Usability Analysis of E-Commerce Mobile Applications

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Article Info

Abstract

E-commerce has completely transformed the way people purchase; it is therefore expedient to prioritize methods for enhancing the user-friendliness of e-commerce applications. Despite the development of e-commerce mobile applications, there exists a substantial vacuum in comprehensive usability evaluations, impeding the improvement of user experiences. Users confront different hurdles, ranging from navigation issues and inadequate search functionality to arduous checkout procedures, which might potentially dissuade them from completing transactions. Due to lack of extensive work on e-commerce apps used by Nigerians, there is lack of understanding regarding how to effectively tackle the usability difficulties observed in e-commerce mobile apps in Nigeria. This research aims to address these gaps by measuring three key usability metrics: Efficiency, Effectiveness, and User Satisfaction on three commonly used e-commerce apps in Nigeria which are Konga, Jumia, and AliExpress. The research approach employed in this study involves a combination of survey and direct observation. The findings indicated that the Jumia e-commerce app is rated better than the AliExpress and Konga app in terms of efficiency, effectiveness, and user satisfaction due to its user-friendly interface, effective data handling and smooth navigation. AliExpress also demonstrated exceptional performance while the Konga app received the lowest ratings across the three usability metrics. In summary, the study underscores the need for user-centric design and ongoing improvement in e-commerce mobile applications in Nigeria. It stresses the value of investing in usability advancements to retain and ensure consumer satisfaction.

1.0. Introduction

Although the concept of e-commerce has been around for a long time, it is still an extraordinarily fresh and continually expanding industry of technology. Therefore, e-commerce is often characterized differently in distinct circumstances. Electronic commerce or e-commerce refers to a vast range of online commercial activities for products and services. It also pertains to "any form of economic transaction in which the parties interact electronically rather than by physical transactions or direct physical contact [1]. E-commerce is in the midst of a new phase of strong entrepreneurial activity based on on-demand services, social networks and the mobile platform afforded by smart phones and tablet computers and plays a fundamental role in knowledge economy. Knowledge economy is an economy where there is a high dependence on knowledge, information, and high skills, and the increasing need for ready access to all these by the business and public section [2][3][4]. These technological and social behaviors are bringing about extraordinary changes to our personal lives, markets, industries, individual companies, and society as a whole. E-commerce is providing thousands of new jobs in all areas from marketing to management, entrepreneurial studies,

and information systems [1]. [5] reports a significant surge in E-commerce in recent years, resulting in the elimination of regional barriers and transforming the way people shop.

Several crucial factors have fueled the unprecedented growth of e-commerce. According to [6], wide use of smartphones and high-speed internet has permitted simple online purchasing, making it easier and more comfortable for customers. Mobile marketing has emerged as a strong component, with over 70% of all retail website visits currently coming from mobile devices. [7] noted that consumers are searching for ease, variety and cost. E-commerce platforms address these desires by delivering a greater assortment of items, frequently at cheaper costs than conventional storefronts. Furthermore, internet buying gives greater freedom and autonomy, enabling customers to purchase from the comfort of their house [7]. [8] acknowledged that-commerce gives enterprises a cost-effective means to reach a broader audience, decrease operational expenses, and tailor the customer experience, but it also increases competition and needs ongoing innovation on the development of online consumer behavior [8]. [9] states that consumers benefit from improved convenience, larger product options, and competitive prices via e-commerce. However, issues regarding data privacy, cyber security, and product integrity remain difficult to solve. Brick-and-mortar retailers confront the problem of competing with the convenience and flexibility afforded by internet platforms. To stay relevant, omnichannel solutions that blend online, and physical purchasing experiences must be deployed and enhanced [10].

Jumia, Jiji, Konga, Slot, and Shopify are some of the most well-known e-commerce platforms in Nigeria. The financial reports of these initiatives are the cause of the development of the e-commerce business. Today, the e-commerce business is expanding its horizons to satisfy clients. When e-commerce is mentioned, the emphasis is on these interfaces of online and mobile apps and depending on the user interface, buyers assess the program on the first go. The change towards mobile platforms has deep effects for social processes and human behavior. One noticeable feature is the change in contact habits [11]. Social media apps and message platforms rule the mobile environment, enabling immediate contact and interaction. The widespread use of smart phones has also changed how individuals receive information, with news, pleasure, and educational material being easily available at one's fingers [12]. Furthermore, the merging of mobile platforms into various industries, such as e-commerce, healthcare, and education, has simplified processes and enhanced accessibility [13]. Mobile apps act as catalysts for creativity, offering answers to social issues and transforming standard models. The spread of mobile platforms can be linked back to the rise of powerful and feature-rich smart phones [14]. The small yet powerful computing powers of these devices have changed the nature of technology usage. The mobile environment, made of apps and services, has become an important part of our lives [15]. The abundance of smart phones and tablets has overcome physical borders, allowing users to interact with technology effortlessly. Moreover, the fast development of mobile networks, moving from 3G to 4G and now 5G, has improved connection and data transfer speeds [15]. This has further sparked the change towards mobile platforms, allowing smooth viewing, real-time conversation, and engaging online encounters. The merging of these technological advances creates an environment that is both dynamic and powerful.

Challenges, especially for tiny devices, also need to be addressed, such as limited battery life, small display, sluggish internet connection, etc., because they turned out to be key difficulties while investigating the usability of the mobile application. User happiness substantially counts in online shopping since the method the application visualizes their goods and details entice the buyer. However, usability testing is fundamentally different from black-box and white-box testing since they focus on functional concerns. Usability testing tries to examine the ease of the application's

user interface [16]. The application might be web-based or mobile. Usability testing is primarily concerned with meeting application objectives such as ease of use, adaptability, and controllability. This usability testing is usually advised at the early stages of development to ensure that user expectations are met. People notice the flexibility and process when they visit an application; thus, the customer wants to test out new pages and find out different facts linked to their product. As a tester of that program, the first thing to take care of is the navigation and flow of the application and next is the user interface. To build a positive image of the application, the user interface must be consistent throughout all the pages, as e-commerce apps keep updating based on daily demands and promotional offers. Some major issues in usability testing of e-commerce apps include code compatibility and portability, as they are accessible on multiple platforms (mobile, computer, tablet, etc.) and operating systems (Windows, mac OS, Android, IOS, etc.).

This study attempts to determine the elements that impact the usability of e-commerce online and mobile applications. The analysis will be based on the experience of certain three renowned e-commerce firms in Nigeria. With the use of surveys, the study examined how simple it is for individuals to use various shopping applications, ease of discovering products, how the app looks, and its functionality. The study also conducted more usability tests to further determine areas of improvement.

2.0 Review of Relevant Literature

[17] investigated the usability of e-commerce applications with the aim of identifying methods to enhance their usefulness. They used survey questionnaires as their methodology while internet tools were used to analyze websites based on four parameters: Connectivity, Readability, Accessibility, and Functional Performance. According to the survey, Amazon, Flipkart, Bigbasket, and Paytm were the top four e-commerce applications in terms of popularity.

[18] study conducted a comprehensive analysis of the current body of literature on the evaluation of usability in mobile applications and provided valuable suggestions. The researchers examined the main elements that are commonly taken into account when evaluating the usability of mobile apps. They also discussed various alternative methods that have been suggested for this purpose. Their research work indicated that no individual model can comprehensively address all areas of usability. Therefore, it is imperative to employ multiple models to conduct a comprehensive examination of the system's usability.

[19] conducted research to compare the mobile shopping apps, ASOS and Amazon, in terms of their usability and user experience. Finding major usability flaws and problems encountered by users was the primary goal of the research, which also sought to provide design suggestions and tactics to fix these problems and enhance the user experience generally. Researchers used a mixed-methods approach, looking at usability data, conducting interviews, heuristic evaluations, and user testing. The key findings showed that the Amazon and ASOS mobile apps had many serious usability issues, such as complicated navigation, no social features, and difficult account creation.

[20] evaluated the user-friendliness of two popular mobile e-commerce apps in Malaysia, namely Shopee and Lazada. A combination of user testing and heuristic evaluation was employed to identify usability issues and areas requiring improvement. The study revealed some noteworthy usability problems that had an impact on user satisfaction. The primary issue was the lack of consistency in navigating between app pages, which resulted in unpredictability for consumers. The research

findings underscore the importance of having well-structured information, user-friendly sites, and a streamlined checkout process when creating mobile interfaces.

[21] conducted a comparative usability research where they used Nielsen's heuristic evaluation approach to evaluate the interfaces of the Wish and Geek shopping apps. The findings indicated that both applications exhibited multiple violations of usability principles. The main issues were the lack of clarity in category labels, which resulted in an ineffective grouping of objects, and the uncertainty in taxonomy and information architecture. Consequently, the utilization of a logical artificial intelligence (AI) system made the process of browsing and searching difficult. The researchers proposed enhancements to enhance usability by addressing the heuristic violations they identified.

[22] conducted research to evaluate the usability and user experience of four mobile shopping applications in Brazil. The study aimed to identify important usability problems and areas of dissatisfaction and to provide design recommendations for enhancing the overall user experience. The research highlighted many problems, including the absence of clear categorization of product categories, inconsistent labeling and navigation, insufficient visual consistency and coherence, crowded layouts, and poor feedback systems. Overall, the research gives significant information on the difficulties that Brazilian mobile shopping app users have and presents a series of recommendations for improving app design to overcome these hurdles.

3.0 Methodology
This section describes the Research Design, Population and sampling, Research Instrument, and method of data collection and analysis.

3.1 Research Design
The research design used is the descriptive research design. The study focused on three key usability metrics of three e-commerce applications which include Efficiency, Effectiveness, and User satisfaction. The research method adopted in this study is the combination of survey and direct observation.

3.2. Study Area
This research was conducted at the University of Benin, Benin City, Ugbowo Campus.

3.3. Population, Sample and Sampling Technique
The population of the study consists of students, employed individuals, and entrepreneurs in the University campus. A purposive sampling technique was used. A purposive sample is a non-probability sample that is selected based on the characteristics of a population and the objective of the study. A purposive sampling technique was used so as to get accurate and consistent results. The goal was to eliminate/prevent people who are novices or have no idea of e-commerce apps from participating in the study. The focus was on using respondents with average knowledge and intermediate experience with at least one e-commerce app. This study used a sample size of forty (40) respondents. A sample size of forty (40) was used because a sample size below this number might not provide good coverage to carry out detailed analysis, thereby resulting in inconclusive results. A sample size greater than forty (40) was not used because of time constraints as it would take more time to conduct a laboratory usability test for more than forty (40) people.

3.4. Research Instrument

The research instrument used was a questionnaire. The questionnaire was divided into two sections. The first section comprises of demographic questions relating to participants' age, gender, and level. The second section consists of 14 questions that relate to the overall usability and satisfaction rate of the e-commerce apps.

The five-point Likert scale was adopted in the questionnaire. The possible responses to the questions are; Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree and they have a coded value of 1, 2, 3, 4, and 5 respectively. The questionnaire was printed on paper and was directly administered by the researchers.

3.5. Validity and Reliability of the Instrument

The research instrument was accessed by experts to determine its appropriateness. The instrument was subjected to both Face and Content validity. Face validity was conducted to evaluate the appearance of the questionnaire in terms of feasibility, readability, consistency of style and formatting, and clarity of language used. Content validity involves detailed and concise examination of the test contents (items in the questionnaire) to determine if they give a good coverage of the domain to be measured. To ensure the reliability of the instrument, the questionnaire was pilot tested with four (4) participants randomly selected from the sample. They provided clarity and understanding on some items. Their responses were used to refine the instrument before administering to the rest of the sample

3.6 Method of Data Collection

First, the study prepared a usability test plan and crafted a test script (Usability test tasks) which ensured that the usability test was organized smoothly. A Laboratory Usability test was conducted. The laboratory usability test was chosen over the remote usability test as it will enable the researcher to directly observe and record the participants as they conduct the test.

Respondents were briefed about the details and purpose of the test and were provided with a list of tasks that needed to be tested. A total of Three (3) task criteria need to be accomplished. They were asked to:

- Create an account on each e-commerce application
- Search for a product and add it to the cart.
- Check out the product.

While the respondents carried out the tasks, the observation technique was used to record task completion rates and times, and the think-aloud protocol was employed to collect feedback. After the tasks were completed, the respondents were given a questionnaire to fill. The questionnaire was administered to all the respondents to get a response from them on their perception of the usability of the apps. The researchers administered the questionnaire physically. The purpose of the questionnaire was explained to the respondents, and after responding to the questionnaire the respondents submitted their responses someday.

3.7. Method of Data Analysis

The data obtained in this study was analyzed and interpreted using simple tables, charts, frequency, and percentages. These statistical tools were used because they are suitable means of breaking down, clarifying, and easily comprehending generated data. Participants' questionnaire outcomes were statistically examined and presented as percentages to indicate overall user satisfaction rates.

To analyze the Efficiency and Effectiveness of the apps, some formulas were adopted. These formulas were adopted from the literature reviewed as they are known to provide accurate results.

Efficiency Analysis

The formula for calculating the overall relative efficiency was adopted. The overall relative efficiency uses the ratio of the time taken by the users who completed the task in relation to the total time taken by all users. The formula is:

$$Overall\ Relative\ Efficiency = \frac{\sum_{j=1}^{R}\sum_{i=1}^{N} n_{ij}t_{ij}}{\sum_{j=1}^{R}\sum_{i=1}^{N} t_{ij}} \times 100\%$$

(1) [23]

Where:

N = The total number of tasks (goals)

R = The number of Users

nij = The result of task i by user j; if the user successfully completes the task, then nij = 1, if not = 0

tij = The time spent by user j to complete task i. if the task is not completed, then time is measured till the moment the user quits.

Illustration

Task: [enter task] (N)

User (R)	Completed (nij)	Time to complete (tij)	Total
User 1	yes (1) / no (0)	[enter seconds]	= nij *tij
User 2	yes (1) / no (0)	[enter seconds]	= nij *tij
User 3	yes (1) / no (0)	[enter seconds]	= nij *tij
User 4	yes (1) / no (0)	[enter seconds]	= nij *tij
Total	[leave blank]	Sum of tij	Sum of Total

Total overall relative efficiency (%) = (Sum of Total / Sum of tij) x 100

Effectiveness Analysis

Effectiveness can be calculated by measuring the completion rate, and can thus be represented as a percentage by using this simple equation by [23]:

Effectiveness (%) = $\frac{Number\ of\ tasks\ completed\ successfully}{Total\ number\ of\ tasks\ undertaken} *100$ (2) [23]

4.0 Data Presentation and Analysis

A total of forty (40) respondents were used and laboratory usability testing was conducted, and afterward, a total of one hundred and twenty (120) questionnaires were distributed to all the respondents (three questionnaires per participant). All the questionnaires were filled and returned, all were found usable.

4.1 Participants' Characteristics and Classification

Table 1 presents detailed information about the respondent's personal data. Amongst them, 23 (57.5%) are male, while the remaining 17 (42.5%) are female. 21 respondents, which account for

52.5% of the total are between the ages of 16 and 20, 13 respondents (32.5%) are between the ages of 21 and 24, while the remaining 6 respondents which makes up 15.0% are above 24 years. 4 respondents, which represent 10% of the total are in 100lvl, 9, (22.5%) are in 200level, 11 (27.5%) are in 300level, 13 participants (32.5%) are in 400level and 3 respondents which account for 7.5% are in 500level and 600level respectively.

Table 1 Personal information of participants

S/N	Variables	Category	Frequency	Percentage%
1	Gender	Male	23	57.5
		Female	17	42.5
2	Age	16-20	21	52.5
		21-24	13	32.5
		Above 24	6	15.0
3	Level	100	4	10.0
		200	9	22.5
		300	11	27.5
		400	13	32.5
		Above 400	3	7.5

4.2 Task Completion Rate and Time

The usability testing phase of the study comprises of three task criteria, which include:
1. Create an account on each of the three e-commerce apps (Konga, AliExpress, and Jumia).
2. Search for a product and add it to cart
3. Add delivery details and checkout the product.
Table 2, Table 3 and Table 4 show the time taken (secs) to complete each task on the different apps as recorded by the researchers.

Table 2: Time spent on task using the Konga mobile app.

Time (seconds) vs. Total number of participants (40)						
Tasks	1-20	21-40	41-60	61-80	81-100	>100
Task 1	0	4	9	11	2	14
Task 2	0	18	15	5	2	0
Task 3	0	5	5	3	6	21

Results in Table 2 shows that most of the respondents completed tasks 1 and task 2 on the Konga app within the first 100 seconds. The longest time was spent on task 3 as the majority of respondents spent over 100 seconds to accomplish the tasks and some gave up along the line. Some respondent stook longer time to complete the tasks as they met with difficulties or got confused with the features. Most of the respondents encountered some difficulties in the account creation and checkout phase. Some of them had to wait for a longer time for the verification code to be sent to their lines during the registration process. On the other hand, during checkout, some of the respondents came across challenged such as adding and selecting a delivery address as the app kept bringing up unnecessary error messages.

Table 3: Time spent on task using the AliExpress mobile app.

Time (seconds) vs. Total number of participants(40)						
Tasks	1-20	21-40	41-60	61-80	81-100	>100
Task 1	2	8	10	5	2	13
Task 2	5	13	12	10	0	0
Task 3	3	6	7	1	7	16

As observed in Table 3, participants/respondents spent less time completing the tasks as compared to that of the Konga mobile app. Tasks 1, 2, and 3 were completed within twenty (20) minutes by two (2), five (5) and three (3) respondents respectively. A total of thirteen (13) and sixteen (16) respondents, which amounts to 32.5% and 40% respectively, required more than one hundred (100) seconds to complete tasks 1 and 3 on the app or to keep trying until they give up.

Table 4: Time spent on task using the Jumia mobile app.

Time (seconds) vs. Total number of participants(40)						
Tasks	**1-20**	**21-40**	**41-60**	**61-80**	**81-100**	**>100**
Task 1	1	3	16	3	4	13
Task 2	6	32	2	0	0	0
Task 3	0	8	15	11	4	2

Table 4 reveals that a larger percentage of participants/respondents were able to complete the tasks within the first one hundred (100) seconds. This is as a result of the Jumia mobile app having good information layout, speed, and load time. Most of the participants had a relaxed look on their faces while interacting with the app. The account creation process is more detailed on the Jumia mobile app as it includes different verification segments. Despite the long process, 27 participants (67.5%) were able to finish within one (i) to one hundred (100) seconds. No participant required more than 60 seconds to search for a product and add it to cart, and finally, thirty-eight (38) participants (95%) were able to check out the product within the first one hundred (100) seconds, while two (2) participants (5%) required more time.

4.3 Effectiveness Analysis
This section presents the analysis of the Effectiveness of the Konga, AliExpress, and Jumia e-commerce mobile apps.

To calculate the effectiveness of each mobile app, direct observation was employed in order to monitor the participants and take count of those who complete the tasks and also the count of those who didn't complete it.

Effectiveness was calculated by measuring completion rate and then computing the value with the equation below by [23]:

$$\text{Effectiveness (\%)} = \frac{Number\ of\ tasks\ completed\ successfully}{Total\ number\ of\ tasks\ undertaken} * 100 \qquad (3)\ [23]$$

4.3.1 Effectiveness Analysis of Konga app
For Task 1 (Account creation), a total of thirty-four (34) participants (85%) were able to complete it. Six (6) participants (15%) were not able to create an account as they encountered different issues and challenges. The most prominent challenge was them waiting forever, yet not receiving the verification code needed to complete the registration. So, we have the effectiveness as:

Effectiveness (Task 1) = (34/40) × 100 = 85%

Thirty-eight (38) participants (95%) were able to successfully complete Task 2 (Product search and add to cart). The remaining two (2), which amount to 5% couldn't add the product to cart because whenever they tried to search for a product, the page kept loading nonstop without displaying the information needed and after trying for a while, they quit. We have the effectiveness calculation as:

Effectiveness (Task 2) = (38/40) × 100   = 95%

Conclusively, thirty (30) participants (75%) were able to add their delivery address and checkout the product without quitting. Ten (10) participants (25%) couldn't complete this task. Six (6) of them were those who couldn't create an account and checkout is impossible without having an account, two (2) of them couldn't search for and add a product to cart, and the remaining two experienced other issues which hindered their completion of the task. We have the effectiveness calculation of Task 3 as:

Effectiveness (Task 3) = (30/40) × 100   = 75%

The summary of the computation is shown in Table 5while Figure1shows the graphical representation as a bar chart.

Table 5: Effectiveness rating of the Konga E-commerce app per task

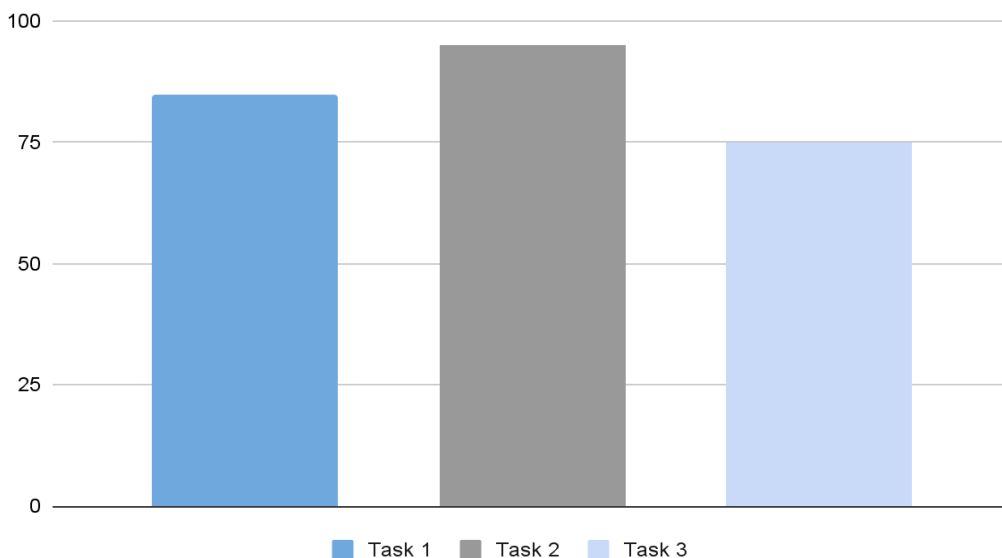| Tasks	Effectiveness(%)
Task 1 (Create an account)	85
Task 2 (Search for a product and add to cart)	95
Task 3(Checkout a product)	75

Figure 1: Bar chart showing the Effectiveness ratings of the three tasks on Konga app

Table 5 shows the Effectiveness percentage calculated after conducting a usability study on the Konga mobile app. We can see that 85% of the participants were able to complete Task 1, while

95% of the participants completed Task 2, and 75% completed Task 3. Forty (40) participants carried out three tasks each, which sums up to a total of one hundred and twenty (120) entries. A total of one hundred and two (102) tasks were completed successfully, which brings the overall effectiveness of the Konga app to:

Overall Effectiveness = (102/120) × 100   = 85%

4.3.2 Effectiveness Analysis of AliExpress App
For Task 1 (Account creation), a total of thirty-four (34) participants (85%) were able to complete it. Six (6) participants (15%) were not able to create an account as they already had accounts on the app before, and they found out the accounts had been deactivated because they had not been using it for a while. They were instructed to recover their respective accounts and log in, but it didn't work out.

Effectiveness (Task 1) = (34/40) × 100   = 85%

Thirty-eight (38) participants (95%) were able to successfully complete Task 2 (Product search and add to cart). The remaining two (2) which represent 5% of the total participants couldn't add the product to cart because whenever they tried to search for a product, the page kept loading nonstop without displaying the information needed, and after trying for a while, they quit. We have the effectiveness calculation as:

Effectiveness (Task 2) = (38/40) × 100   = 95%

Conclusively, thirty-three (33) participants (82.5%) were able to add their delivery address and checkout the product without quitting. Seven (7) participants (17.5%) couldn't complete this task. Six (6) of them were those who couldn't create an account and checkout is impossible without having an account, the remaining one (1) experienced other issues which hindered their completion of the task. We have the effectiveness calculation of Task 3 as:

Effectiveness (Task 3) = (33/40) × 100   = 82.5%

The summary of the computation is shown in Table 6 while Figure 2 shows the graphical representation as a bar chart.

Table 6: Effectiveness rating of the AliExpress e-commerce app per task

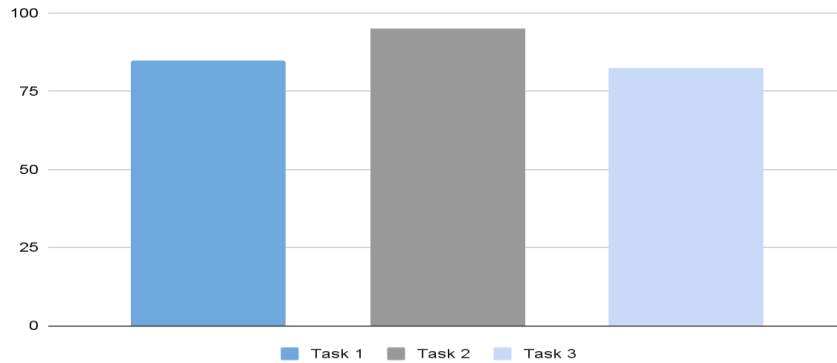| Tasks	Effectiveness (%)
Task 1 (Create an account)	85
Task 2 (Search for a product and add to cart)	95
Task 3 (Checkout a product)	82.5

Figure 2: Bar chart showing the Effectiveness ratings of the three tasks on AliExpress app

Table 6 shows the Effectiveness percentage calculated after conducting a usability study on the AliExpress mobile app. We can see that 85% of the participants were able to complete Task 1, while 95% of the participants completed Task 2, and 82.5% completed Task 3.Forty (40) participants carried out three tasks each, which sums up to a total of one hundred and twenty (120) entries. A total of one hundred and five (105) tasks were completed successfully, which brings the overall effectiveness of the AliExpress app to:

Overall Effectiveness = (105/120) × 100 = 87.5%

4.3.3. Effectiveness analysis of Jumia app

For Task 1 (Account creation), a total of thirty-seven (37) participants (92.5%) were able to complete it. Three (3) participants (7.5%) were not able to create an account as they experienced different hindrances during the signup process.

Effectiveness (Task 1) = (37/40) × 100 = 92.5%

Thirty-nine (39) participants were able to successfully complete Task 2 (Product search and add to cart). The remaining one (1) couldn't add the product to cart due to severe network issues and after trying for a while, they quit. We have the effectiveness calculation as:

Effectiveness (Task 2) = (39/40) × 100 = 97.5%

Conclusively, thirty-eight (38) participants were able to add their delivery address and checkout the product without quitting. Two (2) participants couldn't complete this task as a result of their unsuccessful account creation.

Effectiveness (Task 3) = (38/40) × 100 = 95%

The summary of the computation is shown in Table 7 and Figure3 shows the graphical representation as a bar chart

Table 7: Effectiveness rating of the Jumia e-commerce app per task

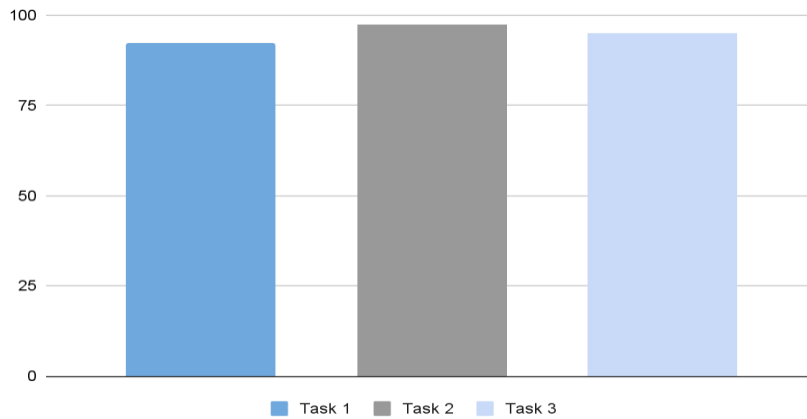| Tasks	Effectiveness (%)
Task 1 (Create an account)	92.5
Task 2 (Search for a product and add to cart)	97.5
Task 3 (Checkout a product)	95

Figure 3. Bar chart showing the Effectiveness ratings of the three tasks on Jumia app

Table 7 shows the effectiveness percentage calculated after conducting a usability study on the Jumia mobile app. We can see that 92.5% of the participants were able to complete Task 1, while 97.5% of the participants completed Task 2, and 95% completed Task 3. Forty (40) participants carried out three tasks each, which sums up to a total of one hundred and twenty (120) entries. A total of one hundred and fourteen (114) tasks were successfully completed, which brings the overall effectiveness of the Jumia app to:

Overall Effectiveness = (114/120) × 100 = 95%

4.4 Efficiency Analysis

This section presents the analysis of the Efficiency of Konga, AliExpress and Jumia e-commerce mobile apps. To calculate the efficiency of each e-commerce app, direct observation was employed to monitor the participants and measure the time taken to complete each task and how long some of them took before eventually giving up on the task.

The Overall Relative Efficiency formula was adopted to compute the efficiency of the apps as follows

$$\textbf{Overall Relative Efficiency (Konga)} = \frac{2979 + 1791 + 3077}{3797 + 1857 + 3984} \text{ x } 100 = \textbf{81.42\%}$$

$$\textbf{Overall Relative Efficiency (AliExpress)} = \frac{2440 + 1706 + 3457}{3373 + 1845 + 3843} \text{ x } 100 = \textbf{83.9\%}$$

Overall Relative Efficiency (Jumia) $= \dfrac{3218 + 1101 + 2495}{3354 + 1132 + 2620}$ x 100 $= \textbf{95.9\%}$

The Efficiency computation of the three apps is summarized in Table 8, and Figure 4 shows the graphical representation as a bar chart.

Table 8. Efficiency rating of the three e-commerce apps

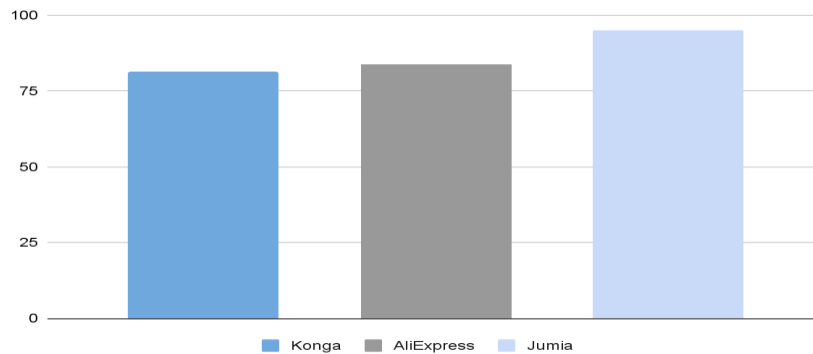| E-commerce App	Efficiency (%)
Konga	81.42
AliExpress	83.9
Jumia	95.9

Figure 4: Bar chart showing the Efficiency ratings of the three E-commerce mobile apps

Table 8 shows that the Konga app is 81.42% efficient, AliExpress is 83.9% efficient and Jumia emerged as the e-commerce app with the highest efficiency with 95.9%.

4.5 User Satisfaction Analysis
After completing the tasks on each e-commerce app, participants were asked to complete a post-task questionnaire to assess the usability of the application and to gauge their satisfaction with the tasks performed and the app in general. The questionnaire used a five-point Likert scale, ranging from 1 (strongly disagree) to 5(strongly agree). The data obtained from the post-task questionnaire for each app are presented in Table 9, Table 10 and Table 11.

4.5.1 User Satisfaction analysis of Konga app
The summary of responses from the post-task questionnaire for the Konga app is shown in Table 9. A total of 29 participants (72.5%) agreed (agree or strongly agree) that it was easy to learn to use the Konga app, and this number corresponds to the number of people who agreed that it was simple to use the app, which is 62.5% (25 participants).

In terms of information management, 55% of participants agreed that it was easy to find the information needed, 45% agreed that the organization of information is clear, and 52.5% agreed that navigating through the pages of the app is easy.

Only 17.5% of participants agreed that the app has a pleasant interface, 30% agreed that the app has great speed and load time, 15% didn't require extra assistance to complete their tasks, and about error and error management, 35% are in agreement that they made no errors while using the app, while half of the participants were able to recover quickly whenever they made errors.

On the other hand, only 8 participants (20%) would like to use the Konga app in the future, and this corresponds to the 12.5% of participants who would recommend the app to others and are satisfied with the app in general, which is a tiny fraction of the total participants.

Table 9: Summary of responses obtained from the Konga app post-task Questionnaire

Satisfaction Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is easy to learn to use this app	1	4	6	23	6
It is simple to use this app	1	8	6	23	2
The organization of information on this app is clear	0	17	5	17	1
It is easy to find the information needed	2	11	5	16	6
Navigating through the pages of this app is easy	2	12	5	19	2
This app has a pleasant interface	4	19	10	6	1
This app has great speed and load time	9	8	11	12	0
I didn't require extra assistance to go about my tasks	23	7	4	4	2
I made no errors while using this app	7	14	6	12	1
Whenever I make a mistake while using the app, I recover easily and quickly	1	5	13	20	1
The app has all the functions and capabilities I expect it to have	3	16	7	13	1
I would like to use this app in the future	7	20	5	7	1
I would recommend this app to people	4	19	12	4	1
Overall, I am satisfied with this app	10	21	4	4	1
Total	**74**	**181**	**99**	**180**	**26**

The coded values for Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree are 1, 2, 3, 4, and 5 respectively. From 9, we see that the frequency of Strongly Disagree responses is 74, Disagree is 181, Neutral is 99, Agree is 180 and Strongly Agree is 26. The sum of these values gives us the total number of responses which is 560.

$$\textbf{User Satisfaction} = \frac{(1*74)+(2*181)+(3*99)+(4*180)+(5*26)}{560*5} \text{x } 100 \qquad \textbf{=56.54\%}$$

Based on the data collected and the subsequent calculations as already illustrated, the user satisfaction rate of the Konga app stands at 56.54%, indicating a low level of satisfaction. It can be inferred that participants are generally not pleased with most aspects of the application.

4.5.2 User Satisfaction analysis of AliExpress app

The summary of responses from the post-task questionnaire for the AliExpress app is shown in Table 10. A total of 29 participants which equals (72.5%) agreed (agree or strongly agree) that it was easy to learn to use the AliExpress app, and this number corresponds to the number of people who agreed that it was simple to use the app, which is 67.5% (27 participants).

In terms of information management, 52.5% of participants agreed that it was easy to find the information needed, 47.5% agreed that the organization of information is clear, and 60% agreed that navigating through the pages of the app is easy. 72.5% of participants agreed that the app has a pleasant interface, 50% agreed that the app has great speed and load time, 25% didn't require extra assistance to complete their tasks, and concerning error and error management, 37.5% are in agreement that they made no errors while using the app, while 65% of the participants were able to recover quickly whenever they committed errors.

On the other hand, 28 participants (70%) would like to use the AliExpress app in the future, and this corresponds to the number of participants who are satisfied with the app in general, while 62.5% of participants would recommend the app to others.

The coded values for Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree are 1, 2, 3, 4, and 5 respectively. From Table 10, we see that the frequency of Strongly Disagree responses is 41, Disagree is 126, Neutral is 75, Agree is 263 and Strongly Agree is 55. The sum of these values gives us the total number of responses which is 560.

$$\textbf{User Satisfaction} = \frac{(1*41)+(2*126)+(3*75)+(4*263)+(5*55)}{560*5} \text{x } 100 \quad \textbf{= 65.89\%}$$

Based on the data collected and the subsequent calculations as already illustrated, the user satisfaction rate of the AliExpress app stands at 65.89%, indicating an average level of satisfaction. It can be inferred that participants are pleased with some aspects of the application.

Table10: Summary of responses obtained from the AliExpress app post-task Questionnaire

Satisfaction Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is easy to learn to use this app	2	5	4	22	7
It is simple to use this app	4	5	4	23	4
The organisation of information on this app is clear	1	16	4	14	5
It is easy to find the information needed	2	15	2	18	3
Navigating through the pages of this app is easy	2	8	6	22	2
This app has a pleasant interface	2	3	7	24	5
This app has great speed and load time	4	12	4	18	2
I didn't require extra assistance to go about my tasks	7	17	6	8	2
I made no errors while using this app	4	14	7	11	4
Whenever I make a mistake while using the app, I recover easily and quickly	2	3	8	22	4
The app has all the functions and capabilities I expect it to have	2	9	12	14	3
I would like to use this app in the future	3	6	3	20	8
I would recommend this app to people	3	7	5	22	3
Overall, I am satisfied with this app	3	6	3	25	3
Total	**41**	**126**	**75**	**263**	**55**

4.5.3 User Satisfaction Analysis of Jumia app

The summary of responses from the post-task questionnaire for the AliExpress app is shown in Table 11. A total of 39 participants (97.5%) agreed (agree or strongly agree) that it was easy to learn to use the Jumia app, and all the participants agreed that it was simple to use the app. In terms of information management, 90% of participants agreed that it was easy to find the information needed, 92.5% agreed that the organization of information is clear, and 95% agreed that navigating through the pages of the app is easy. 92.5% of participants agreed that the app has a pleasant interface, 85% agreed that the app has great speed and load time, 50% didn't require extra assistance to complete their tasks, and concerning error and error management, 70% are in agreement that they made no errors while using the app, while 52.5% of the participants were able to recover quickly whenever they made errors.

On the other hand, 34 participants (85%) would like to use the Jumia app in future, and this corresponds to the number of participants who would recommend the app to others, which is 90%, and in general. 92.5% of participants are satisfied with the app in general.

Table 11: Summary of responses obtained from the Jumia app post-task Questionnaire

Satisfaction Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is easy to learn to use this app	0	0	1	21	18
It is simple to use this app	0	0	0	24	16
The organisation of information on this app is clear	0	0	3	28	9
It is easy to find the information needed	0	1	3	26	10
Navigating through the pages of this app is easy	0	0	2	29	9
The app has a pleasant interface	0	2	1	26	11
This app has great speed and load time	1	2	3	28	6

I didn't require extra assistance to go about my tasks	2	14	4	11	9
I made no errors while using this app	1	4	7	24	4
Whenever I make a mistake while using the app, I recover easily and quickly	1	1	17	16	5
The app has all the functions and capabilities I expect it to have	1	3	3	27	6
I would like to use this app in the future	0	2	4	26	8
I would recommend this app to people	0	1	3	27	9
Overall, I am satisfied with this app	0	1	2	26	11
Total	**6**	**31**	**53**	**339**	**131**

The coded values for Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree are 1, 2, 3, 4, and 5 respectively. From Table 11, the frequency of Strongly Disagree responses is 6, Disagree is 31, Neutral is 53, Agree is 339 and Strongly Agree is 131. The sum of these values gives us the total number of responses which is 560.

$$\textbf{User Satisfaction} = \frac{(1*6)+(2*31)+(3*53)+(4*339)+(5*131)}{560*5} \text{x } 100 \quad = \textbf{79.75\%}$$

Based on the data collected and the subsequent calculations as illustrated, the user satisfaction rate of the Jumia app stands at 79.75%, which is satisfactorily acceptable. It can be inferred that participants are pleased with most aspects of the application. The User Satisfaction computation for the three apps is summarized in Table 12 while figure5 shows the graphical representation as a bar chart.

Table 12 User Satisfaction rating of the three e-commerce apps

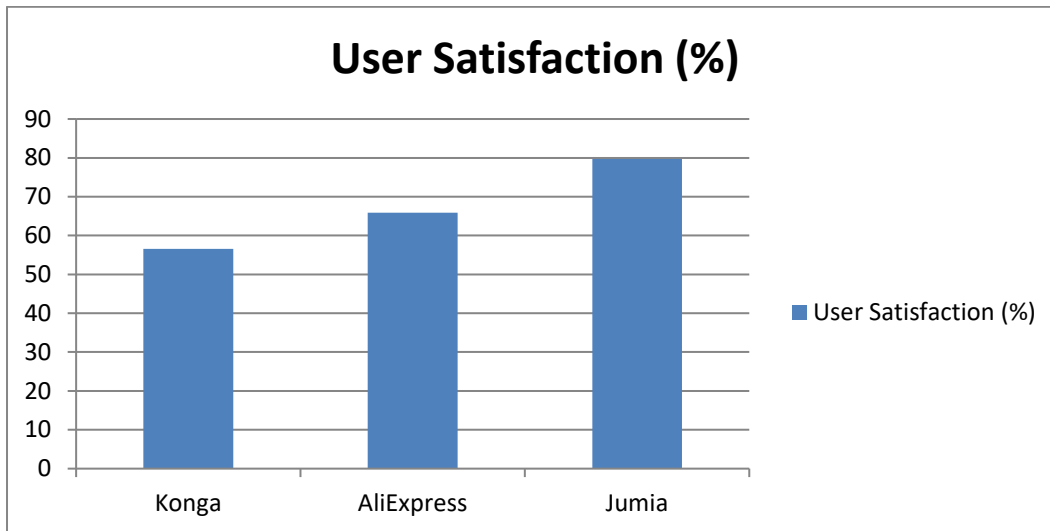| E-commerce App	User Satisfaction (%)
Konga	**56.54**
AliExpress	**65.89**
Jumia	**79.75**

Figure 5: Bar chart showing the User Satisfaction ratings of the three E-commerce mobile apps

4.6 Summary of Findings

The results of the usability testing carried out on the Konga, AliExpress, and Jumia e-commerce mobile applications provide significant insights on user interactions, challenges faced, and overall effectiveness and efficiency of each platform. Across all three applications, participants were quicker on tasks 1 and 2 than on task 3. Challenges arose with Task 3, especially on the Konga app, where a large number of participants spent more than 100 seconds and even gave up halfway through. Issues, including address selection errors and delayed verification code receipts, were common throughout the account setup and checkout processes. Task completion rates differed among applications. Jumia outperformed Konga and AliExpress in terms of task completion effectiveness percentages. Less hassle at checkout was a result of Jumia's more thorough account creation procedure, however, majority of users were able to effectively perform tasks using all three applications. The efficiency estimates showed fluctuations in the applications' performance levels. By far, Jumia outperformed Konga and AliExpress in terms of efficiency, suggesting that users were able to do activities more quickly and with less hassle on this platform.

Each app had a different level of user satisfaction. The three most satisfied online retailers were Jumia, AliExpress, and Konga. The participants were quite complimentary of Jumia in terms of its usability, data management, aesthetics of the interface, and general happiness. The opposite was true for Konga, which scored lower overall and had lower ratings for factors including interface attractiveness, future usage, and recommendation. According to the participants, Jumia has the best user experience due to its well-organized data, simple interface, and speedy job completion. Problems with the interface's attractiveness, speed, and error handling dampened Konga users' enthusiasm and discouraged them from sticking with the program.

The usability research concludes that the three e-commerce mobile apps—Konga, AliExpress, and Jumia offer very different user experiences. Although all three platforms were quite competent in completing tasks, Jumia stood out due to its high customer satisfaction ratings and greater efficiency. Many participants were dissatisfied since Konga had serious problems with the UI, loading times, and handling errors.

5. Conclusion

The study focused on the evaluation of the usability of three e-commerce mobile applications, by measuring three key usability metrics: Efficiency, Effectiveness, and User Satisfaction. A comprehensive test plan and script for a controlled usability test in a laboratory setting was created, with the aim of observing and documenting participant behavior and time spent on tasks. The participants were provided with instructions on the test and given three specific tasks to complete: registering an account on an e-commerce application, searching for a product, and proceeding to purchase the selected product. Completion rates and comments were recorded using observation techniques and a think-aloud approach. A questionnaire was administered to collect feedback on the usability/satisfaction rates of the applications. The data was collected from forty (40) accessible respondents for the study and this data was analyzed and interpreted using simple tables, charts, frequency, percentages. Formulae were also adopted to calculate the effectiveness and efficiency rates.

The research examined the usability of the Konga, AliExpress, and Jumia e-commerce mobile applications. Participants had difficulties in tasks such as creating an account, searching for products, adding things to the basket, and completing the checkout procedure. Konga saw the lengthiest time periods and greater rates of desertion, namely in activities such as creating an account and completing the checkout process. AliExpress demonstrated superior efficiency with greater completion rates and shorter time durations, although still encountered network-related issues. Jumia, however, proved to be the most user-friendly and efficient platform, with better completion rates, shorter completion times, and more user satisfaction. In order to enhance user satisfaction and reduce the likelihood of users leaving the platform, Konga should prioritize the refinement of user interface design, optimization of speed, and effective management of errors. AliExpress should prioritize resolving network difficulties and enhancing the efficiency of the product search feature. Jumia's user-centric design establishes a demanding benchmark, and in order for e-commerce mobile apps to stay competitive, it is essential to continuously emphasize user requirements and consistently do usability testing and enhancements.

5.1 Recommendation
The study makes the following recommendations:

- Konga should prioritize changes to user interface design and error management in light of the difficulties consumers have while using the site, especially throughout the account setup and checkout procedures. One way to improve the user experience and decrease abandonment rates is to simplify the interface, streamline the checkout process, and fix problems with delayed verification codes.

- Although AliExpress outperformed Konga in terms of performance, the website is not without its share of problems with the network and the search bar. A few things AliExpress can do to boost speed include fix network issues that prevent customers from adding items to their carts and make the product search tool operate better so customers can easily find what they're looking for.

- Jumia is an example of an efficient and user-friendly e-commerce mobile app. If Jumia wants to keep its competitive advantage, it has to keep putting consumers' needs first, test its usability often, and listen to their comments to figure out where it can make improvements. In order to maintain its stellar reputation for customer experience, Jumia should keep a close eye on user preferences and actions.

- AliExpress and Konga both had problems with how long it took to do tasks, but to different degrees. Users will notice a considerable improvement in performance and a decrease in job completion times after investments in speed optimization strategies such as server upgrades, caching systems, and code optimization. Users are more likely to be satisfied and return to applications with faster loading speeds and less choppy screen transitions.

- Study findings highlight the significance of user-centric design and continual improvement initiatives across all platforms. Mobile apps for online shopping need to adapt to new features, customer tastes, and technology developments so they can keep up with the ever-changing digital marketplace. Online marketplaces may thrive in the cutthroat world of mobile shopping if they put their customers first and devote resources to improving the platform's usability. This will attract and retain customers, increase engagement, and ensure the platform's longevity.

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