Study of the Usability Testing of E-Commerce Applications

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Abstract. Usability Testing determines the friendliness of the application to meet customers' requirements. It must be adopted in the early stage of SDLC (Software Development Life Cycle) to avoid issues in a later stage. Today, E-commerce has revolutionized the mode of shopping, and thus, we need to focus on ways to improve the usability of e-commerce applications. We opted for survey questionnaires as our research methodology, along with testing websites using online tools based on the four parameters Connectivity, Readability, Accessibility, and Functional Performance. In the survey, the four most popular e-commerce applications were Amazon, Flipkart, Bigbasket, and Paytm. Out of which, Amazon was the most used e-commerce application by the consumers. Although, testing tools are depicted that applications need to improve in certain areas. From the analysis, we concluded that consumers are aware of the upcoming Jio-Mart, which can give tough competition to existing companies. Thus, all the existing e-commerce companies need to improve their web and mobile applications to retain their customer base.

Keywords: Usability, E-Commerce, Application, Performance, User Satisfaction, Customer, Connectivity, Readability, Accessibility, Functional Performance.

1. Introduction
Usability Testing is a parameter of measuring how user-friendly the application is. It mostly involves a group of testers to explore the defects in the application before it goes live. The application can be either web or mobile. The main focus of usability testing is to meet the objectives like ease to use, flexibility, and controllability of the application. As per the reports, 50% of the developer's energy is devoted to fixing usability issues. Thus, usability testing is always recommended in the early stage of development to meet the expectations of users. Also, it is found by the experts that 97% of the mobile application users have chosen Ease of Use as their prime importance. The results of this usability testing are served as recommendations of this study.

Most commonly, two types of usability testing are performed; Laboratory Usability Testing and Remote Usability Testing.
- Laboratory Usability Testing - In this approach, a separate lab is arranged with the tester and observer. The observer keeps note of the behavior of the tester and acts as a silent monitor.
- Remote Usability Testing - In this method observer and tester are at separate locations. Here tester performs the assigned task, which is recorded, and later the results are analyzed by the observer.

E-commerce is one of the most used ways of shopping in recent times worldwide. It all started in 1979 when Michael Aldrich invented online shopping. Today e-commerce is about billions of dollars of business. In India, some of the popular e-commerce giants are Amazon, Flipkart, Myntra, Snapdeal, Paytm, Bigbasket, Grofers, etc., along with Jio-Mart, an upcoming competitor. The financial report of these ventures is the reason behind the boom of the e-commerce sector.
Today e-commerce business is reaching its horizon to please the customer. So, when we talk about e-commerce, the very first thing that notices is the user interface of web and mobile applications. And based on the user interface, customers judge the application on the first go. People notice the flexibility and workflow when they access the application, so the customer wants to try out different pages, want to find out different information related to their product. As a tester of that application, the first thing to take care of is the navigation and flow of the application and another thing to keep in mind is the user interface. In order to create a good image of the application, the user interface must be consistent across all the pages as e-commerce applications keep on changing based on daily needs and promotional offers.

Some other challenges in usability testing of e-commerce applications are code compatibility and portability, as they are accessed on different devices (Mobile, Computer, Tablet, etc.) and operating system (Windows, macOS, Android, IOS, etc.). The customer again reports an issue in case of poor render quality and non-realistic visualization of the product (Geelhaar & Rausch, 2015)[1]. Challenges, especially for small devices, also need to be addressed like short battery life, small display, slow internet connection, etc., because they turned out important issues while studying the usability of the mobile application.

User satisfaction largely matters in online shopping because how the application visualizes the product, and its details attract the customer. However, usability testing totally differs from black-box and white-box testing because they focus on functional problems, while usability testing aims to test the ease of the application's user interface (Hussain et al., 2017)[12]. There are different evaluation methods for usability testing of the application. Some methods are based on real users, while others are based on the opinion of experts (Hussain et al., 2016)[4]. And the selection criterion depends upon factors like time, cost, and efficiency. Improper usability testing can also turn out the loss of customers and revenue. If a homepage of an application is not smooth to read and understand, then customers may switch to other competitors in frustration (Hussain et al., 2016).

This study aims to identify the features that affect the usability of e-commerce web and mobile applications. The study will be based on the experience of some popular e-commerce giants in India. The objective of this study is to suggest some recommendations that will improve the usability issues based on the feedback we receive via the survey.

Usability testing determines whether an application is useful, usable, findable, desirable, and accessible. This testing depends upon the following parameters of the application:

- **Accuracy** - The application should be free from broken links and incorrect information.
- **Effectiveness** - The application should be easy to adapt along with pleasing colour and contrast.
- **Efficiency** - The application should have easy navigation, uniform pages, and a smooth search engine.
- **User-friendliness** - The application should have easy controls and a help section to learn about the application.

Based on the above parameters in this study, we will frame some research and survey questions that will help in analyzing consumer behavior and recommendations.

## 2. Literature Review

The major source of the study was IEEE Explore. The search criteria include strings like "Usability testing of e-commerce application" and "Usability testing of an application." This included papers from 2015 onwards to know about the latest findings. And the criteria for exclusion of papers were non-English papers and documents such as blogs. Also, we focused on conference papers and excluded magazines, articles, courses, etc.

Table 1 shows the number of hits on IEEE Explore after applying criteria for the papers 2015 onwards:
Table 1: Number of hits on IEEE Explore

| S. No. | Search Strings                             | No. of Paper Displayed |
|-------|--------------------------------------------|------------------------|
| 1     | Usability testing of e-commerce application | 12                     |
| 2     | Usability testing of e-commerce application | 13                     |
| 3     | Usability testing of application           | 657                    |
| 4     | Usability testing and e-commerce           | 18                     |
| 5     | Usability testing and e-commerce           | 21                     |

As per the literature, the importance of e-commerce is rapidly growing, and the driving factors are the appearance and visualization of a product to satisfy a customer. This is made possible by 3D product presentation techniques like HTML5 (Geelhaar & Rausch, 2015). There are few other metrics: accessibility, coding standards, connection speed, and readability to measure the usability testing of an application (Zheng, 2016)[2]. We found that there was a major difference when usability testing was brought to a newbie and expert user based on five parameters of application: content, design, ease of use, navigability, and structure (Panda et al., 2015)[3]. Some of the key principles of user-centric application design are knowledge of the user's environment, continuous user feedback, and user-driven evaluation (AXINTE & BACIVAROV, 2018)[6].

In general, there are three methods to test the website; firstly, using eye-movement and scientific instruments; secondly, collect and analyze the data of survey questionnaires and thirdly, using third-party testing tools (Zheng, 2016). Researchers surveyed to measure usability by weight and rating. Under the first survey, weight was given to different features and sub-feature, while the second survey reported the ratings given by the users for e-commerce applications (Panda et al., 2015). [4] Previous researches have shown that most commonly used methods for mobile application usability test are the formal test, heuristic evaluation and think-aloud methods compared to informal test methods (Hussain et al., 2016). There numerous maturity models for e-commerce applications. Some models focus on one element like user experience, and some models focus on another element like product display, but to reach the highest maturity model may take several years (Anchahua et al., 2018)[5]. Today usability test methodologies are advancing, and the focus on Pattern-Based Usability Testing has increased in order to automate the usability tests (Dias & Paiva, 2017)[8].

There are numerous positive outcomes of previous studies. When the innovative and 3D content is deployed on the application, it brings positive emotional feedback out of customer and that directly influence the purchasing decision resulting surge in the sale of a product (Geelhaar & Rausch, 2015). Whenever a product is easier, better, and as per users' need, it increases the sale of the company (Hussain et al., 2016). Today Decision Support Systems are integrated with mobile and web application environments to improve user satisfaction towards the application (Az-Zahra et al., 2015)[7].

Various papers depicted the challenges faced by the customers while accessing the web and mobile application. Customers reported concerns of poor render quality and unpleasant visualization of products and services, and the reason behind this was outdated technologies (Geelhaar & Rausch, 2015). Despite advancements in technologies, e-commerce applications still are lagging in terms of accessibility and coding standards (Zheng, 2016). After studies, it has been found that uncommon and improper usage of widgets in applications affects the usability performance of the application (Az-Zahra et al., 2015).

Results from previous studies have shown that performance and quality play a significant role in user experience and satisfaction (Geelhaar & Rausch, 2015). It has been recommended that vendors should pay more attention to code construction of applications in very early stages and standardized website content (Zheng, 2016). Integrating usability testing tools and practices in the software development stage provide positive feedback towards the application (Anchahua et al., 2018). In this competitive environment [9], a good amount of investment for usability testing will comprehend the potential Return on Investment, and this can be understood by the fact that approximately 50% of
developer’s time is spent in correcting the errors[11] incurred after the software release (Axinte\& Bacivarov, 2018).

The research objective is to analyse the existing studies, feedback received from users and recommendations accordingly. This study is to answer some of the research questions:

Research Question 1 - What is usability testing and its importance?
Research Question 2 - How usability testing can affect the financial growth of an organization?
Research Question 3 - What are the important parameters while testing the usability of an e-commerce application?

3. Research Methodology

3.1. Research Design

As mentioned earlier also usability testing should be considered a critical phase of SDLC (Software Development Life Cycle) while developing an application (Kumar & Hasteer, 2017) [10]. In this study, we will be focusing on four significant factors of usability testing of e-commerce applications in Figure 1. These are Connectivity, Readability, Accessibility, and Functional Performance.

![Figure 1: Model for Usability Testing of E-commerce Applications](image)

- Connectivity - Connectivity of application means how fast the application loads. It depends on various elements like loading speed, page size, page speed, etc. It can be tested using an online tool like GT metrix.
- Readability - Readability of application measures of how easily users can understand the pages and context. It should be constructed keeping an eye on education and the multilingualism of users. It can be tested using an online tool like Web FX.
- Accessibility - Accessibility of application points to well-structured coding, appropriate headers, images, and text. It defines the reach of the user group. It can be tested using an online tool like Nibbler [13][14]
- Functional Performance - Functional Performance will include overall experience with different factors like how satisfying the website is likely to be for users, popularity, technology, headings, amount of content, server behaviour, etc. It can be tested using an online tool like Nibbler.

Along with online tools in this study, we adopted a qualitative method for the research. This approach helps in studying society based on some evidence like a survey, to understand how
society operates [15][16]. Thus, our survey questionnaires are based on above mentioned four factors and previous studies in the related field.

Our questionnaires are comprised of three phases: Filtering Phase, Testing Phase, and Post Testing Phase. The first phase consists of demographic information through which we can filter and categorize the participants. The second phase consists of usability related questions which will help to understand the behaviour of users towards application [17]. The last phase consists of an overall application review and other offerings.

3.2 Data Collection
The survey will be conducted online via Google Forms and the targeted audience will be all the users who are involved in online shopping. The targeted audience is all the online shopping savvy, without any boundation of city, age, profession, etc [18][19]. Survey responses will be collected completely in an unbiased manner and without offering any kind of incentive. The survey questionnaires can be found in Annexure A.

The total number of participants in the survey was 63, with the majority of males (56%). These participants were dominated by the age group of 18-28 Years with student and job as a profession. Approximately one-third of the audience daily visits the e-commerce application. And almost all the participants were comfortable with mobile and web applications [20]. As per the survey, Amazon is the most used e-commerce application by the users followed by Flipkart, Bigbasket, and Paytm.

4. Result and Analysis
As per the response we received from users, we can say that Easy Application Interface, Customer Service, and Reliability of application are the most influencing factors for users while online shopping. We also came to know that Exclusive Offers do not lure much the audience compared to the Brand Value of the e-commerce application.

The survey depicts that Mobile device completely dominates in online shopping. This should ring a bell to the service provider that they should improvise the mobile application especially. The majority of the audience was happy with their existing application interface, but some still want improvement in their application.

After studying the feedback from users, we can say that customers are reluctant to drop the shopping plan due to glitches in the application, which in turn can cause revenue loss for the ventures, but three-fourth of the customers return to the same application due to their loyalty.

Companies should also improve a little their time period of resolving issues in such a fast-growing era. Most of the audience gets the notification for maintenance breaks so that they can reschedule their plans. Recommendations and payment gateway interface of the applications show satisfactory results. Also, users are pretty comfortable with the privacy and security policies adopted by companies. And customers are happy with the overall experience of their favourite e-commerce application.

We have also analysed the four most popular website of the survey using online tools, these are Amazon (EC1), Flipkart(EC2), Bigbasket(EC3), and Paytm(EC4).

- Connectivity - Connectivity of websites was tested using GTmetrix and results are shown below in the Table 2:

| Parameters       | EC1   | EC2   | EC3   | EC4   |
|------------------|-------|-------|-------|-------|
| Page Speed Grade | 60%   | 91%   | 51%   | 82%   |
| Loading time (seconds) | 14.2  | 6.5  | 10.4 | 13.3 |
| Page Size (MB)   | 2.75  | .74  | 4.56  | 1.44  |

Page Speed grade is Google standard measurement of website performance, the higher the better. Loading time is the time taken by the website to load fully. Page size is the total size of the HTML document of that website in MB. EC1 has 60% grade due to heavy page size and loading time,
whereas EC2 turns out the most efficient website with highest page speed grade, lowest page size and loading time. EC4 has also a good page speed grade with high loading time. Out of these four websites, EC3 results in the lowest page speed grade due to the heaviest page size. Thus, EC2 turns out the best website in terms of connectivity.

- Readability – Readability of websites was tested using Web FX and results are shown in the Table 3:

| Parameters                     | EC1 | EC2 | EC4 |
|--------------------------------|-----|-----|-----|
| Flesch Kincaid Reading Ease    | 37  | 49.3| 31.4|
| Coleman Liau Index             | 17.6| 15.1| 21.5|
| Automated Readability Index    | 7.7 | 8.1 | 9.8 |

Flesch Kincaid Reading Ease score indicates how difficult is a page to read and understand, the higher the score easier to read. Coleman Liau Index depends on characters rather than syllables per word. It determines the appropriate of text as per the education system. Automated Readability Index determines the grade level to understand the text. EC2 is easiest to read and understand as per Flesch Kincaid Reading Ease. As per Coleman Liau Index EC1 can be easily understood by a postgraduate student while EC2 can be easily understood by a graduate student. Lastly, as per the Automated Readability Index EC1 and EC2 can be comprehended by 7-8 standard students while EC4 9-10 standard students. Thus, EC4 depicts the poorest results in terms of readability while EC1 and EC2 are easy to comprehend.

- Accessibility and Functional Performance - Accessibility and Functional performance of websites were tested using Nibbler and results are shown in the Table 4:

| Parameters        | EC1 | EC2 | EC3 | EC4 |
|-------------------|-----|-----|-----|-----|
| Accessibility     | 7.8 | 7.9 | 7.8 | 9.4 |
| Experience        | 6.6 | 8.5 | 8.7 | 8.2 |
| Marketing         | 6.1 | 9.2 | 8.9 | 9.5 |
| Technology        | 7.5 | 8.0 | 8.3 | 8.0 |
| Popularity        | 8.8 | 9.2 | 10.0| 8.0 |

In terms of accessibility of websites to all kinds of users, including with disabilities, EC4 shows promising results, and the other three websites need to improve in terms of accessibility. Experience shows how satisfying the website is likely to be for users and EC3 shows promising results. Marketing shows how well the website is reaching to the audience and again EC4 with the highest score followed by EC2, EC3, and EC1. In terms of technology used in building the website, EC3 has better results compared to other websites. Lastly, in terms of popularity, EC3 performed outstanding and it can be easily understood due to its dedication in delivering essential items during Covid-19.

5. Conclusion
This study guides us about the understanding of the usability of an e-commerce application. The study can be beneficial for research practitioners, application developers, and users. Usability testing of some popular e-commerce applications was conducted via online open-source tools and survey methods. The result indicated that currently, e-commerce applications are moving as per customers’ needs, but in the future, they need to improve a lot to stand out from competitors. EC1 turned out to be the most used application by the users.

Although, EC1 is the most popular e-commerce application in the survey but in online testing using tools it is lagging. Thus, EC1 needs to improve in the mentioned sections amid other emerging applications like EC2, EC4, EC3, etc. are trying to increase their customer base.
The only limitation we found is the limited age group participation. We could not get many responses from the age group above 28.

The usability testing should be incorporated at an early stage to avoid loss of time and money in the final phase. Overall, the companies should adopt the changes according to their target users’ needs. They should include the complexity of features to a level that can be adopted easily by their customers.

6. Future Scope
In the future, the study can be extended to shopping over Voice-enabled device (Amazon Echo, Google Home, etc), which is not so popular currently in terms of online shopping. Another extension could be once Jio-Mart enters into the competition. As we all know that Jio is spending a lot in digitization and our survey also clearly showed that the majority of audiences are aware of the upcoming Jio-Mart, and they are considering it is an option that may replace their existing favourite e-commerce application. Thus, all the existing e-commerce ventures must improve their web and mobile applications to prove their solid stand in the market.

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Annexure A

Filtering Phase

1. Name
2. Gender
3. Age Group
4. Profession
5. Rate how comfortable are you with mobile and web applications.
6. How frequently do you use e-commerce applications or websites?
7. Which e-commerce application or website you use most?

Testing Phase

8. To what extent the following factors influence you to prefer e-commerce applications?
9. Customer Service, Exclusive Offers, Brand Value, Easy Application Interface, and Reliability.
10. Which device do you use most for online shopping?
11. Rate your favorite application's user interface.
12. Do you drop the shopping plan due to glitches in the application?
13. Due to technical glitches, do you revisit the same application or look for other applications?
14. How quickly they resolve your issue once you report it?
15. Does the application or website notify for maintenance break?
16. Rate your favorite application's payment gateway interface.
17. Rate the recommendations given by your application.
18. Rate the privacy and security measures taken by the application.

Post Testing Phase

19. Rate the after-sales service (Shipping and Delivering).
20. Rate the overall experience of your favorite e-commerce application.
21. Have you heard about Jio-Mart; an upcoming e-commerce venture?
22. Will you switch to Jio-Mart against your favorite e-commerce application?