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Original Article

Assessing Mobile Money Transfer Systems Usability based on Heuristics Evaluation

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Abstract *- Mobile money technology is an important financial inclusion for many unbanked in mainly developing countries. The usability determines the ability of its consumers to perform tasks with confidence. General conventional heuristics principles are used to assess the usability of systems. The specific objective of this study was to assess the current Mobile Money Transfer Systems based on usability heuristics. The research adapted a mixed method design, including the Design Science Research methodology and survey design. Data was obtained using questionnaires. The target population was mobile money transfer consumers in Nairobi County, Kenya. A sample of 396 was used, with a response rate of 81.1%. The data collected was analysed using descriptive and factor analysis. Ethical issues arising from the research, such as informed and voluntary consent, confidentiality of information and data integrity, were considered. The study highlights the current situation of mobile money transfer systems in Kenya in relation to traditional usability heuristics. The results indicate Mobile Money Transfer System compliance with the following heuristics: visibility of the system status, match between the system and the real world, consistency and standards, minimize user memory load, customization and shortcuts, efficiency of use and performance, aesthetic and minimalist design, help and documentation, pleasant and respectful interaction with the user. On the other hand, control and freedom, helping users recognize, diagnose and recover from errors, error prevention, and privacy principles are lacking and therefore required to enhance Mobile Money Transfer Systems usability. These findings are key heuristics that guide mobile money system developers, Human-Computer Interaction (HCI) practitioners and trainers all around the globe to enhance usability mobile money usability.*

Keywords *- Mobile money, Mobile money transfer systems usability, Usability, Usability heuristics.*

1. Introduction

Relay of information has developed from post office boxes and landlines to mobile telephony and Internet. Communication and information technology serve the basic needs of man by being a channel for accessing food, shelter and clothing. The truth of this is evident in the growth of the computer and telecommunication industry. Mobile technology has found tremendous acceptance among many users worldwide. Information Technology (IT) attempts to keep up with users' craving for more applications that serve their diverse needs. According to an assessment of the Kenyan market, mobile phones have established a solid position in consumer's everyday lives and offer more opportunities for consumers to maximize their usefulness[1]. The users' demand for mobile services has increased over the years.

The mobile service providers and the financial market have tapped into this potential by offering mobile money services to consumers. Mobile money can be simultaneously referred to as mobile payment, mobile money service, or mobile wallet, generally referring to payments operated under financial regulations and performed from or via a mobile device [2]. Mobile Money has the potential to address two areas of financial inclusion: demand for financial services by a population underserved by traditional banking and supply of financial services at a low cost to a large clientele, mainly the poor in remote areas. Mobile money services are a powerful tool for economic growth[3]. Mobile money transfer systems play a major role in the empowerment of the citizens both socially and economically.

The User Interface (UI) serves as the consumer's point of contact with the mobile services system. There is an effort to address the challenges of mobile interaction by consumers in developing countries. Design and usability elements are listed as factors that influence the delivery of mobile services in developing nations[4]. The difficulties include user capability-based usability and navigation hierarchy.

Consumers' demand for quality systems is growing. Quality relates to the usability of a system. Determining the usability of a system can be captured by usability heuristics assessment. Evaluating a usability heuristic analysis specific to mobile money systems is valuable in contributing to usability enhancement for consumers, thus serving their economic, cultural and social needs.

Heuristics are key guidelines that are applied while assessing the usability of any computer interface[5]. Usability heuristics developed and tested over time have been applied in evaluating user needs in a system. Though there is research on the application of heuristics for mobile application user interfaces, there is minimal information on heuristics specific to mobile money transfer systems. There is, therefore, a need to assess the usability of mobile money transfer systems using conventional general heuristics to improve on the heuristics required for their development. An improved interface will ensure ease of use and continuity in the use of mobile money systems.

Studies have noted that human-computer interaction strategies should concentrate on constructing technologies that address local settings rather than redeploying technologies intended for industrialized countries and underdeveloped countries[4]. Kenya is one of the first countries to deploy mobile money systems. One of Kenya's major telecommunications firms, Safaricom, introduced the country's most well-known and popular mobile money transfer system, MPESA, in 2007[6]. MPESA. M referring to mobile and pesa being the word for money in Swahili [6]. It is the first mobile money system in Kenya. MPESA has had the highest number of mobile money subscriber base, followed by AIRTEL KENYA, in Kenya**[12].** Therefore, Kenya's contribution to the usability of mobile money systems is key to the industry.

Provision of empirical findings regarding mobile money transfer systems usability is provided in this study. It highlights the usability of Mobile Money Transfer Systems (MMTS) in Kenya concerning popular usability heuristics. This knowledge is key to system developers, human-computer Interaction (HCI) practitioners and trainers, both locally and globally.

2. Literature Survey

2.1. Mobile Money

Mobile technology has found tremendous acceptance among many users worldwide. In Sub-Saharan Africa, due to its large proportion of people under the age of 18, subscriber growth will continue to be strong for the foreseeable future as young consumers become adults and can sign up for mobile services[7]. One of the services that is recognized as a major need to boost the socio and economic needs of a developing nation such as Kenya is mobile money services. Various studies have indicated the growth of mobile money as satisfying a need of consumers, especially with transferring money to serve the consumer's family and daily needs[8]. Mobile money is an important financial innovation, especially in relation to the inclusion of the unbanked. Mobile money uses mobile phone networks to make financial transactions using customers' funds maintained by mobile network operators[8]. It is, therefore, not the same as customers accessing their bank accounts through the phone. Consumers are not required to have bank accounts and use only their Mobile Network Operator (MNO) to access their funds. Overall, mobile money services enable a majority of the working nation to access financial services, which they otherwise would not have access to due to lack of some technical formality or the other[9].

Noteworthy mobile money services deployment features indicate the following areas: Access Channels, Security, Registration and transaction limit, role of agent networks and consumer awareness and support. Consumers access mobile money through a technical interface from their mobile handset, and their experience can have a significant impact on usage[10]. Most mobile money services can be accessed via various interfaces, including USSD (Unstructured Supplementary Service Data), which initiates a conversation between the mobile phone and the server. The user is guided through a series of steps to accomplish a task. SIM Toolkit (STK) is an approach that helps break down the transaction into a series of logical steps that can be followed to accomplish the transaction; IVR (Interactive Voice Response) technology allows a computer to interact with humans through the use of voice; Applications. In a survey of mobile money account interfaces, USSD access is the highest use in percentage. [10].

Mobile money presents a number of areas to overcome. There is e-commerce legislation, consumer protection, privacy and data protection, telecommunication, financial regulation, competition law, telecommunication and banking regulations, and the dynamism of technologies and business models. Other selected issues of concern are convergence of different regulatory areas, user security issues, handling deposits, and cross-border transfers. A study on consumer acceptance of technology revealed the importance of technology performance and effort expectancy, as well as perceived risk and trust [13]. Consumer activities are one of the transactional activities a mobile money platform needs for successful transactions, making consumer support very important.

2.2. Usability

System quality indicates how good the system is in terms of its influence on intention to use and user satisfaction. One of the constructs used for measuring mobile money service user experience quality is usability[14]. Usability refers to how well certain consumers may use a product to accomplish specific goals in a specific context of use [15]. Usability

fulfills predetermined objectives with effectiveness, efficiency, and satisfaction in a predetermined use context. The term usability, its measurements and definitions have been a long-standing debate with several arguments. Therefore, it is a definition yet to be clear and agreed on [16]. According to [16], the absence of usability problems is the presence of usability. A typical scope of usability measurements is effectiveness, efficiency, satisfaction and absence of usability problems.

2.3. Usability Heuristics

Application of heuristics, a set of broadly applicable usability concepts, rules or principles in system evaluation [17], guides usability assessment. Heuristic evaluation is a "discount usability engineering" method for investigating user interfaces for usability issues[18]. The basis of usability heuristics is proposed by Nielsen's ten (10) heuristics, which include the following: "visibility of system status",; "match between the system and the real world"; "user control and freedom"; "consistency and standards"; "error prevention"; "recognition rather than recall"; "flexibility and efficiency of use"; "aesthetic and minimalist design"; "helping users recognize, diagnose and recover from errors"; "help and documentation"; which present a formal way of enhancing usability in computerized systems. [19]

A study challenging the traditional usability engineering concepts and evaluation methods and their suitability for emerging technologies emphasizes the need for domain-specific heuristics. [20]. Usability heuristics for mobile applications have gained interest with the growing usage and application of mobile systems. In the same regard, research on heuristics for mobile applications has increased. A study was done to analyze the most used set of usability heuristics for usability evaluation for mobile devices by applying a systematic mapping of the related literature. The study recognized that Nielsen's traditional set of heuristics [19] is still widely used, though proposals for new heuristics for mobile interfaces have grown substantially[21]. In a study titled "Mobile Application Usability: Heuristic Evaluation and Evaluation of Heuristics", the researchers evaluated three (3) sets of usability heuristics for mobile applications. It was their concern that traditional usability evaluations are not mobile-specific and may result in mobile application usability issues[22]

A study modified Nielsen's ten (10) heuristics and developed a set of eleven (11) heuristics modified for touchscreen-based mobile devices[23]. Another study with a concern on the difficulties posed by the special traits and features of mobile devices, such as their portability, small screens, low resolution, finite amounts of processing power and memory, and data entry techniques, proposed the usability heuristics for touch screen based mobile devices[17]. These studies indicate the application of the popular general usability heuristics with a few additional to fit mobile applications. A study applied heuristic evaluation on a mobile money platform known as M-Paisa in Fiji. It recommended that mobile money user interfaces must be simple to use and aid users in quickly achieving their goals. The study applied the applied the following heuristics: "Aesthetic and Minimalist Design", "Speak the Users Language,"; "Consistency and Standards", "Provide Feedback", "User control and Freedom", "Ease of Input", "screen readability" as a step towards developing a set of guidelines for design of mobile money applications[24]. Another study of Venmo, a popular mobile payment, pay and request money feature, used interviews and usability testing to detect the consumer's pain points. The study recommended enhancing existing structures that users are familiar with rather than introducing entirely new systems when assessing usability for specific systems [25]. These studies guide the need and assessment of mobile money transfer systems based on usability heuristics**.**

3. Problem Definition

The development of applications has evolved with the introduction of mobile applications. Applications are now available for use on mobile devices, creating a new environment that changes as the user moves around and is applied through a smaller screen than the conventional systems. Various studies have indicated the growth of mobile money services as satisfying a need of consumers, especially about mobile money transfers. Consumers of mobile money services demand for an efficient and effective environment is growing as awareness of their system needs increases.

The usability of a system is key to consumer satisfaction. It is noted that the traditional usability heuristics need to be restructured to fit emerging technologies such as mobile applications. A number of cases have attempted to apply domain-specific heuristics to mobile applications, but a minimal number have gone further to mobile money systems. Though the heuristics developed by Jakob Nielsen still hold today, user additional needs and device characteristics need to be factored into consideration [26].

It noted that a number of studies have reviewed literature that determine domain-specific heuristics for mobile applications. It is almost clear that a good number of studies refer to mobile applications and are not specific to mobile money systems. Consumers' assessment of mobile money services based on usability heuristics is needed to scale up the number of respondents and provide more knowledge.

A higher number of respondents than the conventional method of a few evaluators provides enhanced statistical significance, greater variability, increased confidence in findings and deeper insights. System developers can apply this knowledge, Human-Computer Interaction practitioners, and trainers and can build on usability engineering required to improve MMTS consumer satisfaction and productivity.

The general objective of this study is to assess the usability of MMTS based on heuristics within a quality framework. It addressed the following questions:

- What is the level of usability of MMTS based on usability heuristics?
- What are the predominant usability challenges consumers to encounter when utilizing mobile money transfer systems to usability heuristics?
- How well do established usability heuristics apply to the assessment of mobile money transfer systems?

This study provides empirical findings regarding the usability of MMTS. It analyses the current situation of MMTS in Kenya in relation to usability heuristics evaluation. This study also provides empirical findings on the level to which usability heuristics applied in the assessment enhance mobile money transfer systems. This creates a background for creating a framework for usability heuristics for mobile money systems for improved development.

4. Methodology

This study adopted the critical realism philosophy that focuses on "explaining what we see and experience in terms of the underlying structures of reality that shape the observable events"[27]. A number of authors have identified critical realism as a good fit for the Design Science Research (DSR) approach. [28]. The study applied a mixed-method approach by applying a survey design for data collection and a DSR approach for the structure of the study.

The target population for this study was the consumers of mobile money services in Kenya in Nairobi County, Langata sub-county. The study used purposive sampling to select a county most likely to include different levels of income respondents using mobile money for various reasons. The sample size was statistically computed from the selected population using Taro Yamane's (1967) formula, which is a simplified formula for proportion[29]. The study employed a confidence level of 95% and an error margin of 0.05 using a target population of 35156. Using the above formula, a sample of 396 was applied.

The main instruments for data collection were consumer questionnaires divided into three parts: Background information used to identify the demographic information of the respondents, Consumer information in relation to the usage of Mobile Money Transfer systems, and Mobile money transfer system usability evaluation.

The validity and reliability of research instruments were adhered to for quality control. The face validity involved preparing a face validity form, selecting a panel of experts, reviewing response forms and compiling the responses in that order.[30]. The percentage agreement was 96%, meaning the face validity was valid[30]. The content validity ratio method was applied according to Lawshe(1975), and the Lawshe validity table was applied. Software developers, HCI trainers and frequent MMTS users assessed the questionnaire for content validity in this case.

The results were a Content Validity Ratio (CVR) value of 0.952, which means the content is valid according to the Lawashe table. For the reliability of the research instrument, the study focused on internal consistency reliability. A reliability test of the questionnaire items indicated a Cronbach's Alpha of .870 for 74 items.

Descriptive statistics was applied in assessing the mobile money transfer system's consumer demographics and data usage. Factor analysis was applied in the study, enabling the correlation of observed indicators to be modelled into a smaller number of components referred to as usability heuristics. Since the heuristics are not directly observed, they are inferenced from the indicators. This enabled the mapping of the indicators to their specific heuristics.

For ethical considerations, the respondents were, therefore, asked to make their decisions to participate in the study based on adequate knowledge of the study. All the participants in the research were asked to remain anonymous. The researcher also provided the respondent with information on the purpose of the study, the participants' expected duration and the procedures to be followed. All documents required by the authorities to approve the study were acquired.

5. Results and Discussion

This study used a set of usability heuristics to directly assess the current MMTS usability. According to the sample size required, 396 questionnaires were administered to respondents. From the 396 administered questionnaires, 361 questionnaires were administered to the respondents and physically received back duly filled according to the respondents' competence and inclination.

From this, 91.16% of questionnaires were filled and returned. And 8.84% of respondents did not return the questionnaires. From the 361 questionnaires returned, 11.1% had missing values and were therefore not considered for data analysis. The completed questionnaires were 81.1% and were considered and analyzed, implying a good response rate.

5.1. Demographic Information

Demographic information that includes respondents' gender, age, language used, type of job as per description, respondents owning phones, level of education, and ownership of smartphones are all described in the following section.

Findings on the respondents' gender are seen in Table 1- Gender of Respondents.

Table 1. Gender of respondents

Gender	Frequency	Percent
Male	167	52.0
Female	154	48.0
Total	321	100.0

Males are more than females by a difference of 4%, indicating a balance in the gender responding to the questions. This means a bias in gender is not an issue in the study's findings.

The study collected data on the respondent's age. It sought to find the distribution of the different age ranges among the respondents. The frequency and percent of the findings are presented in Table 2- Age of the respondents.

Table 2. Age of the respondents

Age Ranges	Frequency	Percent
25 and below	40	12.5
26 and below 36	83	25.9
36 and below 46	111	34.6
46 and below 60	75	23.4
60 and Above	12	3.7
Total	321	100.0

The highest number of respondents were between the ages of 36 years and 46 years of age. The lowest number of respondents were from the range of 6o years and above.

The study aimed to gather data on the language the correspondents use, and findings on the language are in Table 3- Language Used.

Table 3. Language used

Language	Frequency	Percent
English	290	90.3
Swahili	31	9.7
Total	321	100.0

Based on 3- Language Used, 90.3% said English is the language they prefer to use and speak best. For Swahili, 9.7% said Swahili is the language they prefer to use. This suggests that a majority of the respondents prefer to use English language other than Swahili.

The study gathered data on the career field or job categories relevant to the work respondents participate in regularly. The findings according to job areas were as follows: Agriculture, Livestock, Fisheries 8.1%, Art, Fashion, Recreation and Tourism, 8.4%; Business, Commerce, Sales and Marketing,10.3%, Communication, Media, Telecommunication and Transport, 5.6%; Computing and Information Technology, 5.6%; Education, Research and Academic Services, 5.0%; Engineering, Construction, Manufacturing, 9.0%; Government and Public Administration,7.8%; Health, Social and Community Services, 5,6%; Home and Family Services, 5.3%; Hotel and Food Industry, 7.8%; Legal Services, 6.5%; Management, Administration and Human Resource, 4.0%; Religious Services, 1.6%; other types of jobs, 9.3%. Business, Commerce, Sales and Marketing are job and career activities where the majority of the respondents work, with 33%.

The study area is cosmopolitan and well-known for business activities ranging from small businesses such as roadside kiosks selling groceries to garages and various companies. Given that business commerce, sales and marketing involves purchases, making payments and receiving payment, mobile money transfer systems are very useful.

Therefore, 33% indicates that the Business, Commerce, Sales and Marketing industries are the main users of Mobile Money Transfer Systems, as they can make payments for purchases and receive payments from buyers through MMTS.

The study purposed to determine whether the respondents owned phones. The findings indicate 100% phone ownership. This is in order because the respondents needed phones to use the mobile money services.

This means they can interact with mobile money services as Mobile Money Transfer Systems (MMTS) platforms offered by mobile network operators (MNO) for use in transacting with money.

5.2. Normality Test

Table 4. Normality test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
MMTS usability	.164	321	.003	.992	321	.000
a. Lilliefors Significance Correction						

The constructs pass the Kolmogorov-Smirnov and Shapiro-Wilk tests with a significant value of less than 0.05 in reference to Table 4: Normality Test. The constructs are significant, and this is according to the P-values for the normality test.

The P-values for the Kolmogorov-Smirnov and Shapiro-Wilk tests are 0.003 and 0.000, less than 0.05. According to the normality test, the data are not normally distributed; thus, the study utilized the non-parametric data analysis procedures.

The study collected data on the education level of the respondents. Table 5-Education Level Distribution, presents a summary of the findings.

Table 5. Education level distribution

Education Level	Frequency	Percent
High school and below	99	30.8
Middle-level college	33	10.3
University Graduate	86	26.8
Students in undergraduate/training	63	19.6
Other	40	12.5
Total	321	100.0

The distribution of respondents' educational levels, as shown in Table 5:Education Level Distribution, depicts that the highest number of respondents, 30.8% of the total, were in high school or below, and the lowest number, 10.3%, were in middle-level college.

The study aimed to identify whether respondents have smart or basic feature phones. The type of phone owned by the respondent indicates the user interface they interact with in making payments and receiving money using the mobile money transfer systems. The mobile money service is uploaded on the interface, meaning the phone type determines the look and feel of the MMTS as the consumer transacts.

Regarding smartphone ownership, 85% of the respondents claimed that they own smartphones, while 15% of the respondents claimed that they don't own smartphones (see Figure 1). This indicates that the Mobile Money Transfer system interface is determined by smartphone features that determine the application, such as the resolution, screen size, memory, and input method.

This implies that the majority of the respondents can interact with MMTS using smartphones while a minority can interact with MMTS based on a basic feature phone screen size, resolution and input method.

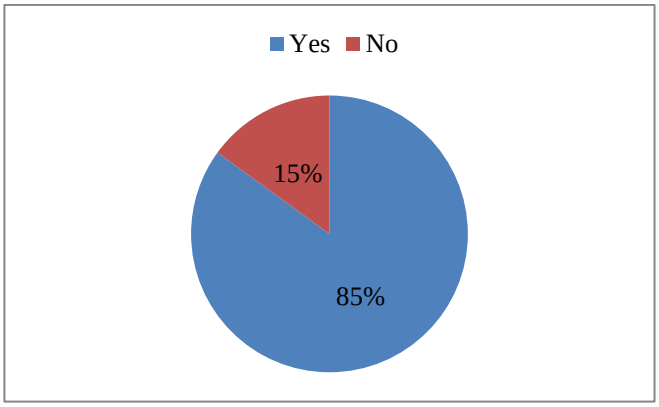

Fig. 1 Smartphone ownership

The study purposed to ascertain that respondents use the Mobile Money Transfer System. The findings indicate 100% system use by respondents. This indicates that all the respondents used MMTS to send and receive money. This implies that the respondents have experience using MMTS.

The study purposed to identify the name of the platforms of Mobile Money Transfer System services the respondents subscribed to (see Figure 2).

The analysis of Figure 2: Mobile Money Transfer System Subscription depicts that 90% of the respondents are using M-PESA MMTS while 10% of the respondents subscribed to AIRTEL MONEY MMTS. This implies that a majority of the respondents used M-PESA services other than any other MMTS.

This may be due to the fact the MPESA was the first mobile money transfer system in Kenya offered by Safaricom, the first mobile network operator in Kenya. Safaricom, being Kenya's first mobile network operator, has enjoyed a high subscription base. The success of MPESA may be ascribed to the simplicity of money transfers made possible by the widespread M-PESA agents[31]. A study on how to predict the adoption of mobile money use in developing countries indicates that mobile phone usage, the existence of M-Pesa users in a customer's ego network, and mobility are the most predictive characteristics[32].

From that study, there is an indication that MPESA is likely to continue dominating mobile money services in Kenya because of its high customer base. This study affirms MPESA's dominance in MMTS by its very high percentage in terms of subscriptions. Airtel Money is a 10% subscription, and in addition to MPESA, the two MMTS cover the subscription that participated in this study.

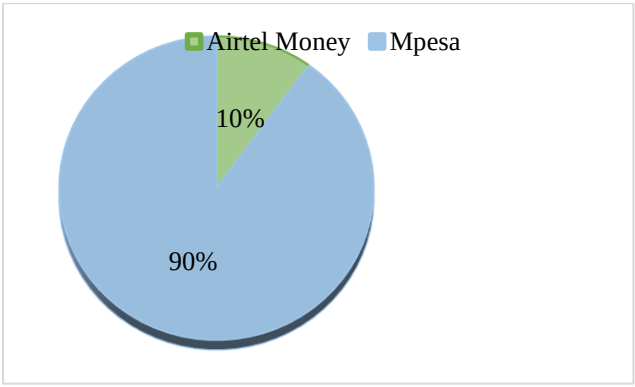

Fig. 2 Mobile money transfer system subscription

The study collected data on the Mobile Money Transfer System frequency. The results are highlighted in Table 6-MMTS frequency of use.

Table 6. MMTS frequency of use

Period	Frequency	Percent
Daily	161	50.2
Weekly	61	19.0
Monthly	52	16.2
Rarely	47	14.6
Total	321	100.0

The data summarized in Table 6- MMTS frequency of use depicts that 50.2% half the respondents use MMTS daily. This implies that most of the respondents are frequent users.

The study collected data on the average amount of money transferred using MMT Systems. The respondents were told to rate the amount they transferred from below 3000ksh to above 100000ksh. The findings are summarized in Table 7- Average Amount transferred using MMT Systems.

Table 7. Average amount transferred using MMTS

Average	Frequency	Percent
Ksh. 3000 and below	146	45.5
Ksh 4000 to 10000	59	18.4
Ksh. 10001 to 50000	56	17.4
Ksh. 50001 to 100000	37	11.5
Above Ksh.100000	23	7.2
Total	321	100.0

The analysis in Table 7 shows that 45.5% of the respondents claimed that they transfer 3000 Ksh and below; this implies that the majority (45.5%) of the respondents transfer an average of 3000Ksh using MMTS, while very few, 7.2% of the respondents can transfer above 100000Ksh by using MMT Systems. This might be due to the income they receive and the type of business they do.

The study sought to determine the respondents perceived benefits from MMTS (see Figure 3). Based on Figure 3, 31% of the respondents claimed that they use the Mobile Money Transfer system because it saves cost, 30% of the respondents pointed out that MMTS saves time, 25% of the respondents claimed that they used MMTS because it was 24 hours accessible while 14% of the respondents claimed that they use MMTS because of physical security. This implies that the majority of the respondents use MMTS because of cost-saving and time-saving. However, the analysis shows that 14% of the respondents feel physically secure using MMTS, as depicted in the distribution.

5.3. Mobile Money Transfer Systems Usability Heuristic

The study purposed to assess the usability of the MMTS systems. The study was guided by learnability, efficiency, satisfaction, error management and memorability quality components for a user-friendly mobile application environment context. Within this framework, Nielsen's ten (10) usability heuristics plus an additional three (3) regarded as suitable for mobile interfaces([33] guided the assessment. These heuristics included: "Visibility of System Status", "Match Between System and the Real World", "User Control and Freedom", "Consistency and Standards", "Error prevention", "Minimize user memory load", "Customization and shortcuts", "Efficiency of use and performance", "Aesthetic and minimalist design", "Helping users recognize, diagnose and recover from errors, Help and documentation", "Pleasant and respectful interaction with the user" and "Privacy"[35] The indicators or variables for the heuristics were adopted from a general heuristic evaluation checklist that has been applied frequently for assessing usability factors and covers all the listed usability heuristic guiding the study[36] The findings are presented in this section.

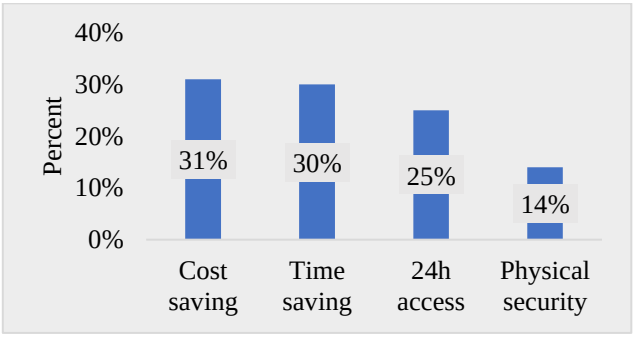

Fig. 3 Mobile money transfer system benefits

5.3.1. Assessment of Suitability of the Data for Factor Analysis

Factor analysis is especially helpful for identifying the factors that underlie variables by grouping related variables into one component[37]. In this study, the main focus is reducing the number of usability indicators into usability heuristic components. The Kaiser-Meyer-Olkin sampling adequacy measure and Bartlett's test of sphericity were used to determine whether the sampled data was appropriate for factor analysis. Table 8: KMO and Bartlett's Test presents the results.

Table 8. KMO and bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.780
Bartlett's Test of Sphericity	Approx. Chi-Square	1846.831
	Df	55
	Sig	.000

The value of the Kaiser-Meyer-Olkin Measure of Sampling Adequacy, as shown in Table 8 - KMO and Bartlett's Test, is 0.780. This suggests that 78.0% of the data are acceptable for factor analysis. However, the significant (p) result of Bartlett's test of sphericity is 0.000, which is less than 0.05. Data are sufficiently diverse, scalable, and capable of being submitted to factor analysis if they have a KMO value of more than 0.6 and a significant Bartlett's test of sphericity value. As per the results, there is enough information in the study's data to conduct a factor analysis.

5.3.2. Factor Extraction

Finding the fewest number of factors necessary to accurately capture the relationships between the collection of variables is referred to as factor extraction. There are several methods for identifying the underlying factors[36]. Principal Component Analysis was used in this study. Large datasets are more prevalent than ever and are frequently challenging to interpret. A method for lowering the dimensionality of such datasets, boosting interpretability while also limiting information loss, is Principal Component Analysis (PCA)[38].

For this study, the respondents were given a usability checklist with 74 items or seventy-four (74) different indicators to rate on a scale of Strongly agree (1) to Strongly disagree (5). These indicators are in the context of usability heuristics applied in systems' heuristic evaluation. To determine the principal components and their supporting indicators the responses were organized and classified using factor analysis to determine the principal components and their supporting indicators.

The main result of principal components analysis is the rotated component matrix, often known as the loadings. Estimates of the correlations between every variable and the estimated components are included. Principal Component Analysis was used. The output is summarized in Table 9:Indicators Mapping onto Components.

Table 9-Indicator Mapping onto Components provides the number of indicators that converged to each component and their respective factor loading. The components were named according to the descriptions of their indicators. The names can be seen in Table 10: Components names.

Table 9. Indicator mapping on components

Component No	No of Indicators	The Respective Factor Loadings for the Indicators
1	8	.801, .731, .900, .743, .689, .694, .630 ,.900
2	7	.563, .729, .754, .791, .976, .976, .909.
3	6	.909, .976, .975, .975, .942, .942.
4	6	.882, .866, .860, .851, .851, .809
5	5	.928, .928, .873, .873, .792
6	6	.862, .862, .901, .901, .910, .910.
7	4	.938, .938, .928, .928.
8	5	.801, .752, .863, .877, .844
9	5	.961, .961, .895, .895, .961.
10	5	.955, .955, .886, .886, .861
11	6	.793, .845, .802, .802, .826, .744.
12	6	.827, .728, .839, .875, .858, .759.
13	5	.894, .585, .650, .549, .900

Table 10. Component names

Component No	No of Indicators	Component name (Heuristics)
1	8	“visibility of the system status”.
2	7	‘Match Between System and the Real World’.
3	6	‘User Control and Freedom’.
4	6	‘Consistency and Standards’
5	5	‘Error Prevention’.
6	5	‘Minimize User Memory Load’
7	4	‘Customization and Shortcuts’
8	5	‘Efficiency of Use and Performance’.
9	5	‘Aesthetic and minimal design’.
10	6	‘Helping Users Recognize, Diagnose and Recover from Errors’.
11	6	‘Help and Documentation’
12	6	‘Pleasant and respectful interaction with the user’.
13	5	‘Privacy’.

Based on a scale of Strongly agree (1) to Strongly disagree (5), the respondents rated the different indicator statements under the components. The analysis is as indicated in Table 11- Rating of Indicators.

Table 11. Rating of indicators

Component name (Heuristic)	PERCENTAGES							
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Percent Total	Total Agreed	Total Disagreed
"visibility of the system status".	43.9	46.8	9.3			**100**	90.7	0
'Match Between System and the Real World'.	45.8	43.9	10.3			**100**	89.7	0
'User Control and Freedom'.	0.9	4.7	16.8	48.6	29	**100**	5.6	77.6
'Consistency and Standards'	29.3	47.7	17	4.4	1.6	**100**	77	6
'Error Prevention'.			15.9	48.9	35.2	**100**	0	84.1
'Minimize User Memory Load'	43.3	46.1	10.6			**100**	89.4	0
'Customization and Shortcuts'	33.6	56.4	10			**100**	90	0
'Efficiency of Use and Performance'.	44.2	50.8	5			**100**	95	0
'Aesthetic and minimal design'.	45.2	48.9	5.9			**100**	94.1	0
'Helping Users Recognize, Diagnose and Recover from Errors'.			16.8	42.7	40.5	**100**	0	83.2
'Help and Documentation'	34.9	51.1	10.3	3.7		**100**	86	3.7
'Pleasant and respectful interaction with the user'.	37.7	42.1	14.3	5.9		**100**	79.8	5.9
'Privacy'.			11.5	30.6	57.9	**100**	0	88.5

Based on the analysis of the level of agreement, the MMTS keeps the user informed about all processes and state changes through comments and within a reasonable time frame. This is because 90.7% of the respondents agreed on the 'visibility' heuristic. 89.7% of the respondents agreed on the 'Match between the system and real world' heuristic,, which implies that the MMT System speaks the users' languages and does not use technical terms of the system. Moreover, 77% of the respondents agreed on the 'consistency and standards' heuristic. This implies that the MMTS allows the users to do things in a familiar, standardized and consistent way.

The MMTS provides actions and options to prevent users from memorizing information when using the system since 89.4% of the respondents agreed on the 'minimize user memory load' heuristic. Also, it's evident that the MMT System provide basic and advanced settings for setting and customizing shortcuts for frequent actions since 90% of the respondents agreed on the 'customization and shortcuts' heuristic. Furthermore, 95% of the respondents agreed on the efficiency of use and performance; this implies that the system can load and display information in a reasonable amount of time and minimize the steps required to perform a task. The MMTS avoids displaying unwanted information by overloading the screen since 94% of the respondents agreed on the 'aesthetic and minimalist design' heuristic. 86% of the respondents agreed on the 'help and documentation' heuristic, and this implies that the MMTS provides documentation that is easy to find and help, focusing on the user's current task and indicating concrete steps to follow. On the 'pleasant and respectful interaction with the user' heuristic, 79.8% agreed on it. This implies that the MMTS provide a pleasant iteration with the user so that the user does not feel uncomfortable using the system.

On the other hand, 77.6% of the respondents disagreed with the 'control and freedom' heuristic. This implies that the MMTS does not allow users to undo and redo their actions and provide 'emergency exits' clearly pointed out, of leaving un-wanted states. Also, the MMTS does not display error messages in a familiar language to the user, accurately indicating the problem and suggesting a constructive solution. This is because 83.2% of the respondents disagreed with the 'helping users recognize, diagnose and recover from errors' heuristic. 84.1% of the respondents disagreed with the 'error prevention' heuristic. This implies that the MMTS does not hide or disable unavailable features. The MMTS does not protect the user's confidential data. This is because 88.5% of the respondents disagreed with the 'privacy' heuristic.

The analysis process of the data collected from consumers provided the findings of the study based on the objectives of assessing and enhancing MMTS. First, the factor loadings to different components identified and named the heuristics as per the indicators' relation to MMTS. Secondly, the ratings of each indicator in the component determined the usability heuristics required to enhance MMTS. They identified them as user control and freedom, helping users recognize, diagnose and recover from errors, error prevention and privacy. These heuristics are, therefore, very necessary when assessing the usability of mobile money transfer systems during development.

6. Conclusion

The study investigated the current MMTS based on demographic data and usability heuristics. This objective was achieved by collecting consumer data on the demographics and evaluating MMTS based on a usability checklist. This study has assessed the gender, age, level of education, job area and the language used as the demographic background of the respondents. In addition, an assessment of the type of phone used and the benefits of using MMTS is recorded. Respondents rated usability indicators enabling an analysis of heuristics that provided quality usage to consumers and noted the heuristics required to enhance usage. Due to the growing popularity of mobile money, additional knowledge on usability is key to developing quality systems. This knowledge benefits system developers, HCI professors and researchers for effective heuristics evaluation of mobile money systems and for reducing development costs. These provide an assessment of the usability of MMTS that can be used to develop a usability heuristic framework for mobile money platforms and for further study.

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