(s) affects mobile services use. In comparison, 65.6 percent agree that access to a mobile network also affects mobile services use. 60.2 percent agree that their type of mobile device limits the types of mobile services their use, and 77 percent agree that access to the internet affects mobile services use. In all, the majority of respondents agree that technical factors affect the performance of mobile services for

MD-PHS. However, results may vary depending on specific contexts and available technical infrastructure. Other factors like data plan cost, network quality, and device affordability may also impact mobile services use.

Table 4: Technical factors

Technical factors(n=425)	Agree	Disagree	Undecided	Total (%)
Access to power for charging my mobile device(s) affects the use of mobile services	94.8	5.2	0	100
Access to mobile networks affects the use of mobile services	65.6	24.4	0	100
My type of mobile device limits the types of mobile services I use	60.2	25.9	13.9	100
Access to the internet affects the use of mobile services	77.8	19.8	2.4	100

The extent to which motivational factors affect PMS for MD-PHS

Table 5 shows that most respondents agree that using mobile services helps them achieve their work goals (94%), connects them to others, and gives them a sense of belonging (96%) and that they can use mobile services (91%). Additionally, 84% of respondents agree that they use mobile services for enjoyment. However, only 62% of respondents agree to the mandatory use of mobile services at their workplace, while 67% disagree that they feel pressure from others to use mobile services. Most respondents agree that motivational factors affect the performance of mobile services for MD-PHS, but individual preferences and contextual factors may impact these results. Other factors such as perceived usefulness, ease of use, and perceived risks may also affect motivation to use mobile services.

Table 5: Motivational factors

Motivational factors (n=425)	Agree	Disagree	Undecided	Total
Using mobile services helps me achieve my work goals	94%	4%	2%	100%
Using mobile services connects me to others and gives me a sense of belonging	96%	2%	2%	100%
I feel able and effective while using the mobile services	91%	4%	5%	100%

I use mobile services because it is enjoyable	84%	8%	8%	100%
It is mandatory to use the mobile service(s) at my workplace	62%	28%	10%	100%
I feel under pressure from others to use mobile services	22%	67%	11%	100%

The extent to which physical factors affect PMS for MD- PHS

Most respondents agree that only user location affects the performance of mobile services for MD-PHS, but results may vary depending on the specific context and physical environment. Table 6 shows that 80 percent of the respondents agree that location affects access to mobile services. For other physical factors, most respondents were undecided about the impact of heat (69 percent) and dusty environments (42 percent) on mobile services. In comparison, 42 percent disagreed that humidity affects the use of mobile services.

Table 6: Physical factors

Physical factors (n=425)	Agree	Disagree	Undecided	Total
My location affects access to mobile services	80%	5%	15%	100%
Heat in my area affects the use of mobile services	18%	13%	69%	100%
The dusty environment I stay in affects the use of mobile services.	35%	23%	42%	100%
The humidity in my place affects the use of mobile services.	20%	42%	38%	100%

The extent to which social/organizational factors affect PMS for MD-PHS

According to Table 7, 44% of respondents agree that an internal mHealth policy regulates their mobile health services/technologies, while 41% agree that there is a dedicated budget for related costs. Additionally, 44% agree that designated staff are in charge of the mobile services they use, and only 39% agree that top management supports them. The results suggest that social and organizational factors impact the use and effectiveness of mobile services in healthcare delivery but may vary depending on the specific organization or setting.

Table 7: Social and organizational factors

Social and organizational factors (n=425)	Agree	Disagree	Undecided	Total
We have an internal mHealth policy/related policy that regulates the health services/technologies we use	44%	40%	16%	100%
There is a dedicated budget for data costs, software upgrades or development costs, maintenance costs, and other costs related to the Mobile services we use	41%	44%	15%	100%
There are designated staff in charge of the mobile/Mhealth services we use	44%	45%	11%	100%
Top management supports the mobile service(s) we use	39%	49%	12%	100%

7 Discussion of Findings

Existing literature and survey findings reveal several contextual factors affecting the performance of mobile services for MD-PHS. In this section, each contextual factor is discussed in terms of how it affects the performance of mobile services for MD-PHS.

The extent to which user characteristics affect PMS for MD-PHS

The study found that user characteristics such as education level, language barriers, experience with mobile services, and attitude towards mobile services influence the adoption and use of mobile services for health-related purposes, specifically public health monitoring. The findings show that individuals with lower levels of education need help accessing and using mobile services for public health monitoring, and language barriers prevent individuals from understanding health-related information. Negative user experience with mobile services can lead to decreased future use, and positive attitudes towards mobile services increase adoption and use for public health monitoring purposes. The UN Survey (2014) and Hammond (2020) support the findings on education and language barriers, while Maguire (2001) supports the importance of describing potential user characteristics for effective public health monitoring.

The extent to which task-related factors affect PMS for MD-PHS

The study findings presented in Table 6 suggest that task characteristics play a significant role in the performance of mobile services for MD-PHS. Most respondents agree that mobile technology is well-suited for time-sensitive, complex, repetitive, and secure tasks. However, the suitability of mobile technology for specific tasks may vary depending on

the context and nature of the task, and usability and accessibility are also essential considerations. These findings are consistent with previous studies by Maguire (2001) and Schmidt et al. (1999) that emphasized the importance of task characteristics and context in the performance of IT systems or products. Overall, the study highlights the importance of tailoring mobile technology to meet the specific needs of users and optimize its performance.

The extent to which motivational factors affect PMS for MD-PHS

Table 8 findings show that motivational factors, such as the potential benefits of enhancing communication and collaboration, enjoyment, and personal motivation, can significantly influence mobile services for MD-PHS. The Self-Determination Theory (SDT) by Peters et al. (2018) highlights the importance of autonomy, competence, and relatedness in self-motivation and psychological well-being, which correlates with the findings. The study acknowledges that individual preferences, perceived usefulness, ease of use, and risks associated with mobile services may impact motivation. Thus, understanding these factors is essential for promoting the use of mobile services and maximizing their benefits.

The extent to which technical factors affect PMS for MD-PHS

The study's results, as presented in Table 7, show that technical factors, including power supply, network connectivity, and device compatibility, are essential in determining the use of mobile services for MD-PHS. Access to power for charging mobile devices was considered crucial by almost all respondents, and lack of affordable electricity was identified as the most significant challenge for adopting and using mobile services. Access to mobile networks was also seen as essential, and the type of mobile device used was found to limit the types of mobile services users could access. Moreover, respondents agreed that internet connectivity affected the use of mobile services, highlighting the significance of internet connectivity in delivering mobile services, particularly in remote or rural areas where network coverage may be limited. Policymakers and practitioners must consider these technical factors when designing and implementing mobile services for Public Health to ensure they reach the intended users and have a meaningful impact on their health outcomes. Previous studies by Ebo et al. (2012), Hammond (2020), and Hammond et al. (2020) have also highlighted the importance of these technical factors in the delivery and adoption of mobile services for health informatics.

The extent to which physical factors affect PMS for MD- PHS

According to the respondents, the findings presented in Table 9 suggest that physical factors such as location, heat, dusty environment, and humidity may not significantly impact the performance of mobile services for MD-PHS. However, most respondents were undecided about the impact of heat and dusty environment, and a significant percentage of respondents disagreed that humidity affects the use of mobile services. These results contradict Ebo et al. (2012), who noted that the physical environment in most rural and remote settings in developing countries, where many health facilities are, is characterized by a combination of heat, dust, and humidity, each challenging mobile device. These results suggest that more research is needed to confirm the impact of physical factors on the use of mobile services for MD-PHS.

The extent to which social/organizational factors affect PMS for MD-PHS

The study emphasizes the importance of social and organizational factors in the implementation of mobile services in healthcare. An internal health policy and a dedicated budget for mobile services can increase their effectiveness and sustainability. Designating staff members and gaining top management support can also facilitate using and integrating of mobile services. However, the study also reveals that most respondents did not have these supportive factors in place, suggesting the need for improvement in policy development, budget allocation, staff designation, and top management support to optimize mobile services in healthcare delivery. These findings are consistent with García-Moreno et al. (2016), Hong and Zhu (2006), and Teo (2007), who highlight the crucial role of management support and financial resources in the adoption and use of technological innovations.

The research adds to the current body of knowledge on mobile services for monitoring public health services by examining the contextual factors that impact their performance based on data collected from a specific population in a particular setting. While most of the findings echo previous studies, such as the importance of technical factors and task characteristics, this study adds to the literature by explicitly focusing on mobile services for MD-PHS and investigating the contextual factors that affect their performance. Additionally, this study provides new insights into the impact of user characteristics, motivational factors, and physical factors on the use of mobile services for MD-PHS. The study's findings can inform the design and implementation of mobile services for public health monitoring, particularly in similar settings, and provide insights for

policymakers and practitioners on optimizing the performance of mobile services for MD-PHS.

8 Conclusion

In conclusion, this field study aimed to investigate the contextual factors affecting the performance of mobile services for MD-PHS in a developing country context. The study findings revealed that user characteristics, task-related factors, and motivational factors all play significant roles in the adoption and use of mobile services for MD-PHS. Specifically, education level, language barriers, experience with mobile services, and attitude toward mobile services were identified as crucial user characteristics that influence the use of mobile services for public health monitoring. Task-related factors such as the nature and context of the task, as well as the usability and accessibility of mobile technology, were also found to be necessary. Motivational factors, such as personal motivation and individual preferences, were also identified as significant drivers of mobile services adoption and use.

9 Recommendations

Drawing from the study results, there are several suggestions for improving the design and execution of mobile services for monitoring public health service delivery in developing countries:

1. It is essential to ensure that mobile services are accessible and user-friendly, particularly for individuals with lower levels of education and those facing language barriers. To achieve this, mobile services for MD-PHS should use local languages and have user-friendly interfaces that require minimal training.
2. Developers and implementers of mobile services should consider the specific task requirements and context when designing mobile technology to optimize its performance.
3. It is crucial to recognize the potential benefits of mobile services for enhancing communication and collaboration in the workplace and to use these motivational factors to promote the adoption and use of mobile services for public health monitoring purposes.

10 Contributions of the Study

This study makes several contributions to theory development. Firstly, it applied six different theories and models to examine the factors that influence the performance of

mobile services for MD-PHS. By applying these theories, the study provided a comprehensive understanding of the contextual factors that affect the adoption and use of mobile services for public health monitoring.

Secondly, the study went beyond previous research by investigating how physical factors, such as location, heat, dusty environments, and humidity, affect the performance of mobile services for MD-PHS. Although past studies have emphasized technical, motivational, social/organizational, and task-related factors, this study's results indicate that additional research is required to validate physical factors' influence on mobile services utilization for MD-PHS.

Thirdly, the study's findings contribute to the body of knowledge on using mobile services for public health monitoring in low-resource settings. The study's focus on low-resource settings provides unique insights into the challenges and opportunities associated with adopting and using mobile services for public health monitoring in these settings.

Overall, the study's application of multiple theories and models, examination of physical factors, and focus on low-resource settings contribute to theory development in mobile services for MD-PHS.

References

Agarwal, R., Sambamurthy, V., & Stair, R. M. (2000). The evolving relationship between general and specific computer self-efficacy—An empirical assessment. Information systems research, 11(4), 418–430.

Appel-Meulenbroek, R., & Danivska, V. (2021). A handbook of theories on designing alignment between people and the office environment (p. 312). Taylor & Francis.

Asif, M., & Krogstie, J. (2013). Role of Personalization in Mobile Services Adoption.

Barabee, L., & Depow, J. (2002). '2002 mobile user survey results, part 2: market segmentation trends', Wireless Mobile Services, The Yankee Group, December.

Bexelius, C., Merk, H., Sandin, S., Ekman, A., Nyrén, O., Kühlmann-Berenzon, S., ... & Litton, J. E. (2009). SMS versus telephone interviews for epidemiological data collection: feasibility study estimating influenza vaccination coverage in the Swedish population. European Journal of Epidemiology, 24(2), 73-81.

Bhatnagar, S. C. (2014). Public Service Delivery: Role of Information and Communication Technology in Improving Governance and Development Impact. Asian Development Bank Economics Working Paper Series, (391).

Bhutkar, G., Karande, J., & Dhore, M. (2009). Significant Challenges with mobile healthcare applications. The British Journal of Healthcare Computing and Information Management, 9(09).

D'Ambra, J., Wilson, C. S., & Akter, S. (2013). Application of the task-technology fit model to structure and evaluate the adoption of E-books by academics. Journal of the American Society for Information Science and Technology, 64(1), 48–64. https://doi.org/10.1002/asi.22757

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, pp. 319–340.

Ebo, I. O., Amosa, B. M., & Adenusi, D. A. (2012). Information and communication technology (ICT) and rural development in Nigeria. International Journal of Science and Advanced Technology, 2(11), 1-4.

García-Moreno, M. B., García-Moreno, S., Nájera-Sánchez, J. J., & De Pablos-Heredero, C. (2016). An explanatory model of the organizational factors that explain the adoption of E-business. Journal of industrial engineering and Management, 9(2), 547-581.

Goodhue & Thompson. (1995). Task-Technology Fit. MIS Quarterly, 19(2), 213–236. https://doi.org/10.1074/jbc.M110.194316

Hammond, A. E. (2020). Mhealth as a Viable Solution for the Prevention and Management of Cholera in the Greater Accra Region of Ghana-Perspectives of Provider-Side Stakeholders (Doctoral dissertation, University of Ghana).

Hammond, A. E., Abor, P. A., Abuosi, A. A., & Adzei, F. A. (2020). Challenges encountered with mobile phones to deliver public health services in the Greater Accra Region of Ghana-A qualitative study.

Heeks, R. (2007). Why anti-corruption initiatives fail: technology transfer and contextual collision. In Corruption and Development (pp. 258–272). Palgrave Macmillan, London.

Hong, W., & Zhu, K. (2006). Migrating to Internet-based e-commerce: Factors affecting e-commerce adoption and migration at the firm level. Information & management, pp. 43, 204–221.http://dx.doi.org/10.1016/j.im.2005.06.003

Kim, C., Kim, J., & Kim, D. J. (2019). Effects of personal motivation and computing characteristics on ubiquitous mobile device usages. International Journal of Mobile Communications, 17(2), 127-156.

Lai, P. C. (2016). Design and Security impact on consumers' intention to use single platform E-payment. Interdisciplinary Information Sciences, 22(1), 111–122.

Lai, P. C. (2017). The literature review of technology adoption models and theories for the novelty technology. JISTEM-Journal of Information Systems and Technology Management, 14(1), 21–38.

Lee, C. C., & Hsieh, M. C. (2009, June). The influence of mobile self-efficacy on attitude towards mobile advertising. In 2009 International Conference on New Trends in Information and Service Science (pp. 1231-1236). IEEE.

Lemaire, J. (2011). Scaling up mobile HealthHealth: Elements necessary for the successful scale-up of mHealth in developing countries. Geneva: Advanced Development for Africa.

Li, Q., & Luximon, Y. (2018). Understanding older adults' post-adoption usage behavior and perceptions of mobile technology. International Journal of Design, 12(3).

Liang, T. P., & Yeh, Y. H. (2011). Effect of use contexts on the continuous use of mobile services: the case of mobile games. Personal and Ubiquitous Computing, 15, 187-196.

Maguire, M. (2001). Context of use within usability activities. International journal of human-computer studies, 55(4), 453–483.

McGill, T. J., & Klobas, J. E. (2009). A task-technology fit view of learning management system impact. Computers and Education, 52(2), 496–508. https://doi.org/10.1016/j.compedu.2008.10.002

Mechael, P., Batavia, H., Kaonga, N., Searle, S., Kwan, A., Goldberger, A., ... & Ossman, J. (2010). Barriers and gaps affecting mHealth in low and middle-income countries: Policy white paper (pp. 1–79). Columbia university. Earth institute. Centre for Global Health and economic development (CGHED): with mHealth Alliance.

O'Connor, Y., & O'Donoghue, J. (2015). Contextual barriers to mobile health technology in African Countries: A perspective piece. Journal of Mobile Technology in Medicine,4(1), 31–34.

Olu, O., Muneene, D., Bataringaya, J. E., Nahimana, M., Ba, H., Turgeon, Y., Karamagi, H. C., & Dovlo, D. (2019). How Can Digital Health Technologies Contribute to Sustainable Attainment of Universal Health Coverage in Africa? A Perspective. *Frontiers in Public Health*, *7*. https://doi.org/10.3389/fpubh.2019.00341

Ongkeko, A. M., Jr, Fernandez, R. G., Sylim, P. G., Amoranto, A. J. P., Ronquillo-Sy, M. I., Santos, A. D. F., ... & Fernandez-Marcelo, P. H. (2016). Community Health Information and Tracking System (CHITS): Lessons from eight years of implementing a pioneer electronic medical record system in the Philippines. Acta Medica Philippina, 50(4).

Pal, A., De, R., Herath, T., & Rao, H. R. (2019). A review of contextual factors affecting mobile payment adoption and use. Journal of Banking and Financial Technology, 3(1), 43–57.

Patil, D. A. (2011). Mobile for HealthHealth (mHealth) in Developing Countries: Application of 4 Ps of Social Marketing. Journal of Health Informatics in Developing Countries, 5(2).

Peters, D., Calvo, R. A., & Ryan, R. M. (2018). Designing for motivation, engagement, and well-being in digital experience. Frontiers in Psychology, 9, 797.

Prakash, A., & De', R. (2007) 'Importance of development context in ICT4D projects: A study of computerization of land records in India'. IT & People, 20(3): 262–281.

Roberts, J. A., Hann, I.-H., & Slaughter, S. A. (2006). Understanding the motivations, participation, and performance of open source software developers: A longitudinal study of the Apache projects. Management Science, 52(7), 984–999.

Salehan, M., Kim, D. J., & Kim, C. (2017). Use of online social networking services from a theoretical perspective of the motivation-participation-performance Framework—Journal of the Association for Information Systems, 18(2), 1.

Schmidt, A., Beigl, M., & Gellersen, H. W. (1999). There is more to context than location. Computers & Graphics, 23(6), 893-901.

Skaria, G. (2013). MHealth in health information delivery: The Indian scenario. Journal of Mobile Technology in Medicine, 2(1), 26–29.

Steele, P., Raj, P., & Nayler, J. (2020). Mobile Technology for Data Collection in the Health Supply Chain: Case Studies and Shared Learnings from Low- and Middle-Income Countries. Pamela Steele Associates.

Siau, K., & Shen, Z. (2003). Mobile communications and mobile services. International Journal of Mobile Communications, 1(1-2), 3-14.

Teo, T. S. (2007). Organizational characteristics, modes of internet adoption and their impact: a Singapore perspective. Journal of Global Information Management (JGIM), 15(2), 91–117.

Tripathi, A., Dadi, G. B., Nassereddine, H., Sturgill, R. E., & Mitchell, A. (2023). Assessing Technology Implementation Success for Highway Construction and Asset Management. *Sensors*, *23*(7), 3671. https://doi.org/10.3390/s23073671

United Nations. (2014) UN Global e-Government Survey 2014, http://unpan3.un.org/egovkb/Portals/egovkb/Documents/un/2014-Survey/E-Gov_Complete_Survey-2 014.pdf

World Health Organization. (2016). Monitoring and evaluating digital health interventions: a practical guide to conducting research and assessment. "WHO | Health systems service delivery." Who. Int. Retrieved 2015-02-17.3