

A STUDY ON USABILITY FACTORS TO RETAIN CUSTOMERS

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ABSTRACT

Customer retention refers to activities and actions taken by organizations in order to retain customers. The key factor of growth and long term profits of any organization is customer retention. Different studies have been conducted to understand and identify possible factors that contribute in customer retention. User interface of mobile applications potentially plays an important role in retaining customers especially in context of mobile applications. There is a need to further explore the role of user interface in customer retention. The main aim of this research is to study usability factors to retain customers in the context online ride hailing services. Firstly, literature review is done to find out the possible usability factors that could led to customer retention. Mostly mentioned usability factors by the researchers are ease of use, effectiveness, efficiency, usability (interaction with interface) and user satisfaction. Secondly, these factors are used as a base to develop questionnaire for the survey. A survey is conducted to see whether there is a correlation between usability factors and customer retention, particularly in the context of ride-hailing services. The sample size for the survey is 446. After doing statistical analysis by using Pearson's Correlation method it is proved that there is positive relationship between customer retention and usability factors in case of ride hailing services. Effectiveness is one of the factor with highest frequency in literature review and it also got highest value 0.7145 that is greater than critical value 0.09 so it proves that it is an important factor that should be taken into consideration while developing any application in order to retain customers. Based on the statistical analysis all factors significantly contribute towards user retention. Ease of use is the factor having least significant value 0.5363 as it is closely related to the critical value so this factor can be said as showing signs of least significant factor as compared to other factors.

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LIST OF ABBREVIATIONS

ISO	International Organization for Standardization
EMGS	Education Malaysia Global Services
UI	User Interface
HCI	Human Computer Interaction

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CHAPTER 1

INTRODUCTION

In this chapter, the background is discussed in section 1.1. Section 1.2 contains related work to this study. Problem statement is defined in section 1.3 and research questions are written in section 1.4. Section 1.5 contains research objectives. In section 1.6 methodology is defined which contains literature review, survey and data analysis. Outline of this thesis is written in section 1.7. Summary of this chapter is written in the section 1.8.

1.1 Background

Globalization has introduced never ending competition in business. High competition beside uncertain client behaviour complicates things more for organizations. In this day and age, mobile phones have become a necessity that almost everyone uses. So, with the increase in the usage of mobile phones there is a need to study different areas of mobile applications as well. Besides receiving incoming and outgoing calls, messages as well as video messages, mobile phone has reached an era of usage in different environment and industry. Mobile applications are becoming more and more important and useful, enabling users to complete more tasks while on the go. They had been widely applied for various purposes [1]. The use of these devices in some situations has suffered as a result of this increase in usefulness. Usability is one of the significant characteristics that ought to be considered by organizations that offer software product or provide online services through online applications. Usability basically refers to methods for improving the ease of use in the application design. Inappropriate interfaces may led customers to easily leave the software or application they are already using. The research study [2] addressed the importance of user experience and user interface in field of software engineering. Inappropriate interfaces may led customers to easily leave the software or application they are already using. Along with these usability is one of the significant characteristics that ought to be considered by organizations that offer software product or provide online services through online applications.

An effective interface of an application enables the user to achieve a high degree of satisfaction in using the application, especially when the application caught their attention by addressing the requirements and needs adequately. Acceptability of users towards an application depends largely on the satisfaction of the user. So, there is a need to study the role of usability factors in customer retention. Customer retention is basically to hold clients of a particular service or product over some predefined length.

Different applications are developed for the ease of the customer for example ride hailing services. Ride hailing services are applications that associate travellers and drivers utilizing their own vehicles or vehicles provided by the organization. Typically this method is less expensive than using licensed taxicabs. The recent introduction of ride hailing service culture in Pakistan in the shape of Uber, Careem, and other services has made public transit accessible and convenient, and it is now widely used for transportation not only in Pakistan but also in other areas of the world.

The main focus of this research is these ride hailing services and different type of usability factors are listed down that compels customer to stay loyal to the service they are using. What are the usability factors behind customer retention? And is there any relation between customer retention and usability factors in case of ride hailing services? These are the two main questions that are the focus of this research study.

1.2 Context

The context of this research is to study those usability factors that helps in retaining customers. Different studies are conducted to understand those usability factors that contributes in customer retention. Some of the studies related to usability factors and customer retention in case of mobile applications are discussed below in order to help in understanding the context of this research.

Several studies were conducted in order to examine the aspects that affect customer happiness in context with online taxi services but few of them measures the satisfaction level of users with mobile applications. The study [3] determines the degree of customer satisfaction and the elements that affect it in the online taxi mobile application services. This study was restricted to some areas like Surabaya, Sidoarjo, and Gresik regions. Results of this study shows that customer were not satisfied with online taxi mobile application and this dissatisfaction was mostly due to connection and service quality.

In another study [4], usability of a mobile application was evaluated. That mobile application was used for higher education for the University of Kuala Lumpur. Effectiveness, efficiency, and satisfaction were the three usability factors that were examined by using usability testing technique ISO (International Organization for Standardization) 9241-11. Results were satisfactory and show that the application meets user expectations for usability but despite that some suggestions were made for enhancing the application's usability. Another mobile application named as "Say Quran" was evaluated [5] in order to investigate how students' perceptions of their performance, satisfaction, and conduct are influenced by their behaviour and how effective the mobile application is for learning the Qur'an. The purpose of the project was to create the Say Quran app and conduct studies to determine how it affected users as mobile learning is still in its infancy in Saudi Arabia. Survey was conducted from a group of 118 Computer Sciences and Information Systems College students at Al Imam Muhammed Bin Saud Islamic University. 9 hypotheses were supported by the survey data, and the suggested model was also supported. The findings of the study demonstrate a favourable correlation between students' reported performance, satisfaction, and conduct when studying the Holy Quran with the mobile application "Say Quran."

As for the purpose of this research, usability factors for mobile applications that help in retaining customers are studied and mobile applications for different ride hailing services are involved so different researches involving usability factors for mobile applications are studied for this research. Some other researches involving mobile applications are mentioned to help in understanding the context of this research better. Twazon is an Arabic-language fitness mobile application as globally obesity is a serious health issue and in Saudi Arabia, the prevalence of obesity is rising alarmingly. Obese people may benefit from mobile applications, but for those users to use them, they must be adaptable and tailored. The study [6] intends to evaluate the usefulness of this application. The study offered a thorough literature assessment of the factors that make fitness applications more user-friendly. The technique and steps for testing the Twazon application were provided in the article. Effectiveness, efficiency, satisfaction, memorability, mistakes, learnability, and cognitive load are the usability characteristics that have been put to the test. Participants from the Saudi Arabian Armed Forces Hospitals - Taif Region were involved in the trial. The conclusion drawn from this trial was that the Twazon application did not match the usability criteria, making it challenging for users to utilise. The main goal of the research [7] was to promote the elderly population's adoption of mHealth technologies. To investigate how user interface design aspects affect older users'

experiences, a hypothesis was put forth. This was verified by performing a quasi-experiment in which a sample of participants was chosen based on the requirement that they be 50 years of age or older. Participants from the experimental group used the Glucosio prototype to measure user experience while those from the control group used the Glucosio application coupled with the QoE probe. In a mHealth application, it had been found that changing any one of the user interface design elements may not make a significant difference in the user experience. However, when changes were made (to the user interface design) with older users in mind, the elderly users' UX was significantly improved after using the application. Above mentioned articles helps in shedding light to the context of this research.

1.3 Problem Statement

Effective customer retention is important for any organization. Ride hailing services are popular way of transportation and as time goes on, new businesses unveil their ride-hailing service applications with updated mobile applications and better services. Customer retention may be greatly influenced by user interface. Further research is required to determine how user interface affects customer retention, particularly in the context of mobile applications. Since ride hailing services are currently a hot issue, it is necessary to investigate the relationship between usability criteria and client retention in the context of ride hailing services.

1.4 Research Questions

Question 1: What are the possible usability factors in the context of mobile applications that contribute to customer retention?

Question 2: What is the relationship between customer retention and usability factors in case of ride hailing services?

1.5 Research Objectives

Objective 1: To find out possible usability factors of mobile applications that lead to customer retention.

Objective 2: To find out the relationship between customer retention and usability factors in case of ride hailing services.

1.6 Methodology

Methodology refers to the overall plan and justification for the study activity. The research technique is specified in order to create a strategy that meets the goal of the investigation. This section briefly discusses the research methodology.

Literature review is done to find out those usability factors that contribute to customer retention in terms of mobile applications as the main focus of this research is ride hailing services. A literature review is conducted to determine the gap and how much of the topic has already been addressed in order to add new discoveries. Literature review is done based on already published material. As stated in the article, the ability to manage numerous tasks at once is essential while reading the literature, from identifying and analysing important content to synthesising knowledge from various sources, from critical thinking to paraphrasing, evaluating, and citation abilities [8].

Survey is conducted in order to find out customer's views about the ride hailing services they are using and the reason behind their loyalty with that company. The survey is based on the guidelines of conducting an effective survey as suggested by Mark Kasunic in his book published by the Software Engineering Institute (SEI) [43]. The problem statement is identified and research objectives are taken into consideration. Afterwards, the respondents are selected to make sure that the terminology of the questionnaire is familiar to them. The usability factors that are derived from literature review are used to design the questionnaires to conduct the survey. Finally, the thorough analysis of the collected data is done and a report is generated on it. Proper data analysis lead us towards coming up with accurate, concise and concrete conclusions.

Data that is collected through surveys is analysed in order to find out whether there is any relationship between customer retention and usability factors or not. Quantitative data analysis techniques are applied for the purpose of the analysis. For data analysis first of all results and statistics of the survey is represented in form of pie charts and bar charts. Cronbach Alpha value is calculated in order to do the reliability test. For the validity test hypothesis are formed and they are tested by using Pearson's Correlation method.

1.7 Thesis Outline

This thesis is divided into five chapters. The first chapter, Introduction, presented the backdrop to the research study, provided the problem statement, research questions and objectives, reviewed the research methodology, provided a chapter summary, and outlined the contents of each chapter.

The second chapter, Literature Review, explores the literature on usability factors for customer retention. It does a literature review on usability factors and customer retention. It examines the usability evaluation of various mobile applications and highlights the research gap that the thesis fills. It closes by detailing the usability elements that aid in customer retention and summarising the literature review.

The details of the method employed in this research study are provided in Chapter 3, Research Methodology. A figure depicts the research strategy. The two primary methodologies of this study, a literature review and a survey, are defined step by step using guidelines. Questionnaire design guidelines are written and justification for the research questions are discussed. This chapter describes each stage of the research.

The survey results are described in Chapter 4, Results and Discussion. Based on the findings of the research study, it proposes a hypothesis model that establishes relationships between usability factors and customer retention. For statistical analysis, Pearson's correlation is used, and Cronbach alpha is used for the reliability test.

Chapter 5, Conclusion, gives the research study's conclusions in terms of the objectives stated in the first chapter. It also analyses the research's shortcomings and finishes with proposals for further research in this area.

1.8 Summary

This chapter provides the introduction of this whole research work. User interface plays an important role in customer retention. This research aims to find out different usability factors to retain customers. Survey is conducted to find out among ride hailing services which application is widely used and why? Why the customers of that application stay loyal to that company instead of trying new applications/services? Those usability factors are listed down that may be the reason of customer loyalty. What are the attributes of the user interface that led to customer retention? And the results of the survey gives answer of these questions to some extent. Along with the survey literature review is done to find out usability factors. Result of Literature review shows that much work is done on importance of customer retention and how it should be done but not much work is done on why customer stay loyal to any product/application. Some researchers did usability evaluation of some applications but there is still a need to work on ride hailing applications. This study focus on these applications in order to find out the relationship between customer retention and usability factors.

CHAPTER: 2

LITERATURE REVIEW

This chapter reviews the literature to find out possible usability factors that could lead to customer retention. Section 2.1 explains the methodology that is used for finding the related work. Section 2.2 of this chapter contains the information about mobile applications and the importance of customer retention especially in case of mobile applications. Section 2.3 contains data related to usability factors and other sections are all those usability factors that are derived from the articles studied during Literature review. Section 2.19 is the explanation of using these articles and research gap. Section 2.20 contains summary of this chapter.

2.1 Methodology for Finding Related Work

A literature review is a collection of scholarly sources that provides a high-level overview of a topic [42]. Literature reviews are compilations of the most relevant and significant publications on a specific topic in order to provide a comprehensive overview of what has been said and who has said it on that topic. First research question of this research work is answered by literature review. What are the possible usability factors that contribute to customer retention in terms of mobile applications is the question that is answered by reviewing related research work. When reviewing the latest research work related to this topic much work was found on the importance of customer retention but not much work is done on usability factors that led to customer retention especially in terms of mobile applications so study related to usability evaluation of different mobile applications are studied to find out usability factors. As these factors are mostly repeatedly emphasized in these research work so it means that these are important factors and must be used for retaining customers so, these factors are used in developing questionnaires for survey for this research. Research databases include articles and other resources that professionals within specific fields write. This means that they are generally more reliable than a source with a regular search engine. Having reliable resources can help find support for your work and ensure that you use accurate information. Different authentic databases like IEEE Xplore, Science direct, Springer, ACM digital library and Google Scholar are used to find out related research articles. Keywords that are used to find related data are

Customer retention, Usability Factors, Customer satisfaction, Usability Evaluation of Mobile applications, Usability assessment of mobile applications etc.

2.2 Customer Retention

Mobile technology has swiftly spread over the world as technology has advanced. According to research [9], more than 5 billion people own mobile phones by 2020, with smart phones accounting for more than half of these connections. With the increase in usage of mobile phones especially smart phones, development and use of mobile applications have also been widely increased. The reason behind the massive growth of these applications is that user appreciated the simplicity of applications because they could readily download and use them and the second factor is the portability of mobile phones. Users can carry their phones with them at all times and at any location. These factors fuelled the growth of mobile apps in ways that desktop software developers couldn't have predicted.

Mobile applications provides a great chance to boost any business and gain new customers. A well- designed and user-friendly mobile app can boost the popularity of a product or service among other smartphone users. As a result, it can be used as a customer retention tool and a means of establishing long-term relationships. A vast majority of programmes, on the other hand, are only utilised once before being deleted. It is unsustainable for businesses and organisations to invest time and money in app development only to have low user retention rates. There could be many factors that led to user disappointment and for them to delete the application. But the most important one is interface. User interface of any application plays an important role in user satisfaction as the first thing that user see and interacts with is user interface. So, user interface needs to be easy to use and not complex. But the question arises what are the possible usability factors that contribute to customer retention in terms of these mobile applications?

Once a customer is initially acquired through a buy or use of a product or service its then up to the company whether to lose the customer or retain him. High customer retention rate is important for the success of a product/service and it is when customer continued to use the product/service and have not moved onto a competitor service/product. In order to find out possible usability factors that lead to customer retention in terms of these mobile applications literature review was done.

Customer retention is critical for a company's long-term viability and competitiveness in the marketplace. Marketers and businesses now have more chances to strengthen their customer loyalty programmes by making mobile applications available for customers to download and use, thanks to the evolution of smartphones and digital marketing [10]. Companies that can recruit and keep customers in this highly competitive and increasingly saturated sector stand to gain significantly, therefore customer retention is an essential area of research in this developing business [11]. So, it can be said that customer retention is an important factor for the growth and longevity of any business. Especially in this era of growing technology thousands of applications are developed and deployed in the market on daily basis so to compete in this market companies need to develop their mobile applications in a way that will be able to retain customers.

The purpose of the study [3] was to determine the degree of customer satisfaction and the elements that affect it in the online taxi mobile application services. Research on customer satisfaction factor analysis has been spurred by the large number of complaints that have been made regarding the performance of online taxi services. Significant study has examined aspects that affect customer happiness with online taxi services, but none of them looked into how satisfied users were with mobile applications. The study attempts to determine customer satisfaction with online taxi mobile app services and to pinpoint how it affects the creation of business strategic planning. The study was restricted to online taxi users in the Surabaya, Sidoarjo, and Gresik regions. The CSI findings show the degree of customer satisfaction, which offers input to raise the calibre of services. The IPA results demonstrate both levels of satisfaction and unhappiness. According to the findings, the customer satisfaction rate was 76.117%, falling into the cause of concern group. This indicates that the system's performance fell short of what the customer had hoped for. The findings also indicated that route identification, engagement, and content quality are the top three elements in online taxi mobile apps. Meanwhile, connection and service quality were the causes of client dissatisfaction. With the help of technology, taxi businesses can develop solutions to ensure that customer satisfaction levels meet expectations.

2.3 Usability Factors

One of the most important success elements for mobile applications is usability. When designing a mobile application, user interface design is one of the most critical factors to consider because the app's success is dependent on it [10]. Customers that uses mobile

applications are mostly non-technical people that just interacts with the user interface and are either satisfied with its functionality or are unsatisfied and never uses the application again. So an application must be developed in a way to satisfy customer's needs and interface design must be easy to use only then customer will come back to use that application again. Usability is a great challenge that developers have to deal with. To design an interactive user interface developer must take into consideration the usability. Effective customer retention is important for company survival. Different studies have been conducted to understand and identify possible factors that contribute in customer retention. User interface potentially plays an important role in retaining customers. There is a need to further explore the role of user interface and usability factors in customer retention. So this literature review is done to find out possible usability factors that can help in retaining customers. The factors written below are those factors that are mentioned by the researchers.

2.4 Efficiency

Efficiency is an important aspect of usability since it measures how quickly users can execute tasks after becoming acclimated to the design of an interface. Consider how many keystrokes or mouse clicks the user needs to complete the operation. Efficiency is an important factor that is repeatedly emphasized on by the researchers. All the articles mentioned below focuses on efficiency as an important usability factor.

The study [12] looked at how well an online shopping app called Carousell performed in terms of efficiency, effectiveness, and satisfaction. Results shows that application was convenient and good to use from the perspective of both buyers and sellers. A survey of University Utara Malaysia (UUM) students was undertaken. Along with the survey experiment was conducted in a close environment. Overall usability performance was far better on the buyer's side than on the seller's side, according to the findings. However, the overall result indicates that the application was useful and simple to use, although there is still room for improvement as there is some problem in interface and some validation issues.

Main focus of the research [13] was to assess the usability of the EMGS (Education Malaysia Global Services) mobile application based on four client interactions that are perceived efficiency, usability, usefulness, and user satisfaction. A survey of 20 users who completed five assignments on the EMGS mobile application was conducted. Result shows that people were pleased with the application. Most of the user were satisfied by the application to the extent the four usability qualities surveyed in the examination.

The purpose of the study [19] was to evaluate the usability of various mobile weather danger alert apps, it revealed multiple usability issues that were linked with the tested features of the weather radio application. Those issues could also be found in several other weather alert applications and in applications with similar inherent features.

Client experience assessment was done in [20] of Amazon Kindle mobile application and for that purpose research centred based usability assessment was done. The study primarily evaluated this application based on four client-experience factors: perceived ease of use, visibility, enjoyability, and efficiency. Outcomes shows that most of the users were satisfied from this application but still there was a space for improvement as some users faced some issues while interacting with the application.

Usability of Mudah.my Mobile application was evaluated and tested in [30]. It was done in terms of effectiveness, efficiency and user satisfaction. 10 participants were selected to test the application interface and performed five tasks. User performance and perception were used to assess usability. The application was put to the test at University Utara Malaysia, and the findings showed that it is simple to use and consistent. The survey also discovered that the app allows users to easily access commodities and services from faraway markets, as well as advertise and sell products without owning or renting a business. But still there is a need for improvement as there were some usability issues faced by the users.

Evaluation of HU an e-commerce of Islamic fashion product which have website as well as application for its customers is done in [33]. Every year, the number of HU visitors grows, but at the same time, the number of orders that are cancelled grows, and the conversion rate of visitors to buyers remains low, necessitating an evaluation of both the website and application to identify flaws while focusing on usability and user acceptance to provide suggestions for improvement. By measuring efficiency, effectiveness and user satisfaction, evaluation with usability approach is done. To measure user acceptance Consumer acceptance of Electronic Commerce Questionnaire are used. More than 70% of the participants completed the task assigned to them during the evaluation, indicating that both the HU website and application are effective. The amount of time required to accomplish a task and the number of errors produced indicate that both the website and the application are inefficient. Results of user satisfaction shows different level of satisfaction from each group of participants that are expert groups, novice group for both website and application. Similarly, the results of user acceptability show

that each group of participants has a varied level of pleasure. There were eight proposed website upgrades and nine proposed mobile app modifications based on the findings. Results also suggested to take into consideration user opinions and point of view and involve them during evaluation. Future research could be conducted focusing on different factors and it is also expected to evaluate minor features like HU play and E-magazine.

Usability evaluation of a mobile print shop and design shopping evaluation was done in [38]. Effectiveness, efficiency and satisfaction of the application was measured using usability testing methodology. Ten random participants were selected for this purpose. Some of them were experienced in using these kinds of applications others were novices. Observations and questionnaires were used for data collection Test scenarios were created from issues that were observed earlier in addition users were asked to fill demographic questionnaires before the start of the usability test. Test scenarios were given and users were asked to perform them and they were under the observation of evaluators. Effectiveness, satisfaction and efficiency were the 3 usability metrics that were measured. The application under study was Achik.biz mobile app. However, results were not as good as they were expected. Usability score of the application was 66% which was below average. It indicates that users were dissatisfied with the application. Another factor that may have contributed to this outcome is users' lack of understanding. Users failed to understand the guidelines and test scenario so they could not complete the task as stated in the scenario. Results shows that the application needs further improvement in terms of usability as the application had weak and poor usability.

Usability evaluation of a mobile health application was done in [41] on basis of task performance evaluation and satisfaction of patient. Evaluation was done to measure satisfaction, efficiency and effectiveness. Participants of the study were patients having different types of seasonal disease like cold, cough etc. and they also need to be educated so they can use and understand the application. They were also novice user as they have not used and interacted with the application before. After performing tasks participants were interviewed with the questions prepared beforehand. "Mytabeeb" is an m-health application that is studied and evaluated in the research. This application also provides list of recommended doctors that are available anytime. Results varied based on the gender, age and patient experiences. Male patients have higher average success rate, error rates were low and the mean satisfaction rate that is SUS as compared to females. On the other hand younger patients had higher average task completion rate, higher mean satisfaction ratings, just one error on average and task

completion periods were shorter. Patients who had recently acquired a disease had a higher mean satisfaction level, less mistakes, higher SUS score, task completion rate was high and shortest total task time. Education does not appear to have much of an impact on satisfaction ratings, however using mobile devices resulted in less errors when performing tasks. The study shed light on how the characteristics of the patients may influence interaction performance and developers have to improve m-health and e-health applications on practical grounds.

2.5 Effectiveness

Effectiveness is measured by how precisely and thoroughly an objective is attained. Effectiveness is mentioned as an important factor in the study [12] where effectiveness of an online shopping application called Carousell is discussed. Survey was conducted for the research from the students of University Utara Malaysia (UUM). Overall results were quite positive and users were satisfied but still there is a room for improvement.

Mudah.my mobile application was reviewed and tested in [30]. It was completed with consideration for user pleasure, effectiveness, and efficiency. Five tasks were assigned to the ten volunteers who were chosen to test the application's user interface. To evaluate usability, user performance and perception were considered. The application was tested at University Utara Malaysia (UUM), and results revealed that it is straightforward and reliable. The survey also discovered that users may easily advertise and sell products without owning or renting a business using the app, as well as locate goods and services from distant marketplaces. However, there is certainly room for development given that several customers encountered usability problems.

Effectiveness is also mentioned as an important factor in the study [26] that evaluates HU an online retailer of Islamic clothing that has a website and a mobile application for their consumers. Every year, more people visit HU, but at the same time, more orders are cancelled, and the conversion rate from visitors to buyers is still low. This calls for an assessment of the website and application to find flaws while concentrating on usability and user acceptance to offer suggestions for improvement. Evaluation using a usability method is carried out by measuring efficiency, effectiveness, and user satisfaction. Consumer Approval of Electronic Commerce Questionnaires are used to gauge user acceptance. More than 70% of the participants finished the job that was given to them during the evaluation, proving the efficacy of both the HU website and application. The amount of time it takes to perform a task and the quantity of errors it generates demonstrate how ineffective the website and the programme are. The user

satisfaction results reveal varying levels of satisfaction from each participant group, including expert groups and novice groups for the website and application. In a similar vein, the outcomes of user acceptance reveal that each participant group experiences varying degrees of pleasure. Based on the findings, nine changes were suggested for mobile apps and eight for websites. Results also indicated that user comments and points of view should be considered.

Utilizing usability testing methodologies, the application's effectiveness, efficiency, and satisfaction were evaluated in [38] it is done by doing usability evaluation of a mobile print shop and design shopping application. For the experiment, ten people were chosen at random. While some of them had experience using these programmes, others were beginners. Data collecting methods included questionnaires and observations. Prior to the start of the usability test, subjects were requested to complete demographic surveys and test scenarios were designed based on problems that had been previously noted. Users were given test situations, instructed to complete them, and evaluated while they were doing so. Three usability metrics effectiveness, satisfaction, and efficiency were assessed. The subject of the investigation was the Achik.biz mobile app. Results, however, fell short of expectations. The application had a 66% usability score, which was below average. It shows that users were not pleased with the programme. The inability of the users to comprehend the situation is another element that could have affected the result. Users were unable to accomplish the task as specified in the scenario because they did not comprehend the instructions and test scenario. Results indicate that the application's usability still needs to be improved, as it was weak and unreliable.

A mobile health app's usability was assessed in [41] based on patient satisfaction and task performance assessment. Evaluations were conducted in order to gauge satisfaction, efficacy, and efficiency. Patients with various seasonal illnesses, such as colds, coughs, and others, made up the study's participants. These patients needed education so they could utilise and comprehend the programme. Since they had never used or engaged with the application previously, they were likewise inexperienced users. Participants were interviewed with pre-planned questions after completing assignments. The m-health application "Mytabeeb" is examined in the study. Additionally, this application offers a list of suggested doctors who are always on call. Results vary according to patient experiences, age, and gender. In comparison to female patients, male patients have greater average success rates, lower error rates, and a higher mean satisfaction rate (SUS). However, younger patients completed tasks on average more quickly, had higher mean satisfaction ratings, made fewer errors overall, and had shorter task completion times. Recent illness patients exhibited greater mean satisfaction levels, less

errors, higher SUS scores, high job completion rates, and shorter overall task times. These all articles shows that effectiveness is an important usability factor.

2.6 User Satisfaction

The level of user satisfaction indicates how pleased your consumers are with your good or service. Additionally, it makes the difference between success and failure for many businesses. The phrase "customer satisfaction" is widely used in marketing. It assesses if a company's goods and services meet or surpass customers' expectations and reveals how satisfied your customers are with your product or service. Furthermore, it determines the success or failure of many businesses. The phrase "customer satisfaction" is widely used in marketing. It determines if a company's goods and services meet or surpass the expectations of its customers.

User satisfaction is one of the main factors that companies focuses on. It is an important factors as it is mentioned in several articles listed down below. Article [12] also considered user satisfaction as an important factor as it was a factor that customer sought for while using an online shopping application named as Carousell.

User satisfaction was one of the client interactions on which the usability assessment of EMGS mobile application was done [13]. Survey was done and the majority of users were content with the application's four surveyed usability attributes to some degree.

The study [16] looked into whether the backdrop colour of icons and icon symbols have an impact on menu selection time and customer satisfaction. Both the icon background and the icon symbol have a substantial impact on menu selection time and it is indicated by two-way ANOVA. The results showed that icon backdrop colour had the greatest influence on menu time selection, and that icons with multi-colour backgrounds and pictorial symbols had the highest satisfaction score. Overall, the experiment and survey findings indicated that icons with a multi-colour backdrop and pictorial symbol have the greatest design since they satisfy customer expectations and allow for the quickest menu choosing time. More research is needed to better understand the impact of the two variables on icon and menu design.

The study [18], [19] addressed Usability evaluation of mobile applications. In this modern era mobile is widely used and with that almost everything is done using different applications. Client experience typically upgrades and expands the manner in which individuals work. One of the key ideas of HCI is usability engineering. Evaluation was done in [18] to assess the usefulness of the Lazada mobile application in terms of proficiency, adequacy, and satisfaction.

Usability test was done which shows some pros and cons of the application. The study is useful to Lazada app developers and owners because it highlights usability difficulties and suggests fixes that helps them design a better version.

The researcher's goal was to assess the usability of various mobile weather hazard alert apps, and it identified a number of usability problems that were related to the elements of the weather radio programme that were put to the test [19]. Several other weather alert applications and programmes with comparable built-in capabilities also have such problems. User satisfaction was tested in the article.

These days M-commerce has become one of the main way to do shopping which brings about more rivalry so execution must be improved basically for satisfaction of clients. The research [24] aims to study usability evaluation of one of M-commerce site in Indonesia. Intellectual walkthrough and heuristic ease of use strategy were utilized for assessment cycle and information was gathered utilizing profundity meeting and surveys. The discoveries reveal some fresh information for designers and developers concerning M-Commerce, notably in terms of usability and features, as well as the issues and challenges that users confront.

Usability evaluation is done in [27] of an online banking site in Iran. It shed lights on the plan of banking sites, with accentuation on usability and client fulfilment as two significant proportions of Web achievement. In a restricted and serious market to plan a decent site is by all accounts one of the difficulties that Iranian financial industry may experience. User satisfaction was likewise affected uniquely by the Web configuration ascribes and not by the individual attributes of the clients. Web structure had the strongest link to customer fulfilment among the Web configuration attributes, followed by format, personalization, search, and execution. User satisfaction was also influenced by the usability of the website. The lack of personal qualities of users when it comes to usability and user happiness is significant, and it recommends that Web designers should pay more attention to this.

Usability evaluation of Amazon Shazam application is done in [29]. 15 users with varying levels of experience completed a task-based evaluation in which they completed five tasks using the most common functions of the Shazam mobile application: create an account and login, discover music, use Shazam in a noise-free environment, use Shazam in a noisy environment, and explore a favourite music. Participants completed a post-test questionnaire to provide their opinions on the usability of the application's UI. The majority of users were satisfied with the

application's services; it was simple to use and met the needs of the customers, according to the findings.

A mobile application named as Mudah.my was assessed and put to test with effectiveness, efficiency and user satisfaction in mind [30]. 10 people were chosen to help in testing the application interface by performing some tasks.

The influence of responsive web design on the user experience when using the e-Ebola Awareness System on laptop and smartphone devices was tested and evaluated in [31]. The devices used in the testing were Android and Blackberry. Task completion rate, task error rate, task time, task difficulty, perceived usability (system satisfaction), perceived learnability and loyalty were among the user experience metrics that were collected. After gathering and analyzing the data, it was determined that customers preferred their smartphone to their laptop. This shows that the smartphone's web design was superior to the laptops in terms of responsiveness. However, at $\alpha=0.05$ the observed variations for most of the metrics were not substantially different from zero. This means that when utilizing the e-Ebola Awareness System Website for those measures, users had identical user experiences on both types of devices, and that the impact of the responsive web design for laptop and mobile devices was similar for those metrics.

The goal of the study [32] was to see how effect of pictures, review credibility, and personalization options affect user pleasure when using restaurant recommendation apps. Quantitative study was done to measure the relationship between variables. Customers of two popular Indonesian restaurant recommendation apps, Zomato and Qraved, were surveyed. After collecting data from 419 people and analysing the results with multiple regressions in SPSS 22.0, the findings show that pictures and review credibility have an impact on user satisfaction with restaurant recommender apps. From the results it was evident that the customer feels good to see the picture of the food and it helps them in selecting the menu as the photos represents the actual food that is served in the restaurant. Results also suggests that credible reviews from an expert affect customer satisfaction on using restaurant recommender app. User satisfaction in accessing the application can be further improved by providing personalization on a restaurant recommender app. As it could help in finding the customer's preferences through the personal data they have provided when accessing the application for the first time.

In the study [33] that assesses HU, an online seller of Islamic clothes with a website and a mobile application for their customers, effectiveness is also cited as a crucial feature. More

people visit HU every year, but at the same time, more orders are cancelled, and the ratio of visitors to buyers is remains low. This necessitates a review of the website and application to identify issues and make recommendations for improvement while focusing on usability and user approval. Utilizing a usability approach, evaluation is done by gauging effectiveness, efficiency, and user happiness. Questionnaires are used to measure user acceptance of electronic commerce. The effectiveness of the HU website and application was demonstrated by the fact that more than 70% of the participants completed the task that was assigned to them during the evaluation. The time it takes to complete a task and the number of mistakes it produces show how inefficient the website and the programme are. The user satisfaction scores for the website and application show various degrees of satisfaction from both expert groups and novice groups of participants. Similar to this, the results of user acceptability show that the levels of pleasure experienced by each participant group vary. Nine adjustments for mobile apps and eight for websites were recommended in light of the findings. Additionally, the findings suggested that it would be wise to take into account customer feedback.

Literature review is done in [35], in order to evaluate yoga app and to find the factors affecting user experience, satisfaction and design. It also implies that the yoga app's user experience design evaluation mechanism has yet to be built. Using Schmitt's SEMs, the user experience design criteria for the daily yoga software were separated into five dimensions: sense, think, feel, act, and relate. The research hints on the necessary criteria framework of user experience design for the daily yoga app using the DEMATEL (Decision Making and Trial Evaluation Laboratory)-based ANP (Analytic Network Process) technique to work out the factor's importance order as well as the causative relationships among them using the Delphi method composed of eight experts. Then, after merging the results of an important performance analysis of 16 genuine users, improvement measures were explored. The results demonstrate that the yoga class is important in the daily yoga app's user experience design, and that there is room for development, since an appealing interface can increase user experience. The evaluation approach employed in the study can be utilised to improve the user experience of the daily yoga app and can be used to the user experience design process, questionnaire development, health app assessment, and other related application evaluation and optimization.

The study [36] is an empirical study of customer's satisfaction and intention of repurchase in case of online shopping in Vietnam. Data was collected by sending questionnaires online through social media apps Facebook and Zalo. Data was collected from 597 Vietnamese randomly who are experienced in online shopping. Mixed method study is used applying both

qualitative and quantitative methods and impact of factors such as responsiveness, convenience, trust, information quality, delivery and perceived usability on intention of repurchase and customer satisfaction was investigated. Results discovered that the factors that have most vital impact on customer satisfaction and intention are 1) Convenience, information quality, perceived website usability and delivery. 2) Trusting moderately affects repurchase intention and satisfaction of customer. 3) There is no significant influence of responsiveness on the intention of repurchase. 4) Gender and marital status of the customers are two control factors that have a significant impact on customer satisfaction and repurchase intention. Male customers were more satisfied than female customers, and single people were more likely to repurchase at their typical familiar websites than other people, according to the findings. The data also revealed that the six elements described above had various degrees of impact on consumer satisfaction and repurchase intention, as well as demographic considerations. Researchers recommended to increase the level of satisfaction so that more customers will use their online sites for shopping. First and foremost these businesses must ensure accuracy, completeness, understand ability and timeliness information about the product that they are selling. Secondly e-vendors should work together with well-known distribution services, this could ensure the timely and safely delivery of the products to the customers. Payment methods could be improved and more payment methods could be introduced for the ease of the customer and the most important thing is the usability of the website as it is important that the user friendly website should be developed so that customers can shop with ease.

The effectiveness, efficiency, and satisfaction of the application were assessed using usability testing approaches in [38]. This was done by conducting a usability evaluation of a mobile print shop and design shopping application. 10 participants in this experiment were selected at random. Some of them were seasoned users of these programmes, while others were new. Surveys and observations were used as data collection techniques. Subjects were asked to complete demographic surveys prior to the start of the usability test, and test scenarios were created based on issues that had already been identified. Users were presented with test scenarios, given instructions on how to perform them, and graded as they went. Effectiveness, satisfaction, and efficiency of three usability indicators were evaluated. The mobile app Achik.biz was the focus of the inquiry. But the results were insufficient. The application's usability rating was below average at 66%. It demonstrates that users were dissatisfied with the programme. Another factor that might have had an impact on the outcome was the users' incapacity to understand the circumstances. Users were unable to complete the work according

to the scenario because they did not understand the test scenario or the instructions. The application's usability, which was poor and unreliable, has to be enhanced, according to the results.

In [41], the usability of a mobile health application was evaluated based on patient satisfaction and task performance evaluation. Assessments were made to determine satisfaction, effectiveness, and efficiency. The study's participants included patients with a range of seasonal ailments, including colds, coughs, and others. To use and understand the programme, these patients need education. They too were inexperienced users because they had never used or interacted with the application before. After completing the projects, participants were questioned using pre-planned questions. The mobile health app "Mytabeeb" is investigated. Additionally, this application provides a list of recommended on-call doctors. Results vary depending on patient history, gender, and age. As a result of the study, developers of m-health and e-health applications can better understand how patient attributes may affect interaction performance.

2.7 Usability (Interaction with User Interface)

The primary goal of the study [13] was to evaluate the EMGS mobile application's usability using four client interactions: perceived efficiency, usability, usefulness, and user satisfaction. 20 users of the EMGS mobile application who finished five assignments were polled. The outcome indicates that users were happy with the application. The majority of users were content with the application's four surveyed usability attributes to some degree.

The study [16] investigated if menu selection time and customer satisfaction were impacted by the background colour of icons and icon symbols. Two-way ANOVA results show that the icon backdrop and icon symbol both have a significant impact on the length of time it takes to select an item from the menu. The findings revealed that the colour of the icon backdrop had the biggest impact on choosing a menu time, and that icons with multi-coloured backgrounds and pictorial symbols had the best satisfaction levels. Overall, the experiment and survey results showed that icons with a multi-coloured background and a pictorial symbol have the best design since they meet customer expectations and enable the quickest menu picking time.

oBike is a global bicycle sharing platform that provides commuters with a convenient, accessible, and environmentally friendly way of transportation[17]. The majority of participants agreed that the oBike mobile application could be improved to better meet user needs.

Implementing the advice ensures that the app will be improved and that it will continue to be a user-centric mobile app. The study suggests adjustments and justifications based on the success rate, behaviours, and opinions of the participants. A severity rating is included with each recommendation.

An Iranian online banking site's usability has been assessed in [27]. It provided insight into the design of banking websites, highlighting usability and customer satisfaction as two crucial components of web success. User satisfaction was also specifically impacted by the Web configuration attributes rather than by the particular client attributes. Out of all the Web configuration criteria, web structure showed the strongest correlation to customer satisfaction, followed by format, customization, search, and execution. Web designers tried to pay greater attention to the attributes like usability and user satisfaction.

The research [28] was done on participants of Germany and Taiwan in order to find out their preference in using online stores and their culture differences are also highlighted which effects customer retention. In order to measure and explore the research objectives experiment was conducted in lab along with survey from participants of these two countries. Results indicated that different online customer shows different responses towards different website interface design according to their culture and taste so cross culture left a huge impact on the outcomes.

In the study [29] usability evaluation of the Amazon Shazam application is performed. The activities included creating an account and logging in, finding music, using Shazam in a noisy area, using Shazam in a quiet location, and exploring a favourite piece of music. The task-based evaluation involved 15 users with varied levels of experience. After the test, participants responded to a post-test survey asking them about the usability of the application's user interface. According to the data, the majority of users were happy with the application's offerings, feeling that it was easy to use and catered to their needs.

When utilising the e-Ebola Awareness System (a Web-based health awareness portal for the Ebola virus disease), on laptop and smartphone devices, the impact of responsive web design on the user experience was tested and evaluated in [31]. Blackberry and Android-powered devices were tested. The user experience metrics that were gathered included task completion rate, task error rate, task time, task difficulty, perceived usability (system satisfaction), perceived learnability, and loyalty. Customers preferred their smartphone to their laptop, it was found after collecting and evaluating the data. This demonstrates that the responsiveness of the

site design on smartphones was greater than that on desktops. The observed fluctuations for the majority of the metrics, however, were not significantly different from zero at $\alpha=0.05$. This indicates that users had the same user experiences using the e-Ebola Awareness System Website for those metrics on both laptops and mobile devices, and that the responsive web design had a similar impact on both types of devices.

Disaster applications are being investigated as a one-way communication mechanism for providing information about natural dangers in [34]. There are many disaster apps in the market but to retain customers to continue using the application is a challenge. In the study, a mixed method approach was utilised to determine whether usability characteristics influence a user's inclination to continue using an application or not. Both quantitative and qualitative approaches are used. For quantitative method usability continuance model is tested using structural equation modelling and data was collected from 271 disaster app users. For the qualitative approach in depth interviews were conducted from 18 participants. Results showed that there are 5 usability factors influencing the continuance intention that are: 1) App utility: whether the app delivers its functionality or not in terms of user's perspective, 2) app dependability: whether the application is dependable or not, 3) user interface output: whether the information provided by the application is easily understood by the user, 4) too much focus on user interface graphics, 5) user interface input can discourage continuance intention. These factors can help both designers and developers and guide them so they can focus on those factors that can enhance the continuance intention of disaster apps. The study also discovered that disaster app usability factors have distinct relationships with continuation intention that may differ from other generic apps, such as users of disaster apps negatively perceiving the app to have too many visual elements, which is not the case with any other generic app.

A review of the literature is conducted in [35] to assess the yoga app and identify the variables influencing user satisfaction, experience, and design. Additionally, it suggests that the user experience design evaluation tool for the yoga software has not yet been created. The daily yoga software's user experience design criteria were broken down into five categories using Schmitt's SEMs: sense, think, feel, act, and relate. Improvement measures were then investigated after combining the findings of an important performance investigation of 16 real users. The findings show that the yoga class plays a significant role in the daily yoga app's user experience design and that there is still potential for improvement because a user-friendly interface can enhance the experience. The evaluation strategy utilised in the study can be used to enhance the daily

yoga app's user experience as well as the development of questionnaires, evaluation of health apps, and other related application evaluation and optimization processes.

An empirical examination of consumer satisfaction and repurchase intentions in the context of Vietnamese internet shopping is presented in the study [35]. By distributing questionnaires online using the social media applications Zalo and Facebook, data was gathered. Data were gathered from 597 Vietnamese people who had previously shopped online. The impact of variables like responsiveness, convenience, trust, information quality, delivery, and perceived usefulness on customer satisfaction and repurchase intention was examined in a mixed method study using both qualitative and quantitative methodologies. Results showed that 1) Convenience, information quality, perceived website usability, and delivery have the greatest influence on consumer happiness and intention. 2) Customer satisfaction and repurchase intention are moderately impacted by trust. 3) The likelihood of a repeat purchase is not much impacted by responsiveness. 4) Two control factors that significantly affect customer satisfaction and repurchase intention are the consumers' gender and marital status. The results showed that single people were more inclined than other people to make another purchase at their usual, familiar websites, and that male consumers were more satisfied than female customers. The results also showed that the six factors mentioned above affected consumer happiness, repurchase intent, and demographic factors to varying degrees. Researchers suggested boosting customer satisfaction to encourage more people to shop on their websites. These companies must first and foremost ensure that the information they provide is accurate, thorough, easy to grasp, and timely. First and foremost, these companies need to guarantee that the information they provide on the products they offer is accurate, thorough, easy to grasp, and timely. Second, e-vendors should collaborate with reputable distribution services to guarantee the prompt and secure delivery of goods to clients. The most crucial factor is the website's usability as it is crucial that the user-friendly website should be established so that people can buy with ease.

The goal of the study [37] is to look into the new usability features of mobile apps and websites. The usability models, frameworks and platforms were also discussed in the study. The findings of the study will be useful in providing various guidelines for developing future design strategies to improve usability for mobile applications and websites. A review of the most recent and evolving usability criteria was presented in the article. The study only looked at the usability features of websites and mobile apps, which can be used as important factors in the development

of e-commerce/m-commerce applications. A comprehensive analysis of the most recent and developing usability elements of websites and mobile applications was conducted. Only publications with significant usability characteristics for the construction of websites, mobile applications, and mobile device interfaces were found. Usability attributes were discussed from various point of views from articles from 2010-2019. Some authors concentrated on the impact of usability attributes on the development of mobile apps and websites, while others concentrated on user usability and accessibility concerns. The usability of commercial, public, educational, travel, and health-related mobile apps and websites was also investigated. According to the study, an e-commerce website or mobile application cannot succeed without customer approval. Surveys and questionnaires were initially used for user acceptance testing. Usability testing was also conducted in a lab environment with a user centered interface. Usability criteria have gradually increased and most recent researches focuses on usability problems for disable people like blind users or users with low power vision. This study will be helpful in designing potential plans and recommendations for developing websites and mobile applications that are more accessible to disable people.

Aim of the research [39] is to study m-health wellness application and inquire usability problems. The application under study is named as “Activio”. M-health is basically a division of e-health which is developed as a result of new innovations and advancements in smartphones and applications. Main purpose of these applications is to provide ease to people by tracking and monitoring various daily life activities and provide services accordingly. Firstly literature review is done to study previous studies in the related field and to find out about usability evaluation methods. Usability test was conducted from 20 participants that were selected from a fitness club. By the help of usability testing and literature review questionnaires were designed which help the author in understanding the level of satisfaction that user have felt while using the application and the areas which need further improvement. Results of the study will help in developing an efficient m-health fitness application which will be helpful in building effective communication between trainers and trainees.

Online techniques are used to evaluate 79 e-government websites in Tanzania[40]. The main goal was to identify accessibility, usability, and web security flaws. Results were not as good as expected as there were many issues related to these 3 factors. Other usability issues detected included broken links on all websites and 52 out of 79 pages taking more than 5 seconds to load. All the websites have violated the WCAG 1.0 guidelines and have several accessibility

issues. According to the findings, 40 out of 79 websites, or 50.6 percent, have one or more high severity vulnerabilities. On the other hand, 64.5 percent of websites, or 51 out of 79, have one or more medium severity vulnerabilities, such as denial of service or cross-site request forgery. Results revealed that there are several flaws that needs to be addressed so the research not only states the issues but also recommended some solutions to further improve these websites. These results also shed light on the lack of awareness among web developers and designers to comply with usability and accessibility standards while developing the websites. As a result, they must be taught to think about accessibility and usability during the creation process.

2.8 Usefulness

Anything that moves you closer to your goals is usefulness. Usefulness is one of the many variables that influence and contribute to a product's usability. When something is useful, it can be applied to accomplish a certain goal. The studies below put emphasis on the importance of usefulness as a usability factor.

The primary goal of the study [13] was to evaluate the EMGS mobile application's usability using four client interactions: perceived efficiency, usability, usefulness, and user satisfaction. 20 users of the EMGS mobile application who finished five assignments were polled. The outcome indicates that users were happy with the application. The four surveyed usability factors for the application met the needs of the majority of users to some extent.

The purpose of the study [32] is to determine how user satisfaction with restaurant recommendation applications is impacted by the usage of photos, review credibility, and customisation choices. The link between the factors was measured using quantitative research. Customers of Zomato and Qraved, two well-known restaurant suggestion applications in Indonesia, were polled. The data is collected from 419 individuals and the findings showed that customers enjoy viewing food images and that doing so aids them in choosing items from the menu because the images show the cuisine as it is actually served in the restaurant. The findings also imply that the reliability of expert reviews has an impact on how satisfied customers are with restaurant recommendation apps. Personalization on a restaurant recommender app can increase user happiness with visiting the programme. Considering that it could be able to determine the customer's preferences using the personal information they provided while using the application for the first time.

2.9 Proficiency

Proficiency basically means a high degree of knowledge or expertise to use an application. Today's world uses mobile devices frequently, and as a result, various applications are employed for nearly everything. The way people operate is often improved and expanded by the client experience. Usability engineering is one of the fundamental principles of HCI. The effectiveness of the Lazada mobile application was evaluated in [18] in terms of proficiency, adequacy, and satisfaction. A usability test was conducted to identify the application's advantages and disadvantages. The study was helpful to Lazada app creators and owners because it identifies usability issues and makes recommendations for solutions to enable them to create a better version.

2.10 Adequacy

Adequacy is basically concerned with addressing the user's understanding of the tasks. So, it's important to know whether user can understand the features of the application and can complete the tasks. The study mentioned below also emphasize on this factor while performing the usability evaluation of a mobile application.

The study [18] evaluated the Lazada mobile application's effectiveness in terms of proficiency, adequacy, and satisfaction. To determine the benefits and drawbacks of the programme, a usability test was performed. The study was useful to Lazada application developers and owners because it identifies usability faults and suggests improvements to help them create a better version.

2.11 Ease of Use

Ease of use is a central usability concept. A fundamental idea that outlines how simple it is for customers to utilise a product is ease of use. Design teams of the mobile applications define specific metrics for the ease of use of customers.

In order to evaluate the client experience of the Amazon Kindle mobile application, a research-based usability study was conducted in [20]. Perceived simplicity of use, visibility, enjoyability, and efficiency were the four client-experience variables that the study largely used to evaluate this programme. Results indicate that while the majority of users were happy with this programme, there was still room for improvement because some users encountered difficulties using it.

The study [22] targets assessing availability and ease of use of airline websites. The airline sector has recently resorted to online channels in order to provide online help, optimal data, and expand its consumer base. The sites were assessed by WCAG 2.0 accessibility guidelines. The findings demonstrate that website designers and developers must be aware of ease of use and accessibility requirements in order to meet the demands of handicapped persons with physical disabilities and linguistic impairments in order to create a universally accessible online environment.

A usability assessment of the Amazon Shazam app is done in the study [29]. Making an account and logging in were among the tasks, along with looking for music, utilising Shazam in a busy place and in a calm one, and researching a favourite piece of music. There were 15 users, all with different degrees of experience, in the task-based evaluation. Participants in the test responded to a post-test survey that inquired about the application's user interface's usability. The results showed that most users were content with the services provided by the programme, feeling that it was user-friendly and fitted to their needs.

Mudah. My mobile application underwent testing and evaluation in [30]. It was completed with consideration for user pleasure, efficacy, and efficiency. Five tasks were assigned to the ten volunteers who were chosen to test the application's user interface. To evaluate usability, user performance and perception were considered. The application was tested at University Utara Malaysia (UUM), and results revealed that it is straightforward and reliable. The survey also discovered that users may easily advertise and sell products without owning or renting a business using the app, as well as locate goods and services from distant marketplaces. However, there is certainly room for development given that several customers encountered usability problems.

2.12 Visibility

The effectiveness with which the system's status is communicated to its users is referred to as visibility. Systems should always keep users informed of what is going on by giving relevant feedback in a timely manner.

The study [20] conducted an empirical usability study to evaluate the client experience of the Amazon Kindle mobile application. The study heavily relied on four client-experience variables to evaluate this programme: perceived ease of use, visibility, enjoyability, and efficiency. The

findings show that even though the majority of users were satisfied with this programme, there was still potential for improvement because some users had trouble utilising it.

2.13 Enjoyability

Enjoyability means the application is enjoyable and pleasant to work on. The interface of the application is not boring and complicated. The application is easy to use and enjoyable to use. The study [20] conducted an empirical usability study to assess the customer experience of the Amazon Kindle mobile application. The study made considerable use of four client-experience factors perceived ease of use, visibility, enjoyability, and efficiency to evaluate this programme. The results demonstrate that, despite the fact that the majority of users were happy with this programme, there was still room for development because some users had problems using it.

2.14 Accessibility

Accessibility relates to the technical side of a website or application. Accessibility is that the application is easily accessible to the client. It refers to how people can perceive, comprehend, navigate, and engage with the website or application. Accessibility also refers to the ability for persons with impairments to use a website, tool, or technology. The articles mentioned below considers accessibility as an important usability factor.

The purpose of the study [22] was to evaluate the accessibility and usability of airline websites. The airline industry has increasingly turned to online resources in order to offer online assistance, superior statistics, and increase its customer base. The websites were evaluated using WCAG 2.0 accessibility standards. The results show that in order to address the needs of people with disabilities, including those who are physically disabled and linguistically impaired, website designers and developers must be conscious of usability and accessibility requirements.

The purpose of the research [39] was to examine usability issues in m-health wellness applications. "Activio" was the name of the application under investigation. M-health, which was really a subset of e-health, has grown as a result of new developments and improvements in cellphones and applications. These applications' primary goal was to make people's lives easier by measuring and monitoring numerous aspects of daily life and offering services accordingly. First, a survey of the literature was conducted to examine earlier research in the topic and learn more about usability assessment techniques. 20 people who were chosen from a fitness club participated in a usability test. Questionnaires were created with the use of usability testing and literature reviews to help the author assess how satisfied users were with

the programme and what still needs to be fixed. The study's findings will aid in the creation of a useful m-health fitness application that will facilitate successful interaction between trainers and trainees.

E-government websites were reviewed in [40]. The evaluation of Tanzania's 79 e-government websites was done online. Finding accessibility, usability, and web security problems was the main objective. Since there were numerous problems relating to these 3 elements, the results were not as good as anticipated. Other issues with usability included 52 out of 79 websites taking longer than 5 seconds to load, and all pages had broken links. All of the websites break the WCAG 1.0 rules and have a number of accessibility problems. The research shows that 40 out of 79 websites, or 50.6%, have one or more high severity vulnerabilities. In contrast, 51 of 79 websites, or 64.5 percent, contained one or more medium severity vulnerabilities, such as cross-site request forgery or denial of service. The research not only identifies the problems but also suggests some remedies to further enhance these websites, as the findings showed that there are a number of defects that need to be solved. These findings also highlight the lack of understanding among web designers and developers on the need to adhere to usability and accessibility standards while creating websites.

2.15 Readability

The ease with which a piece of writing may be read and understood is known as readability. Readability is all about how simple or complex a text is to read. The presentation of a text (such as the font, spacing, or colours) and context both affect how readable it is (the words and sentences on the page). Readability is an important factor as the application must be readable for the users to easily understand and use it. Sometimes applications are specially designed for the disable or the visually impaired people. The articles mentioned below put emphasis on readability as an important usability factor for the websites or applications.

The objective of study [22] was to assess the usability and accessibility of airline websites. In order to provide online help, superior data, and grow its customer base, the airline sector has increasingly turned to online tools. The websites were assessed in accordance with WCAG 2.0 accessibility guidelines. The findings demonstrate the necessity for website designers and developers to be aware of usability and accessibility criteria in order to accommodate the needs of persons with disabilities, including those who are physically challenged and linguistically impaired.

Examining usability concerns in m-health wellness applications was the goal of the study [39]. The application under examination was called "Activio." M-health had expanded as a result of new advances and advancements in mobile devices and applications, which was actually a subset of e-health. The main objective of these applications was to simplify people's lives by measuring and keeping track of many aspects of daily living and providing services accordingly. First, a review of the literature was done to look at past studies on the subject and discover more about usability testing methods. 20 individuals from a fitness centre were recruited to take part in the usability test. In order to gauge how satisfied users were with the programme and what still needs to be improved, questionnaires were developed using usability testing and literature research. The results of the study will help in the development of a practical m-health fitness application that will promote effective communication between trainers and trainees.

2.16 App Utility

App utility is that whether the app delivers its functionality or not in terms of user's perspective. If the application is not delivering its functionality properly then the customer will never use it again. So, the application must deliver its functionality properly so the customer will be satisfied with the application and will use it again.

Disaster applications were being researched in [34]. A mixed method approach was utilised to determine whether usability characteristics influence a user's inclination to continue using an application or not. Approaches that are both quantitative and qualitative were employed. In order to assess the usability of the continuation model quantitatively, data from 271 users of catastrophe apps was gathered. 18 participants were subjected to in-depth interviews as part of the qualitative methodology. The 5 usability criteria that were found to be influencing the continuing intention were app utility, app dependability, too much emphasis on user interface graphics, user interface input that discourages continuation intention, and user interface output that determines if the information offered by the application was easily comprehended by the user. These elements can support and direct designers and developers, allowing them to concentrate on elements that can improve the continuance intention of catastrophe apps. The study also found that the usability aspects of disaster apps may differ from other generic apps in their relationships to users' intentions to continue using them. For example, users of disaster apps may perceive them negatively because they contain too many visual elements, which is not the case with other generic apps.

In order to evaluate the yoga app and determine the factors influencing user pleasure, experience, and design, a review of the literature is carried out in [35]. Schmitt's SEMs were used to divide the user experience design criteria for the daily yoga programme into five categories: sense, think, feel, act, and relate. Improvement measures were investigated after combining the findings of an important performance evaluation involving 16 real users. The results show that the yoga class has a major influence on the daily yoga app's user experience design and that there is still room for improvement because a user-friendly interface can improve the experience.

2.17 App Dependability

App dependability is that whether the application is dependable or not. Customer can rely on the application for the completion of their task or not. The article [34] mentions this factor as an important factor for customer as it helps in influencing a user's inclination to continue using an application.

Applications for disasters were being studied in [34]. Both quantitative and qualitative approaches were used. Data from 271 users of catastrophic apps was collected in order to quantitatively evaluate the continuation model's usability. As part of the qualitative methodology, in-depth interviews with 18 individuals were conducted. App utility, app dependability, placing too much emphasis on user interface graphics, user interface input that deters continuation intention, and user interface output that determines whether the information provided by the application was easily understood by the user were the 5 usability criteria that were found to be influencing the continuing intention. The study also discovered that the usability features of catastrophe apps may be distinct from those of other types of applications in terms of how they relate to users' intents to keep using them. Designers and developers can concentrate on aspects that can enhance the continuation intention of disaster apps with the help and guidance of these elements, which can support and steer them.

2.18 Responsiveness

Responsiveness is the ability of reacting quickly and positively. It refers to a system's or functional unit's capacity to execute assigned tasks within a specified time frame.

The study [35] presents an empirical analysis of customer satisfaction and repurchase intentions in the context of Vietnamese internet shopping. Data was acquired by sending surveys on the

social media sites Zalo and Facebook. 597 Vietnamese individuals who had previously shopped online provided the data. In a mixed-method study that combined qualitative and quantitative techniques, the influence of factors like responsiveness, convenience, trust, information quality, delivery, and perceived usefulness on customer satisfaction and repurchase intention was investigated. Convenience, information quality, perceived website usability, and delivery were found to have the greatest impact on customer satisfaction and intention. The degree of responsiveness has little bearing on the likelihood of a repeat purchase. The findings revealed that male consumers were more satisfied than female consumers and that single persons were more likely than other people to make another purchase at their typical, trusted websites. The findings also demonstrated that, to varied degrees, the six criteria described above had an impact on demographic factors, consumer contentment, and repurchase intent. To encourage more consumers to shop on their websites, researchers proposed increasing customer happiness. These businesses must first and foremost make sure that the information they offer is precise, comprehensive, understandable, and timely. First and foremost, these businesses must make sure that the details they present on the things they sell are correct, comprehensive, simple to understand, and timely. Second, in order to ensure the quick and secure delivery of goods to customers, e-vendors should partner with renowned distribution providers. The usability of the website is the most important component since it is essential to have a user-friendly website so that visitors can easily make purchases.

Table: 2.1 List of Usability Factors

S.NO	Factors	Frequency	References
1.	Efficiency	08	[12],[13],[19],[20],[30],[33],[38],[41]
2.	Effectiveness	05	[12],[30],[33],[38],[41]
3.	User Satisfaction	16	[12],[13],[16],[18],[19],[24],[27],[29],[30],[31],[32],[33],[35],[36],[38],[41]
4.	Usefulness	02	[13],[32]
5.	Usability(user interface)	14	[13],[16],[17],[24],[27],[28],[29],[31],[34],[35],[36],[37],[39],[40]
6.	Proficiency	01	[18]
7.	Adequacy	01	[18]
8.	Ease of use	04	[20],[22],[29],[30]
9.	Visibility	01	[20]

10.	Enjoyability	01	[20]
11.	Accessibility	03	[22],[39],[40]
12.	Readability	02	[22],[39]
13.	App utility	02	[34],[35]
14.	App dependability	01	[34]
15.	Responsiveness	01	[36]

2.19 Relevant Research Studies

The main goal of doing this literature review was to find out the possible usability factors that could contribute to customer retention in terms of mobile applications and interaction of the user with the interface of the application. The data/material found was not directly related as there is not much work done in this field. Mostly articles were on usability evaluation and usability assessment of different mobile applications and websites and how can they improve customer experience and satisfy them by finding issues and further improving the application especially in terms of customer satisfaction, effectiveness and efficiency. All the above articles are explained below that how they are directly or indirectly linked with the topic of this research.

Usability performance of an online shopping application was checked in terms of efficiency, effectiveness and satisfaction [12]. Results shows that application was convenient and good to use from the perspective of both buyer and seller but there were some usability issues and validation issues which need to be further improved. So these factors efficiency, effectiveness and satisfaction can play an important role in retaining customers. As the overall result of this application “Carousell” was much better so it means customers are satisfied and they may want to use this application again so customers can be retained.

Usability evaluation of EMGS mobile application was done in [13] on the basis of 4 client encounters that are perceived efficiency, usability, usefulness and user satisfaction. Results revealed that users were satisfied by the application so it means that on basis of these factors customers can be retained as people were pleased using this application so they will use this application again.

Systematic literature review was done in [14] on usability of mobile applications and in [15] on usability studies on mobile user interface design patterns. These both researches can contribute in this way that these are focusing on studying literature about usability of mobile applications and interface design which could help in understanding the issues customer faces while using the mobile applications so they can be improved in future versions and can help in fulfilling user needs and satisfying them so customers can be retained if these issues are tackled properly and timely.

The study [16] looked into whether or not the backdrop colour of icons and icon symbols affect menu selection time and consumer satisfaction. Results shows that both of these features have greatest impact on menu selection time and customer satisfaction especially icon background colour had the largest impact on the selection of menu time. Overall, the experiment and survey findings indicated that icons with multi-colour backgrounds and pictorial symbols have the greatest design since they satisfy customer expectations and have the shortest menu selection time. From this, we can conclude that icons background colour and icon symbols are important for customer retention as applications with good background colour and icon symbols help customers in selecting menu faster and satisfy customers so they can help in retaining customers.

The user perception of the usability of the mobile application of oBike, a global bicycle sharing company, has been discovered in [17]. While interacting with the interface of the application user point out the areas that needs improvement. Like the search and reserve bicycle button and the logout from the account button needs improvement as participants faces problems while doing these tasks on the other hand menu items were well organized and functions were simple to locate. Interface plays an important role in attracting customers as the first thing that user interacts with and see is the interface so interface must be well made to attract and retain customers.

The study [18], [19] addressed Usability evaluation of mobile applications. Evaluation was done in [18] to gauge usability assessment of Lazada mobile application in the parts of proficiency, adequacy and satisfaction. Main factors were perceived effectiveness, efficiency and satisfaction on the basis of which the application was evaluated and in study [19] the usability assessment of the mobile weather hazard alert apps was done on the basis of two factors that are efficiency and user satisfaction.

These studies and the studies mentioned above which includes usability evaluation of applications are mostly done on the basis of three factors that are efficiency, effectiveness and user satisfaction. This means that these 3 factors are important in order to make an application effective, easy to use and to satisfy customers. So these factors must be taken into consideration while developing applications as they can play a significant influence in retaining customers.

In the research [20] laboratory-based usability assessment of Amazon kindle e-reader application was done. The research fundamentally assessed this application dependent on 4 client experienced factors namely perceived ease of use, visibility, enjoyability, and efficiency. Outcomes shows that most of the users were satisfied from this application. So these factors can be associated with customer retention.

A systematic literature review to present usability methodologies often utilised in m-commerce application usability assessment was conducted in [21]. The study's findings provide additional knowledge to usability practitioners and the research community on the current state of research and practises in usability techniques and evaluation approaches in the m-commerce application area, which can aid in our study by stating usability factors that can satisfy and retain customers.

The goal of the study [22] is to assess the quality of Sites of Indian aircrafts. The assessment is done based on accessibility, ease of use, and readability of the website using online automated tools. These factors are important to make any website/application effective and satisfy customers. So in order to retain customer accessibility, ease of use, and readability of the website/application is important as these are the basic things that must be present in any application/website to attract customers.

Systematic review of the usability and appropriateness of diabetes applications was conducted in [23]. The findings demonstrated that expert and patient satisfaction levels differed. The most common usability issues discovered were multi-step tasking, restricted functionality and interactivity, and difficult system navigation. So it was recommended to improve user satisfaction.

The study [24] focuses on evaluation of usability on M-commerce site in Indonesia and it highlights the usability issues faced by the user which can be taken into consideration by developers to further improve the site so the customer would be more satisfied while using the website.

Research [25] aims to focus on existing usability models for mobile applications. According to the findings of the literature research, overall usability evaluation models cannot assess the qualities of these numerous apps because each application has unique functional and non-functional criteria. As a result, specific usability models may be required to evaluate various applications. Usability models are needed to assess applications and websites in order to resolve usability issues so that customer will be satisfied using the application/website and will return to use that application again instead of looking for alternative options.

Same is the case with the research [26] as systematic literature review is done on usability of mobile learning applications which can help in gathering knowledge about usability of mobile applications and about factors that needs to be taken into consideration while developing applications so the outcome will be according to customer needs and they will be satisfied and stick to that application.

Usability evaluation is done in [27] of an online banking site in Iran. It is possible to draw conclusions from the research findings that user centered web design, usability and user satisfaction are important factors in making customers loyal so these factors must be kept in mind while developing any website.

The research [28] was done on participants of Germany and Taiwan in order to find out their preference in using online stores and their culture differences are also highlighted which effects customer retention. Results indicated that different online customer shows different responses towards different website interface design according to their culture and taste so cross culture left a huge impact on the outcomes. So it can be concluded that cultural differences can impact the customer retention rate as people from different cultures/countries may not find some things suitable or according to their taste due to cultural differences which may result in lower customer retention rate. So if developers are developing the website/application for global use or for the users of different countries so they may have to develop a generic interface and not use symbols/colours which may not be appropriate for another culture/country.

In the studies [29], [30] usability evaluation is done of different mobile applications. Usability evaluation of Amazon Shazam application is done in [29]. Participants tested 5 most common Shazam's mobile application functions. And the results revealed that the application's interface is simple, enjoyable, and usable. Mudah.my's mobile application was tested in terms of efficiency, effectiveness, and satisfaction in [30]. As previously stated, these three

characteristics are often employed by researchers to assess the usability of various mobile applications.

The study [31] assessed and evaluated the impact of responsive web design on the user experience with a laptop and smartphone devices while using the e-Ebola Awareness System (a Web-based health awareness portal for Ebola virus disease), and the results revealed that users had a better experience with smartphones than with laptops. This indicates that the web design of smartphone was better and more responsive than that of the laptop so it means that web design is the first thing that attracts customer so it should be well-built, effective, easy to use and according to customer needs so more customer could be attracted and then retained.

The study [32] seeks to ascertain the effects of visuals, review authenticity, and personalization options on customer satisfaction when using restaurant recommendation apps. According to the findings, visuals and review reliability have an impact on customer satisfaction while using restaurant recommender applications. From the results it was evident that the customer feels good to see the picture of the food and it helps them in selecting the menu as the photos represents the actual food that is served in the restaurant. Results also suggests that credible reviews from an expert affect customer satisfaction on using restaurant recommender app. User satisfaction in accessing the application can be further improved by providing personalization on a restaurant recommender app. As it could help in finding the customer's preferences through the personal data they have provided when accessing the application for the first time. So these factors can help in retaining customers.

Evaluation of HU an e-commerce of Islamic fashion product which have website as well as application for its customers is done in [33]. Every year number of HU visitor increases but at the same time the rate of cancelled order also increases and the conversion rate of customers from visitors to buyers is also not very good so there was a need to do the evaluation of both the website and application to find out flaws while focusing on usability and user approval to make suggestions for improvement. By measuring efficiency, effectiveness and user satisfaction, evaluation with usability approach is done. As mentioned above these 3 factors are usually used for the evaluation of websites/applications because these are most important factors and can led to customer retention.

Disaster applications that are one way communication tool to provide information about natural hazards is studied in [34]. There are many disaster apps in the market but to retain customers

to continue using the application is a challenge. Results showed that there are 5 usability factors influencing the continuance intention that are: 1) App utility: whether the app delivers its functionality or not in terms of user's perspective, 2) app dependability: whether the application is dependable or not, 3) user interface output: whether the information provided by the application is easily understood by the user, 4) too much emphasis on user interface graphics, 5) user interface input can discourage intention to continue. These factors can help both designers and developers and guide them so they can focus on those factors that can improve the long-term goal of catastrophe applications.

Literature review is done in [35] in order to evaluate yoga app and to find the factors affecting user experience, satisfaction and design. The results demonstrate that the yoga class is important in the user experience design of the daily yoga app and that there is room for development, since an appealing UI can increase user experience. So, the conclusion of the study is that user interface needs to be attractive and according to customer needs only then it can help in satisfying customers and retaining them.

The study [36] is an empirical investigation of customer's satisfaction and intention of repurchase in case of online shopping in Vietnam. Results discovered that the factors that have most vital impact on customer satisfaction and intention are 1) Convenience, information quality, perceived website usability and delivery. 2) Trusting moderately affects repurchase intention and satisfaction of customer. 3) There is no significant influence of responsiveness on the intention of repurchase. 4) There are some control variables that have a great influence on the satisfaction and repurchase intention of customers like gender and marital status of the customers. The studies also revealed that the six aforementioned characteristics have various degrees of influence on customer satisfaction and repurchase intention. Furthermore, demographic characteristics influence satisfaction and repurchase desire. Researchers recommended to increase the level of satisfaction so that more customers will use their online sites for shopping for that purpose there should be accurate, complete information about the product that they are selling. And the most important thing is the usability of the website as it is important that the user friendly website should be developed so that customers can shop with ease and they could be retained.

The goal of the research [37] was to examine the emerging usability attributes of mobile applications and websites. The usability models, frameworks and platforms were also discussed

in the study. The findings of the study will be useful in providing various guidelines for developing future design strategies to improve usability for mobile applications and websites.

Usability evaluation of a mobile print shop and design shopping evaluation was done in [38]. Effectiveness, efficiency and satisfaction of the application was measured using usability testing methodology. The study's findings shows that the application needs further improvement in terms of usability as the application had weak and poor usability. It means that an application must be effective, efficient and should be able to satisfy customers only then it will be called as successful application and it will be able to retain customers.

The aim of the research [39] was to study m-health wellness application and inquire usability problems. The application under study is named as "Activio". Results revealed that there were some issues in interface of the application as the icon were suitable for trainers but on the other hand failed to attract students so colors must be integrated in a way that they must be suitable for all users. As there are different type of users ranging from young to older age so the font size and language option must have personalization option so the user could easily choose the desired size and it will also increase the visibility of contents. As for the language usually English was used as a general language but as it was mobile health wellness application so in order to improve the readability and accessibility for older customer regional language should also be included. These are some of the features that must be taken into consideration while developing an application as these features plays an important role in customer satisfaction and if customer is satisfied than customer can be retained.

E-government websites were evaluated in [40]. Main focus was to find out accessibility, usability and web security vulnerabilities. These results shed light on the lack of awareness among web developers and designers to comply with usability and accessibility standards while developing the websites. So they needed to be trained to consider accessibility and usability during development stages as these were very important for customer satisfaction and retention.

Usability evaluation of a mobile health application was done in [41] on basis of task performance evaluation and satisfaction of patient. Evaluation was done to measure satisfaction, efficiency and effectiveness. The study shed light on how the characteristics of the participants may influence interaction performance. Usability evaluation of the applications/websites are mostly done on basis of satisfaction, efficiency and effectiveness. So,

it can be concluded that an application must be effective to use, efficient and must be according to customer needs so they can be satisfied, only then customers can be retained.

Table: 2.2 Relevant Research Studies

Paper#	Key Findings	Limitations
[12],[13],[17],[18],[19],[20],[26],[29],[30],[38],[41]	Usability evaluation of mobile applications was done in these studies. These studies especially focused on how well these applications performed in terms of efficiency, effectiveness, usability, ease of use, visibility, enjoyability, usefulness, proficiency, adequacy and satisfaction. These studies evaluated the applications according to some of these usability factors.	The overall result indicates that the application was useful and simple to use, although there is still room for improvement as there is some problem in interface and some validation issues. Only the mentioned four factors are examined in this study.
[14], [15]	Systematic literature review was done in [14] on usability of mobile applications and in [15] on usability studies on mobile user interface design patterns. These both researches can contribute in this way that these are focusing on studying literature about usability of mobile applications and interface design which could help in understanding the issues customer faces while using the mobile applications so they can be improved in future versions and can help in fulfilling user needs and satisfying them so customers can be retained if these issues are tackled properly and timely.	Systematic literature review was done on usability of mobile applications, overall mobile applications are studied so some specific mobile applications should be focused.
[16]	The study [16] looked into whether the backdrop colour of icons and icon symbols have an impact on menu selection time and customer	More research is needed to better understand the impact of the two variables on icon and menu design.

	<p>satisfaction. The results showed that icon backdrop colour had the greatest influence on menu time selection, and that icons with multi-colour backgrounds and pictorial symbols had the highest satisfaction score. Overall, the experiment and survey findings indicated that icons with a multi-colour backdrop and pictorial symbol have the greatest design since they satisfy customer expectations and allow for the quickest menu choosing time.</p>	
[21]	<p>A systematic literature review to present usability methodologies often utilised in m-commerce application. The study's findings provide additional knowledge to usability practitioners and the research community on the current state of research and practices in usability techniques and evaluation approaches in the m-commerce application area.</p>	<p>Only m-commerce applications were studied in this research.</p>
[22],[24]	<p>The study targets assessing availability and ease of use of airline websites and usability evaluation of one of M-commerce site in Indonesia. The findings demonstrate that website designers and developers must be aware of ease of use and accessibility requirements in order to meet the demands of handicapped persons with physical disabilities and linguistic impairments in order to create a universally accessible online environment. The discoveries reveal some fresh information for designers and developers concerning M-Commerce, notably in terms of usability and features, as well as the issues and challenges that users confront.</p>	<p>The study focuses on accessibility and usability issues of handicapped persons only.</p>

[23]	Systematic review of the usability and appropriateness of diabetes applications was conducted. The findings demonstrated that expert and patient satisfaction levels differed. The most common usability issues discovered were multi-step tasking, restricted functionality and interactivity, and difficult system navigation.	Systematic review of a specific type of applications was done in this research. Different applications related to medical field could be studied in future research.
[27]	Usability evaluation of an online banking site in Iran was done. Web structure had the strongest link to customer fulfilment among the Web configuration attributes, followed by format, personalization, search, and execution. User satisfaction was also influenced by the usability of the website. The lack of personal qualities of users when it comes to usability and user happiness is significant, and it recommends that Web designers should pay more attention to this.	This research focuses on the usability evaluation of a specific online banking site in Iran. Other sites can be studied in future studies.
[28]	The research was done on participants of Germany and Taiwan in order to find out their preference in using online stores and their culture differences are also highlighted which effects customer retention. In order to measure and explore the research objectives experiment was conducted in lab along with survey from participants of these two countries. Results indicated that different online customer shows different responses towards different website interface design according to their culture and taste so cross culture left a huge impact on the outcomes.	This study is limited to the participants of Germany and Taiwan only and hence focuses on the culture of these two countries while studying usability issues.
[31]	The influence of responsive web design on the user experience when using the e-Ebola Awareness System on laptop	The devices used in the testing were Android and Blackberry.

	<p>and smartphone devices was tested and evaluated. Task completion rate, task error rate, task time, task difficulty, perceived usability (system satisfaction), perceived learnability and loyalty were among the user experience metrics that were collected. After gathering and analyzing the data, it was determined that customers preferred their smartphone to their laptop.</p>	
[32]	<p>The goal of the study was to see how effect of pictures, review credibility, and personalization options affect user pleasure when using restaurant recommendation apps. The findings show that pictures and review credibility have an impact on user satisfaction with restaurant recommender apps. From the results it was evident that the customer feels good to see the picture of the food and it helps them in selecting the menu as the photos represents the actual food that is served in the restaurant. User satisfaction in accessing the application can be further improved by providing personalization on a restaurant recommender app. As it could help in finding the customer's preferences through the personal data they have provided when accessing the application for the first time.</p>	<p>Customers of two popular Indonesian restaurant recommendation apps, Zomato and Qraved, were surveyed. Further restaurant recommendation applications can be studied in future studies.</p>
[34]	<p>Disaster applications were being investigated as a one-way communication mechanism for providing information about natural dangers. In the study, a mixed method approach was utilized to determine whether usability characteristics influence a user's inclination to continue using an application or not.</p>	<p>Mobile application were evaluated by focusing on the five mentioned usability factors. Only disaster applications were studied, this research could be done on different types of applications in the future.</p>

	<p>Results showed that there are 5 usability factors influencing the continuance intention that are app utility, app dependability, user interface output, too much focus on user interface graphics, user interface input can discourage continuance intention. The study also discovered that disaster app usability factors have distinct relationships with continuation intention that may differ from other generic apps, such as users of disaster apps negatively perceiving the app to have too many visual elements, which is not the case with any other generic app.</p>	
[35]	<p>Literature review was done in order to evaluate yoga app and to find the factors affecting user experience, satisfaction and design. Using Schmitt's SEMs, the user experience design criteria for the daily yoga software were separated into five dimensions: sense, think, feel, act, and relate. The results demonstrate that the daily yoga app's user experience design is important, and that there is room for development, since an appealing interface can increase user experience.</p>	<p>Yoga application was studied for this research and the factors affecting user experience, satisfaction and design were studied only. So, this research can be further extended by evaluating the application using different factors.</p>
[36]	<p>The study was an empirical study of customer's satisfaction and intention of repurchase in case of online shopping in Vietnam. Mixed method study is used applying both qualitative and quantitative methods and impact of factors such as responsiveness, convenience, trust, information quality, delivery and perceived usability on intention of repurchase and customer satisfaction was investigated. Results discovered that the factors that have most vital impact on customer satisfaction and intention are 1)</p>	<p>This study focuses on customer satisfaction and repurchase intention of an online shopping site in Vietnam. This study was limited to a specific area, website and some specific factors based on which this site was evaluated.</p>

	<p>Convenience, information quality, perceived website usability and delivery. 2) Trusting moderately affects repurchase intention and satisfaction of customer. 3) There is no significant influence of responsiveness on the intention of repurchase. 4) Gender and marital status of the customers are two control factors that have a significant impact on customer satisfaction and repurchase intention. The data also revealed that the six elements described above had various degrees of impact on consumer satisfaction and repurchase intention, as well as demographic considerations.</p>	
[37]	<p>The goal of the study was to look into the new usability features of mobile apps and websites. The usability models, frameworks and platforms were also discussed in the study. The findings of the study will be useful in providing various guidelines for developing future design strategies to improve usability for mobile applications and websites. Usability attributes were discussed from various point of views from articles from 2010-2019. This study will be helpful in designing potential plans and recommendations for developing websites and mobile applications that are more accessible to disable people.</p>	<p>The study only looked at the usability features of websites and mobile apps, which can be used as important factors in the development of e-commerce/m-commerce applications.</p>
[39]	<p>Aim of the research was to study m-health wellness application and inquire usability problems. The application under study was named as “Activio”. Main purpose of this applications was to provide ease to people by tracking and monitoring various daily life activities and provide services accordingly. Results of the study helps</p>	<p>Usability problems of a specific mobile application was studied in the research, in future researches usability problems of different applications can be studied.</p>

	in developing an efficient m-health fitness application which will be helpful in building effective communication between trainers and trainees.	
[40]	E-government websites are evaluated. Online techniques are used to evaluate 79 e-government websites in Tanzania. The main goal was to identify accessibility, usability, and web security flaws. Results were not as good as expected as there were many issues related to these 3 factors. Results revealed that there are several flaws that needs to be addressed so the research not only states the issues but also recommended some solutions to further improve these websites. These results also shed light on the lack of awareness among web developers and designers to comply with usability and accessibility standards while developing the websites.	Websites were evaluated to find out the flaws related to the three mentioned factors. In future research other different websites can be evaluated using different factors.

2. 20 Summary

This chapter contains literature review about this research. The goal of this literature analysis was to answer the question, what are the possible usability aspects that lead to customer retention in mobile applications? After studying the latest literature that directly or indirectly links with the research topic some factors were concluded which are listed above. From the list it can be concluded that most widely used or the factors which are mostly emphasized on are user satisfaction, user interaction with the interface (usability), efficiency, effectiveness, ease of use, usefulness, accessibility and responsiveness.

CHAPTER 3

METHODOLOGY

Section 3.1 of this chapter provides the entire research strategy for this research project. The research flow is covered in the section on research strategy. The survey phase of research technique is covered in Section 3.2. The Kasunic rules for conducting an effective survey are presented in this section. Section 3.3 contains Research Context and Justification. Respondent's profile for survey is mentioned in section 3.4. The guidelines for questionnaire design are covered in section 3.5. Justification for Survey questions is written in section 3.6. Section 3.7 is about the analysis of survey result. The chapter's summary is found in Section 3.8.

3.1 Research Strategy

A strategy is developed to aid the researcher in identifying the most appropriate data collection and analysis technique when conducting a study. As a result, determining the best research strategy is crucial. It provides insight into the research problem and hence aids in the attainment of the research objective. Figure 3.1 shows the research flow of this research work. Research methodology is the specific procedures or techniques used to identify, select, process, and analyse information about a topic. In a research paper, the methodology section allows the reader to critically evaluate a study's overall validity and reliability.

Literature review is done to find out the answer of the first research question and one of the main objectives of the research that is to find out those usability factors that contribute to customer retention in terms of mobile applications. After deriving usability factors from the related research work questionnaires are developed based on those usability factors then survey is conducted after finding out appropriate sample size and participants who are involved in the survey. Results of the survey is then analysed according to appropriate statistical tests.

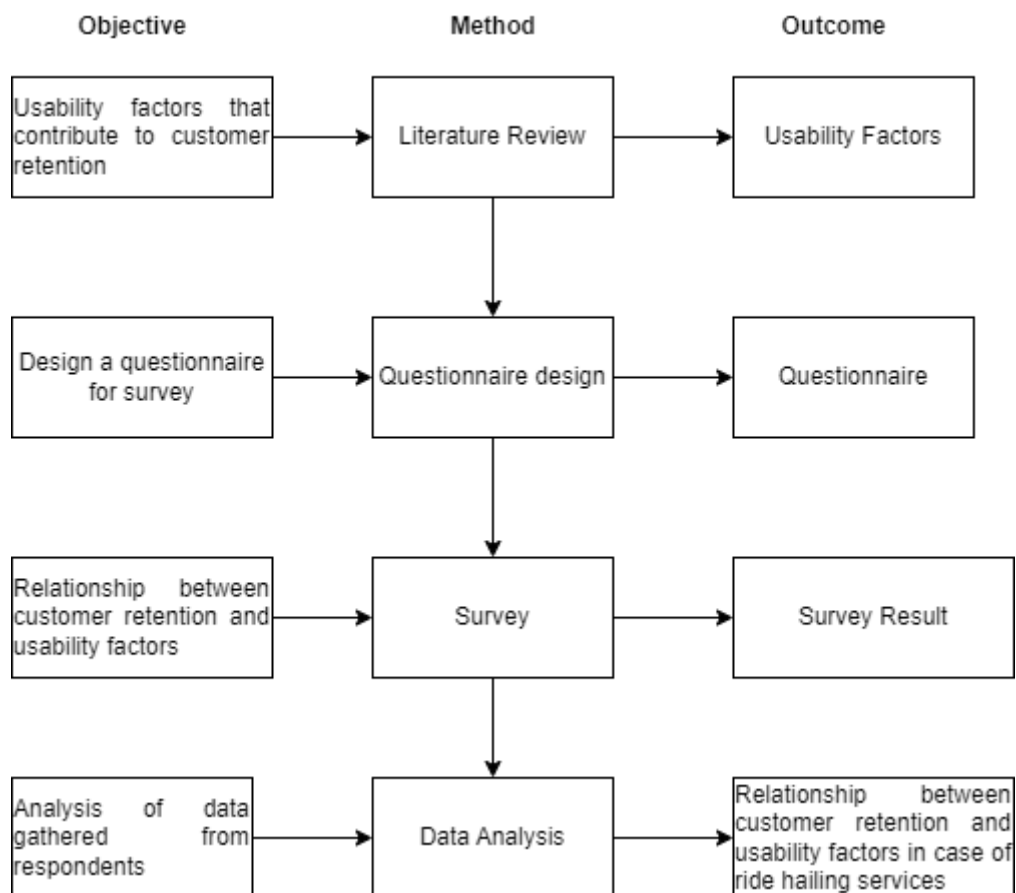


Figure 3.1 Research Strategy

3.2 Survey Research

A survey is a data gathering and analysis process in which respondents reply to pre-created questions or statements [43]. In a significant aspect, surveys differ from other types of data collection methods. When done correctly, a survey allows you to make broad generalizations about the views and opinions of a large group of individuals by analysing a subset of them. In survey methods, questionnaires are used to collect information from respondents. This is a useful tool for researchers who are interested in perceptions, beliefs, attitudes, or perspectives. Survey administration methods include verbal (in person or over the phone), written (mailed or distributed questionnaires), and electronic (email and electronic surveys). Survey data collection methods have the advantage of being generally inexpensive and simple to use. The Kasunic technique is described as a seven-stage procedure that includes the steps listed below. [43].

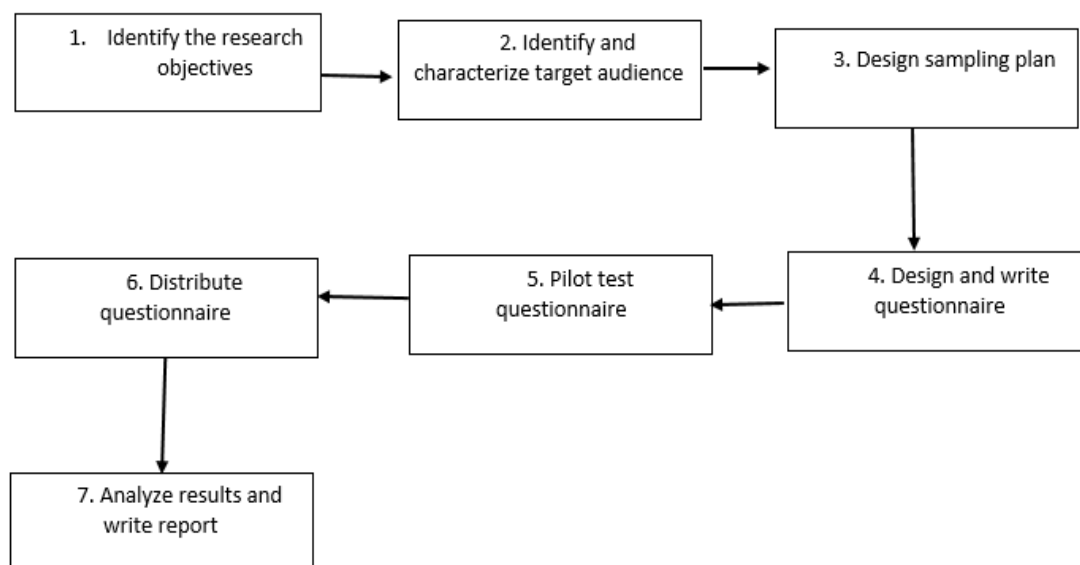


Figure 3.2 Kasunic Guidelines for Survey [43]

3.2.1 Identify Research Objectives

First step is to identify research objectives. What do we hope to achieve with the survey? The primary goal of this survey is to find out the relationship between customer retention and usability factors in case of ride hailing services. What information concerning the problem about which we're inquiring already exists? Many researches and survey are conducted on the usability evaluation of different mobile applications [3], [4] and different studies are done on ride hailing services but they are not related to HCI and usability, they are done in terms of different fields like business. The initial stage in survey research must be a characterization of the problem and how the survey will answer questions regarding the problem. The main problem is to find out the relationship between customer retention and usability factors as mentioned above and to solve this problem first step is to develop questionnaire based on the usability factors that are concluded from literature review.

3.2.2 Identify and Characterize Target Audience

Who will take the survey and who will not? People who use online ride hailing services are taking this survey and people who don't utilize this service are not participating in this survey. What assumptions can you make about their understanding of the questions you're asking, the language they're familiar with, and their willingness to do the survey, and so on? As the respondents of this survey are those people who usually use online ride hailing services so they are able to understand the questions of the survey and respond to it easily as all the questions are related to the online ride hailing service application that they are using.

3.2.3 Design Sampling Plan

What is the size of the target audience? As the target audience are those people who use online ride hailing services but it is not possible to gather data from whole Pakistan, so target audience is limited. Is it possible to identify the target audience? Yes, in this case target audience is those people who use online ride hailing services. As mostly young people uses this application so they are the targeted audience. How will you make sure that people who take the survey are representative of the target demographic? As the target audience is those people who avail this service and mostly are young people so this survey is sent to those people who use avail this service.

To determine an acceptable sample size from a population, Solvin's formula is utilised. It is used to determine the sample size based on the population size. Because of money, cost, time, or effort, it is frequently impossible to poll every member of a population. By using Solvin's formula sample size is found that is 400 ,people having age ranging from 15-64 years old are the main target of this survey so sample size of this survey is 446, and population is 132981800 that is 60.2% of 220.9 Million [Appendix A].

Snowball sampling is a non-probability sampling method where new units are recruited by other units to form part of the sample. Snowball sampling can be a useful way to conduct research about people with specific traits who might otherwise be difficult to identify (e.g., people with a rare disease) [54].Snowball sampling can be used to attract participants through other participants if the population is difficult to reach. As you interact with more people, the amount of people you have access to "snowballs."

For this research non-probability sampling and snowball sampling is used. As the population is hard to access and sample size is also large so participants are recruited via other participants.

3.2.4 Design and Write Questionnaire

The survey's objectives and internal questions must be translated into properly constructed questionnaire items that can be easily analysed and comprehended. On the basis of usability factors that are derived after studying different research articles in literature review, questionnaires are designed to do the survey in order to determine the relationship between customer retention and usability factors. Questionnaire design process is discussed in section 3.6.

3.2.5 Pilot Test Questionnaire

To eliminate flaws and improve the questionnaire instrument, it is "tested" with members of the target population and they are also verified from the expert. As a result, the reviewed questionnaire is used for the survey [Appendix B].

3.2.6 Distribute the Questionnaire

According to the sample plan, the questionnaire are sent to selected people of the target population. Questionnaire is distributed among 446 users of online ride hailing services applications. The survey is conducted online by sending Google Form survey through internet to different users of online ride hailing services mobile applications.

3.2.7 Analyse Results and Write Report

The data is gathered and transformed into relevant graphical displays to aid comprehension. Gathered data is also analysed using statistical tests.

Surveys are classified into two types:

- Questionnaires that are self-administered
- Interviews

Questionnaires are developed to perform the survey for this research. As the both research questions are related to each other so from the result of literature review these questions were derived. Respondents were asked about their demographic information first like age, gender, education etc. Question 1, 2 and 3 are the personal information of user on the basis of which they are differentiated. Question 4 is asked to find out the ride hailing service people are mostly using, so some of the mostly used and popular services are written in the options. On the basis

of the ride hailing service chosen in question no: 4 other questions are answered in context to the service used. In question 5 some of the general factors like price, safety, ease of use of application are listed down to check on basis of which general factor the ride hailing service is chosen. In question: 6 focuses on the type of the application that is used by user whether it is buggy, works well or not. To find out the user's expectations regarding the application that whether it meets user expectations or not question: 7 is asked. In order to find out that whether usability factors have relationship with customer retention or not we have to first ask about the application that is being used and why it is used so question: 5 and 6 is asked. Other questions are all based on those usability factors that are derived from literature review so that the relationship between usability factors and customer retention in case of ride hailing services could be find out.

3.3 Research Context and Justification

For the prosperity and growth of any business customer loyalty that is also known as customer retention plays an important role. Nowadays, ride-hailing services are a popular and profitable business. Mobile applications for ride hailing services are critical to the success of this industry. To find out whether there is a relationship between customer retention and usability factors in case of these ride hailing service applications this research is done. Firstly usability factors that could led to customer retention were listed down by doing literature review. Then on basis of those usability factors questionnaires were developed and survey was conducted. As survey is the best way to find out users and customer reviews regarding ride hailing service applications as sample size could be large so survey is the best option. To validate the questionnaires already build questionnaires on usability factors and usability evaluation were used and expert's advice was also taken into consideration while developing the questionnaires for survey and to validate the findings statistical tests are conducted.

3.4 Respondent's Profile for Survey

The questions that were asked in order to find out about the respondents are the age of the respondent, gender, qualification and the Online ride hailing service that they mostly used.

Table: 3.1 Respondent's Profile for Survey

Respondent's Profile	Survey (n=446)
Age of respondent	
Less than 18 years old	16 (3.6%)
18 to 40 years old	420 (94.2%)
40 to 60 years old	8 (1.8%)
Older than 60 years old	2 (0.4%)
Gender	
Male	168 (37.7%)
Female	278 (62.3%)
Respondent's qualification	
Under Matric	3 (0.7%)
Matric	4 (0.9%)
Intermediate	70 (15.7%)
Graduation	369 (82.7%)

3.4.1 Response Format

The response format is how you collect the respondent's response [44]. This study employs a structured format and a Likert scale. When gauging attitudes or expressing opinions, a scale with a range of responses is preferable to a yes/no answer. A range of methods are available to help evaluators collect data. One of these ways involves using a scale. A Likert scale is one of the most common scale kinds. A Likert scale is a popular tool for assessing attitudes, knowledge, perceptions, values, and behavioural changes. A Likert-type scale consists of a set of statements from which respondents can select to rate their responses to evaluative questions. The Likert scale is a popular method (typically a 5- or 7-point scale). It expresses how powerful a particular attitude or conviction is. Mean scores can be computed for any given collection of statement responses.

The scale used for this survey is 5 point Likert scale. 1 represents strongly disagree, 2 represents disagree, 3 represents neutral, agree is scored as 4 and strongly agree is scored as 5.

3.5 Questionnaire Design Guidelines

It depends on the survey research whether the tool is a questionnaire or an interview. Face-to-face interaction is used in an interview, whereas a questionnaire employs the mail and other indirect ways to collect replies from respondents.

Questionnaires are the survey instrument for this research. The survey questionnaire serves as a conduit for information to move from everyday behaviour and opinion into the world of research and analysis [45]. Valid, reliable, clear, interesting, and succinct (brief and clearly expressed) are all qualities of a good questionnaire. Guidelines to design a good questionnaire is discussed below [46].

3.5.1 Developing a Conceptual Framework

The first stage in developing an effective questionnaire is to develop a conceptual framework. The researcher must be very explicit about his study questions as well as the "dependent" and "independent" variables he wishes to investigate. This method is significant since it ensures that the research includes all relevant factors and that any irrelevant variables are removed. Dependent variable in this study is customer retention and independent variables are usability factors that are derived from literature review. The second research question is to find out the relationship between customer retention and usability factors in case of ride hailing services so in order to do that Pearson correlation is used in analysis phase. This research covers all the relevant variables as questionnaires are designed based on those usability factors that are derived from literature review. Irrelevant questions were removed after discussion with the expert and all the key questions which are necessary for this research are included.

3.5.2 Asking the Right Questions

After defining the conceptual framework and determining which questions to ask, it is time to construct the questions so that they are legitimate and reliable. Through brainstorming, the researchers must generate preliminary questions. After defining the dependent and independent variable and focus of the survey, questionnaires are designed by using already developed available questionnaire.

3.5.3 Close vs Open Ended Questions

These questions might be either "closed-ended" or "open-ended." Closed-ended questions provide respondents options and require a response. They must choose one or more options from the menu. "Open-ended" questions allow the respondent to express themselves freely. They are not constrained in their ability to express themselves.

If the range of replies is well known and the possibilities are limited, the former is favoured; the latter is chosen if the answer options are multiple and unknown.

Close ended questions are used in this survey. As it is online survey and usually people tend to avoid writing paragraphs and giving long answers as it is time consuming and require brain storming so, usually respondents are more comfortable in filling close ended questionnaire especially in online survey.

3.5.4 Options/Choices

The alternatives available for each inquiry should be as comprehensive as possible. This ensures that the respondent can select the optimal alternative for his response. To discover the viable options, the researcher must brainstorm, analyse related published research, consult experts, and, if necessary, conduct a focus group discussion with the target respondents. To allow for other possibilities, the researcher can include "Other: please define _____" category as one of the alternatives.

When measuring factual knowledge, it is vital to include "don't know" as one of the choices because not all respondents may know the answer to the question. By not offering the option, the researcher is "forcing" the responder to make a decision.

Other: please specify category is used in this research to allow respondents for other possibilities. Don't know option is not used in this study since studies have shown that agree and disagree replies produce more trustworthy findings than don't know options. As a result, the questionnaire for this study includes agree and disagree answers.

3.5.5 Filtering

Filtering is used to direct the respondent to answer just the pertinent questions in a questionnaire having several components, some of which are optional. However, we should avoid using too

much filtering because it may confuse responders and make the questionnaire more complicated.

Questionnaire of this research is developed after carefully considering only important questions and it is done by not only consulting already developed questionnaire on this research topic but also discussing with expert. So only relevant questions are asked in this survey and optional questions are not asked. Filtering is used to purify the survey and to ask only relevant and important to the point questions in order to save respondent's time and avoid making the questionnaire complicated.

3.5.6 Order of Questions

The questions should be answered logically. Begin with simple questions and work way up to more challenging ones. Some people like to begin with the respondents' socio-demography, while others keep it for last because it involves more personal topics such as household income, education level, and religion.

This, however, is dependent on the desire of the target population to cooperate. It may be necessary to explain to the respondent why a personal question was asked, or to make a general comment to normalise the "sensitive" subject.

Firstly demographic questions are asked then basic questions about the ride hailing service app that the respondent is using and then questions based on usability factors are asked.

3.5.7 Avoid Double-Barrelled Questions

Another common error is a "double-barrelled" inquiry. Avoid asking two inquiries at the same time. This will make evaluating the responses difficult when analysing the data. Double barrelled questions are not used in this survey.

3.5.8 Avoid Ambiguous Questions

Be as specific as possible when asking a question. Keep questionnaire items to a minimum of 20 words. As you go through the questions, ask yourself, "Is this question clear?" "Can it be more specific?"

Questions are to the point and specific in the survey for this research.

3.5.9 Design the Questionnaire with Analysis in Mind

When designing a questionnaire, it is crucial to consider how the information gathered is analysed. Questionnaires are designed for this survey with analysis in mind.

3.5.10 Format

The final "touch-up" of the questionnaire is crucial since the questionnaire's "appearance" may influence whether or not the responder completes it. Divide the questionnaire into sections if possible. It should also flow easily from one section to the next.

A proper format is followed as first demographic questions are asked then in the next section questions about the application that the respondent is using is asked and then the questions based on the usability factors are asked.

3.5.11 Pilot Test

Before data collection begins, a pilot test is an important step in the questionnaire design process. It helps in the detection of content, grammatical, and format errors in the questionnaire. To begin, ask your co-workers, family, or friends to provide feedback on the questionnaire. Any mistakes in content, grammar, or format is discovered. The potential respondents should next be requested to complete the questionnaire and provide feedback. It is crucial to solicit feedback from responders, especially during the pilot test, on any questions that you believe are confusing or sensitive.

After discussing with expert and using questions from already developed questionnaires for pilot testing some people that use these applications were asked to fill and test the survey and analyse the questions. Their feedback and opinions were taken into consideration before finalising the questions for the survey.

3.6 Justification for Survey Questions

The main focus of this research is to find out the possible usability factors that contribute to customer retention and literature review was done to answer this question. The other main question was to find out the relation between customer retention and usability factors in case of ride hailing services. Survey is conducted to find out the answer of this question.

Result from Literature review revealed these factors were mostly used by the researchers: User satisfaction, Usability (interaction with interface), Efficiency, ease of use and effectiveness. Other factors that were mentioned in the literature review were usefulness, proficiency, adequacy, visibility, enjoyability, accessibility, readability, app utility, app dependability and responsiveness.

In this section all those usability factors that are important and mentioned several times by the researchers as shown in literature review are used in developing the questions for the survey. So, already built questionnaires are used and their reference is also provided below in the table along with questions and articles in which those factors are mentioned.

3.6.1 Ease of Use

Usability factor Ease of use is really important. If an application is simple to use eventually it helps in retaining customer as mostly users are non-technical people and want to use an application that is easy to use and user friendly so ease of use is an important factor to retain customers. As the articles [20],[22],[29],[30] in the literature review also sheds light on the importance of ease of use so questions related to this factor is included in the survey. Question: 9 focuses on ease of use of the application. One of the general issue that mostly people faces while using any mobile application is to get stuck whenever they make a mistake, they usually are confused and don't know what to do so question: 23, 25 are asked that whether the customer required to learn a lot of things before using the system or not and whether they would require the assistance of a technical expert in order to use this application. These questions are also related with ease of use factor so these questions are asked.

Table 3.2 Questionnaire Items for Ease of Use

Sr.	Items	Reference
1	This application was easy to use.	[47]
2	I think I would need the support of a technical person to be able to use this application.	[48]
3	I needed to learn a lot of things before I could get going with this system?	[48]

3.6.2 Efficiency

Efficiency is the third most used factor as shown in the literature review done before. Articles [12], [13], [19], [20], [30], [33], [38], [41] mentioned efficiency as an important usability factor. Efficiency basically measures the speed and how quick user can accomplish the task, and it is also related to accuracy. Question 10 is asked to find out the consistency of navigation when moving between the screens. Question: 11 is asked to find out that whenever user make a mistake while using the application they can recover quickly and easily or not? Question: 12 is asked to find the user's expectation about the application. These questions are asked in the survey to find out that the application is efficient or not?

Table 3.3 Questionnaire Items for Efficiency

Sr.	Items	Reference
1	The navigation was consistent when moving between the screens.	[50]
2	Whenever I made a mistake using this application I recover quickly and easily?	[47]
3	This application has all the functions and capabilities I expect it to have?	[49]

3.6.3 Usefulness

Usefulness is an important factor which is used to measure the usefulness of the application that whether the application is useful and fulfil its core functionality or not. Articles [13] and [25] from literature review shows the importance of usefulness as a usability factor that customer seeks for. So, two questions 13 and 17 that are mentioned below are used to measure the usefulness and mentioned in the survey.

Table 3.4 Questionnaire Items for Usefulness

Sr.	Items	Reference
1	This application made it convenient for me to use online ride hailing service?	[49]
2	This application gave error messages that clearly told me how to fix problems?	[47]

3.6.4 Effectiveness

Effectiveness in simple words refers to how useful something is. If an application is effective in other words it is useful and lives up to the expectations of the customer then it can retain. While doing literature review most of the articles put the emphasis on effectiveness of the application which results in as an important usability factor that could retain customer. Articles [12], [30], [33], [38], [41] put emphasis on the importance of effectiveness as an important usability factor that could retain customers.

Question: 15 of the survey asked the user if the application help them manage their transportation effectively as it is the main function of the application. Question: 16 is asked to find out that customer felt comfortable while this application?

Table 3.5 Questionnaire Items for Effectiveness

Sr.	Items	Reference
1	This application help me manage my transportation effectively?	[50]
2	I felt comfortable using this application?	[47]

3.6.5 Accessibility

Accessibility is used to see that the application is accessible in different situations or not and whether different important and main features and functions of the application is easily accessible or not. Articles [22], [39], [40] from literature review sheds light on the importance of this usability factor so question 18, 19 in the survey are used to find out the accessibility of the application. First question that is asked based on accessibility factor is that whether the application is accessible even when the internet connection is bad or not and the second question is about the information that the application provided is clear or not?

Table 3.6 Questionnaire Items for Accessibility

Sr.	Items	Reference
1	I could use this application even when internet connection is poor?	[50]
2	The information (such as driver's information, location, transactions details etc.) provided by the application is clear?	[47]

3.6.6 Responsiveness

Responsiveness is the ability of an application or system to fulfil assigned tasks within a certain timeframe. In other words it can be said that responsiveness is how quickly the application responds to requests or commands. Article [36] shed light on the importance of responsiveness so question: 20 that is written below in asked in the survey.

Table 3.7 Questionnaire Items for Responsiveness

Sr.	Items	Reference
1	This application adequately acknowledged and provided information to let me know the progress of my action?	[50]

3.6.7 Usability (Interaction with Interface)

Usability here is defined as user interaction with the interface. What type of issues user faces while interacting with the interface, interface meets user expectations or not. These types of questions related to interface are defined. Interface is the first thing that user see and interacts with, so if the interface is not good or interactive user may leave that application before even using it. Interface is an important part of the application if interface is up to user's liking and he is satisfied with it then he may retain using the application and service. In literature review many researchers focuses on usability and states it as an important factor. Articles [13],[16],[17],[24],[27],[28],[29],[31],[34],[35],[36],[37],[39],[40] all put a major emphasis on usability(interaction with interface). So questions 21, 22, 24 are related to the interface of the application.

Table 3.8 Questionnaire Items for Usability

Sr.	Items	Reference
1	The interface of this application was pleasant?	[47]
2	I found the application unnecessarily complex?	[48]
3	I found the various functions in this application were well integrated?	[47]

3.6.8 User Satisfaction

User satisfaction is main and the most important factor for the progress and success of any product or service. A product or service cannot run for a long time if customer is not satisfied. User satisfaction can be said as one of the key point for customer retention as shown in the result of the literature review.

Articles[12-13],[16],[18],[19],[24],[27],[29],[30-33],[35],[36],[38],[41]mentioned customer satisfaction as one of the most crucial factor for the customer retention. From this we can conclude that most of the researchers shed light on the importance of user satisfaction and how it should be prioritized. So this factor can led to customer retention so question 14, 16, 26, 27 28 are asked to find out whether user is satisfied from the application they are using or not. These questions directly or indirectly are related to customer satisfaction. Like in question: 14 user is asked that whether the information in the application is well organized so that they can easily find the information when needed, this question is related to customer satisfaction that they are satisfied with the application. Other questions also are relate to this important usability factor as in these questions customer is asked that whether they felt comfortable while using the application, if they will use this application again and recommend this application to a friend or not.

Table 3.9 Questionnaire Items for User Satisfaction

Sr.	Items	Reference
1	The information in the application was well organized, so I could easily find the information I needed?	[50]
2	I would use this application again?	[50]
3	I felt comfortable using this application again?	[47]
4	Overall I am satisfied with this application?	[47]
5	Would you recommend this application to a friend?	[51]

3.7 Analyse Results and Write Report

Survey results are shown and discussed in detail in chapter 4. In section 4.1 survey results are discussed in form of tables and charts. First survey results are discussed and then they are analysed using statistical tests.

3.7.1 Reliability Test

The degree to which the outcomes of an evaluation are predictable and consistent is referred to as measurement reliability. In layman's words, research reliability is the degree to which a research process delivers consistent and reliable outcomes.

Cronbach Alpha

Cronbach Alpha is the commonly used technique to measure the reliability effect [52]. Cronbach's alpha is a measure of internal consistency, or how closely linked a group of things are. It is recognised as a scale reliability metric. Cronbach alpha is calculated as follows:

$$\alpha = \frac{N\bar{c}}{\bar{v} + (N - 1)\bar{c}}$$

N is the number of items or components, c^- is the covariance between the items and v^- equals the average variance.

If the value of alpha is closer to 1 or greater than 0.7 than the data is reliable.

3.7.2 Validity Test

The reliability and validity of measurements must be checked in quantitative research. The accuracy with which the methods are measured is indicated by their validity. If a method measures and the results closely match real-world values, it is considered valid. Validity is classified into four types: construct validity, content validity, face validity, and criterion validity [55].

3.7.2.1 Construct validity

Construct is a concept that cannot be measured directly. Construct can be an individual characteristic such as height, weight, intelligence etc. Construct validity evaluates that whether measurement tool really represent the thing which is supposed to be measure. In this research study “Usability factors that contribute in customer retention” is a construct that cannot be measured directly. These usability factors can be find out by doing literature review and finding usability factors that are important for customers as stated by researchers and by doing survey. Construct validity is also about ensuring the method of measurement. In this study an already built questionnaire is used to find out usability factors that help in retaining customers in case of ride hailing services. To achieve construct validity there is necessary to ensure that indicators or measures are based on existing theory. In this research study the indicators of questionnaire are usability factors derived from literature review. However, this research study can have construct validity about method of measurement. Usability factors that help in retaining customers in case of ride hailing services can be identified using other method of measurement rather than survey.

3.7.2.2 Content Validity

Content validity is about whether the measurement is representative of the construct or not. To produce valid result survey or any measurement method must cover all relevant parts of the construct. Content validity is threatened if some aspects are missing in the measurement and

irrelevant aspects are included. In this research study usability factors that contribute in customer retention are derived after literature review. Out of those usability factors, those factors are listed down that are having high frequency and mostly mentioned by researchers. Those eight usability factors are used as basis for developing questionnaire for the survey. Some usability factors are discussed and emphasized in this research study. So, this research study has content validity threats about other usability factors.

3.7.2.3 Face Validity

Face validity shows how suitable the content of the test. It is similar to the content validity. Face validity is a subjective measure. Face validity checks on surface that survey questionnaire seems like a good representation of what you want to test. In this research study usability factors that lead to customer retention in case of ride hailing services are find out. This research study has face validity threats in terms of other usability factors that are not focused in this research.

3.7.2.4 Criterion Validity

Criterion validity is about the outcome of the test. To ensure criterion validity there is need to calculate the correlation between the results of measurements and the result of criterion measurement. Criterion validity ensure that how well the results of test approximate the results of another test. The result of this research study is verified by Pearson Correlation Test. It is done to find out the positive correlation between independent variables that are usability factors and dependent variable that is customer retention. Results shows that there is a positive correlation between customer retention and all those eight usability factors. This research study has no criterion threat.

3.7.3 Pearson Correlation

The Pearson correlation method is the most common method to use for numerical variables; it assigns a value between -1 and 1 , where 0 is no correlation, 1 is total positive correlation, and -1 is total negative correlation [55]. The Pearson's correlation coefficient measures linear correlation between two continuous variables. Values obtained using an ordinal scale are NOT continuous but their corresponding ranks are. Hence, we can still use the Pearson's correlation

coefficient on those ranks. For this research Likert scale is used for survey which is categorized as ordinal scale so we are using Pearson Correlation for the analysis.

3.8 Summary

In order to find out the second research question that is there a relationship between customer retention and usability factors in case of ride hailing services or not, this survey is conducted. First research strategy is defined, sample size is calculated and survey is design according to guidelines then questionnaires are developed on the basis of usability factors that were concluded from literature review. Questionnaire design guidelines and the justification for writing the questions in survey is mentioned in this chapter.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter includes result of the survey, discussion and statistical tests that are performed on those results. Section 4.1 contains the data analysis by showing results of the survey in the form of charts and tables. In section 4.2 statistical analysis is done and reliability test is done in section 4.3. Summary of this chapter is written in section 4.4.

4.1 Data Analysis

The primary emphasis of this research is to find out the possible usability factors that contribute to customer retention and literature review was done to answer this question.

Factors that were mostly mentioned after studying different articles about the research topic are User satisfaction, Usability (interaction with interface), Efficiency, ease of use, effectiveness, Usefulness, accessibility and responsiveness. The other main question was to find out the relation between customer retention and usability factors in case of ride hailing services. Survey was done to determine the answer of this question. The factors that are mentioned above that were mostly mentioned by researchers are used as a base to develop questionnaire for the survey.

Result of demographic information is already explained in chapter 3 section 3.3. Survey result is shown below in form of charts and tables.

4.1.1 Information about the Application

In order to find out the information about the online ride hailing application, questions are asked from the user [appendix a] and results are discussed below.

The mostly used application as seen in in the survey [Figure 4.1] is Careem getting 40.1% of the responses. Uber is the second most used ride hailing application but other than that mostly people use different applications and other way of transportation so other option gets 31.6% of responses.

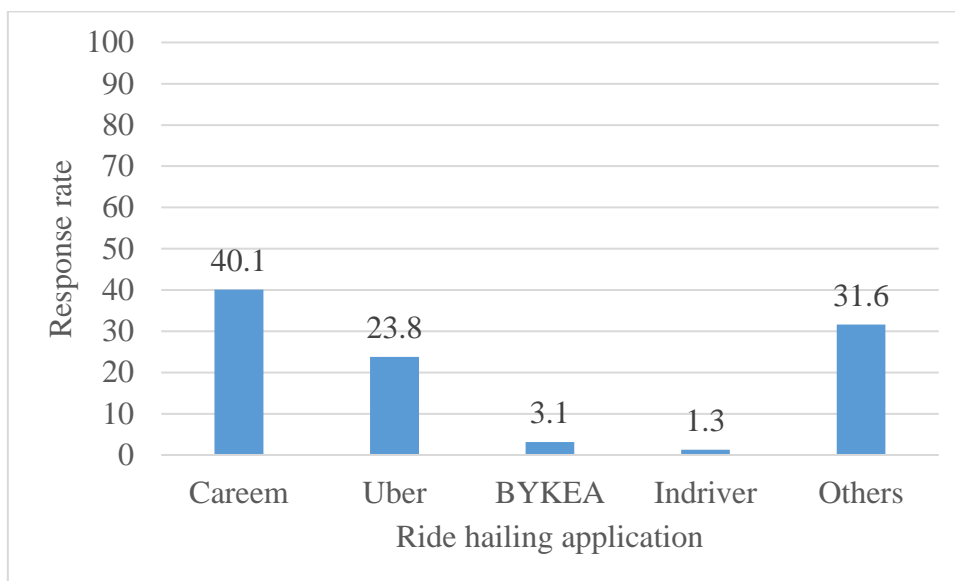


Figure 4.1 Mostly used Ride Hailing Application

In order to know about the preference of the customer for choosing the application the question is asked about the factors for choosing the application [Figure 4.2]. Majority that is 42.8% of the people chose all of the above option which means price, safety and security, application is easy to use are the factors that people seek for while choosing an application for ride hailing.

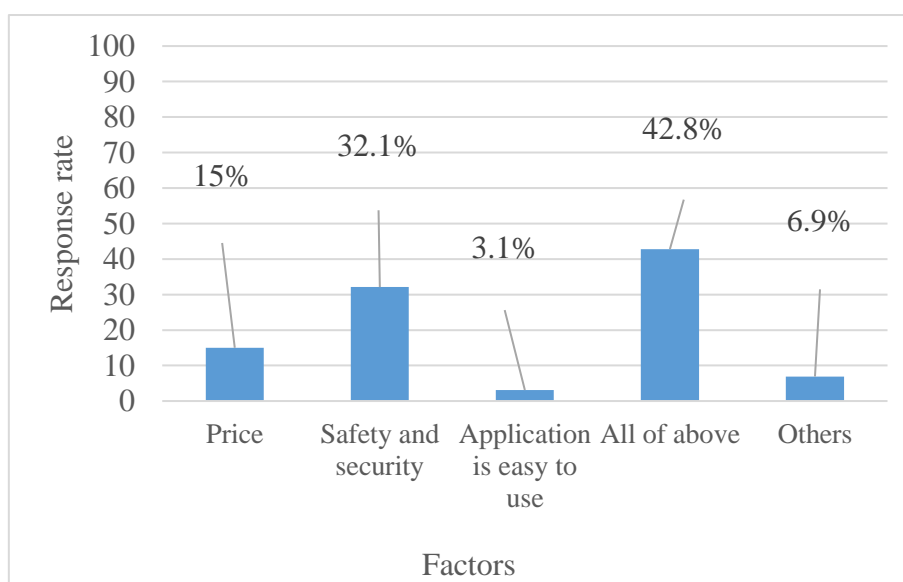


Figure 4.2 Factor for Choosing the Application

To find out the expectation of customers the question is asked [Figure 4.3]. 47.8% of respondent's response is that the application that they are using is fine.

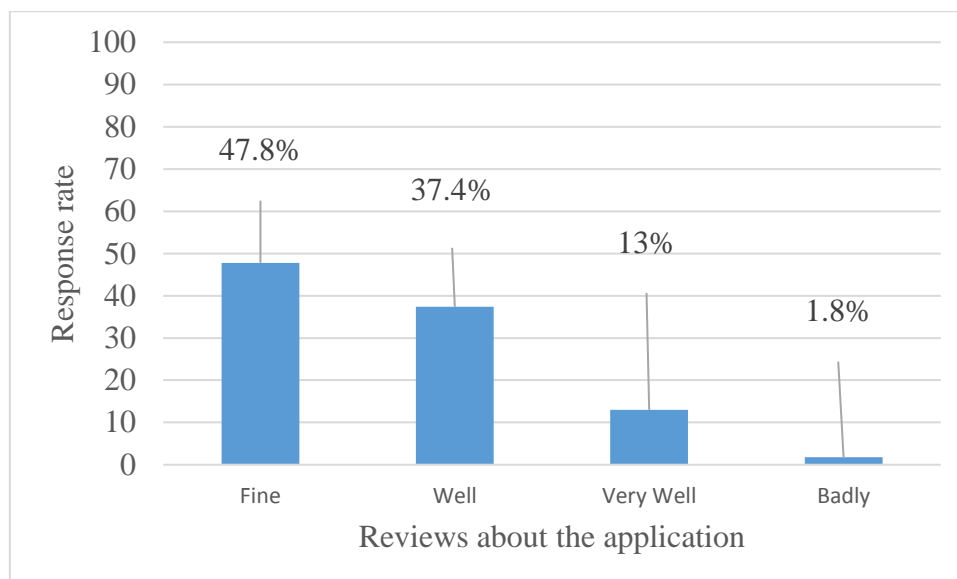


Figure 4.3 Expectation About the Application

The question is asked to find out the effort the customer has to put in order to book the ride [Figure 4.4.]. This give an insight about the application that whether the application is easy to use or not. 56.3% of the respondents says that they have to put in a small amount of effort to book the ride and 24.7% says that they put zero effort and face no difficulty in booking the ride through the application they are using.

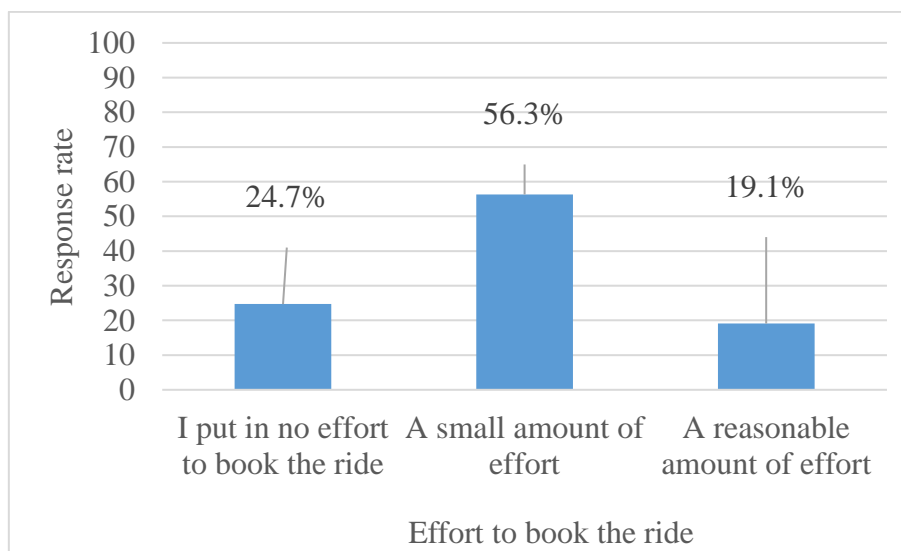


Figure 4.4 Effort to Book a Ride

4.1.2 Ease of Use Responses

Ease of use is one of the most mentioned factors in the articles mentioned in the literature review and result of the survey also revealed that it is an important factor that customer seeks for. 42.2% people agree that the ride hailing application they are using is easy to use and 32.3% people choose strongly agree as the option.

Table 4.1: Ease of Use Responses

Sr.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	This application was easy to use.	4 (0.9%)	10 (2.2%)	100 (22.4%)	188 (42.2%)	144 (32.3%)
2	I think I would need the support of a technical person to be able to use this application.	127 (28.5%)	88 (19.7%)	91 (20.4%)	82 (18.4%)	58 (13%)
3	I needed to learn a lot of things before I could get going with this system?	66 (14.8%)	96 (21.5%)	108 (24.2%)	100 (22.4%)	76 (17%)

28.5% people choose strongly disagree as they do not need require the assistance of a technical person to use the application that they are using. It means that the application they are using is easy to use.

24.2% people means majority are neutral when asked if they needed to understand a lot of things before they could use the system and 22.4% people agree with this question. So, it means that some people might have found some features of the application problematic.

4.1.3 Efficiency Responses

Efficiency is another one of the most mentioned factor in the literature review. To test the efficiency of the application customer are asked about the consistency of navigation when moving between the screens and 38.6% are satisfied and 27.8% chose neutral.

Table 4.2: Efficiency Responses

Sr.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	The navigation was consistent when moving between the screens.	8 (1.8)%	34 (7.6)%	124 (27.8)%	172 (38.6)%	108 (24.2)%
2	Whenever I made a mistake using this application I recover quickly and easily?	22 (4.9)%	52 (11.7)%	153 (34.3)%	119 (26.7)%	100 (22.4)%
3	This application has all the functions and capabilities I expect it to have?	9 (2)%	39 (8.7)%	142 (31.8)%	157 (35.2)%	99 (22.2)%

When asked that whenever they made a mistake they could recover easily and quickly or not majority (34.3%) chose neutral and 26.7% agreed that they could recover easily. It means that the application people are using is somewhat problematic and not that efficient as majority chose to remain neutral while answering this question.

35.2% people agreed that the application they are utilising has all the features and capabilities they are looking for. 31.8% people chose to remain neutral.

4.1.4 Usefulness Responses

To measure usefulness the below mentioned questioned are asked and 41.5% people agreed with the question showing their happiness to use the application as it was convenient and useful.

Table 4.3: Usefulness Responses

Sr.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	This application made it convenient for me to use online ride hailing service?	6 (1.3)%	24 (5.4)%	96 (21.5)%	185 (41.5)%	135 (30.3)%
2	This application gave error messages that clearly told me how to fix problems?	22 (4.9)%	63 (14.1)%	146 (32.7)%	139 (31.2)%	76 (17)%

The other that is asked to measure the usefulness is that the application give error message to customers that clearly stated how to fix the problem or not. 32.7% people are neutral in their opinion but 31.2% people agreed with the question which clearly shows that the application is overall useful.

4.1.5 Effectiveness Responses

41.7% people agreed and 29.6% strongly agreed that the application is effective to use as they help them manage their transportation effectively.

Table 4.4: Effectiveness Responses

Sr.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	This application help me manage my transportation effectively?	5 (1.1)%	18 (4)%	105 (23.5)%	186 (41.7)%	132 (29.6)%
2	I felt comfortable using this application?	11 (2.5)%	11 (2.5)%	102 (22.9)%	174 (39)%	148 (33.2)%

39% people agreed that they felt comfortable using this application. So, the result from both of these questions shows that the application was overall effective to use.

4.1.6 Accessibility Responses

To check the accessibility of the application below mentioned questions are asked. When asked if they could access the application even if their internet connection was bad, 24.9% disagreed on the other hand 24.7% people remained neutral.

Table 4.5: Accessibility Responses

Sr.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I could use this application even when internet connection is poor?	102 (22.9)%	111 (24.9)%	110 (24.7)%	62 (13.9)%	61 (13.7)%
2	The information (such as driver's information, location, transactions details etc.) provided by the application is clear?	14 (3.1)%	30 (6.7)%	124 (27.8)%	141 (31.6)%	137 (30.7)%

31.6% agreed that the important information that they needed is clearly provided by the application and 30.7% people strongly agreed, it means that application clearly provides all the needed information.

4.1.7 Responsiveness Responses

To check the responsiveness of the application below mentioned question is asked and majority are satisfied by the responsiveness of the application they are using as 39.2% people agreed.

Table 4.6: Responsiveness Responses

Sr.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	This application adequately acknowledged and provided information to let me know the progress of my action?	14 (3.1)%	18 (4)%	125 (28)%	175 (39.2)%	114 (25.6)%

4.1.8 Usability (Interaction with Interface) Responses

To check that whether customers are happy with the interface, question is asked that whether the interface of this application is pleasant and majority agreed that the interface of the application they are using is pleasant.

To check the complexity of the application, question is asked that if they find the application unnecessarily complex and 32.3% people disagreed. It means that majority does not find their application complex.

Table 4.7: Usability (interaction with interface) Responses

Sr.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	The interface of this application was pleasant?	12 (2.7)%	10 (2.2)%	111 (24.9)%	189 (42.4)%	124 (27.8)%
2	I found the application unnecessarily complex?	61 (13.7)%	144 (32.3)%	121 (27.1)%	71 (15.9)%	49 (11)%
3	I found the various functions in this application were well integrated?	11 (2.5)%	17 (3.8)%	146 (32.7)%	165 (37)%	107 (24)%

37% people agreed that they find the various functions in the application well integrated and 32.7% chose to remain neutral.

Results of these questions shows that overall people are happy with the interface of the application that they are using and they are not facing that much problems.

4.1.9 Satisfaction Responses

Satisfaction is the most important factor that any company focuses on as it can also be seen in literature review. Customer satisfaction is an important factor so different questions are asked to check the level of satisfaction that customer gets by using the application.

Table 4.8: Satisfaction Responses

Sr.	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	The information in the application was well organized, so I could easily find the information I needed?	9 (2)%	20 (4.5)%	108 (24.2)%	183 (41)%	126 (28.3)%
2	I would use this application again?	13 (2.9)%	19 (4.3)%	82 (18.4)%	162 (36.3)%	170 (38.1)%
3	I felt comfortable using this application again?	11 (2.5)%	11 (2.5)%	102 (22.9)%	174 (39)%	148 (33.2)%
4	Overall I am satisfied with this application?	8 (1.8)%	15 (3.4)%	89 (20)%	189 (42.4)%	145 (32.5)%
5	Would you recommend this application to a friend?	11 (2.5)%	16 (3.6)%	80 (17.9)%	157 (35.2)%	182 (40.8)%

Question is asked that the information that customer is seeking for is well organized in the application or not and 41% of the people are satisfied as they choose agree option and 28.3% chooses strongly agree. When asked that whether they would use this application again or not. Majority (38.1%) people chooses strongly agree and 36.3% people chooses agree emphasizing that they would use the application again.

39% people agreed that they felt comfortable using this application and 33.2% people strongly agreed. Majority (42.4%) are satisfied using this application. When asked that whether they would recommend this application to someone else or not 40.8% people strongly agreed and 35.2% people agreed that they would definitely recommend the application which shows that people are satisfied using the application.

As the question asked for testing the level of satisfaction that people felt while using the application and the result of all these questions showed that people are highly satisfied while using the specific application that they choose for ride hailing service.

4.2 Relationship between Customer retention and Usability Factors

Question: Is there any relation between customer retention and usability factors in case of ride hailing services?

Above mentioned question is the second research question that was one of the main purpose for conducting this research. Survey was done to determine the answer of this research question now to analyse the result hypothesis are formed and those hypothesis are tested through statistical tests. Survey was conducted online from 446 respondents other details about the survey is mentioned in chapter 3.

H1: Perceived ease of use is positively related to customer retention.

H2: Perceived efficiency is positively related to customer retention.

H3: Perceived usefulness is positively related to customer retention.

H4: Perceived effectiveness is positively related to customer retention.

H5: Perceived accessibility is positively related to customer retention.

H6: Perceived responsiveness is positively related to customer retention.

H7: Perceived application user interface is positively related to customer retention.

H8: Perceived satisfaction is positively related to customer retention.

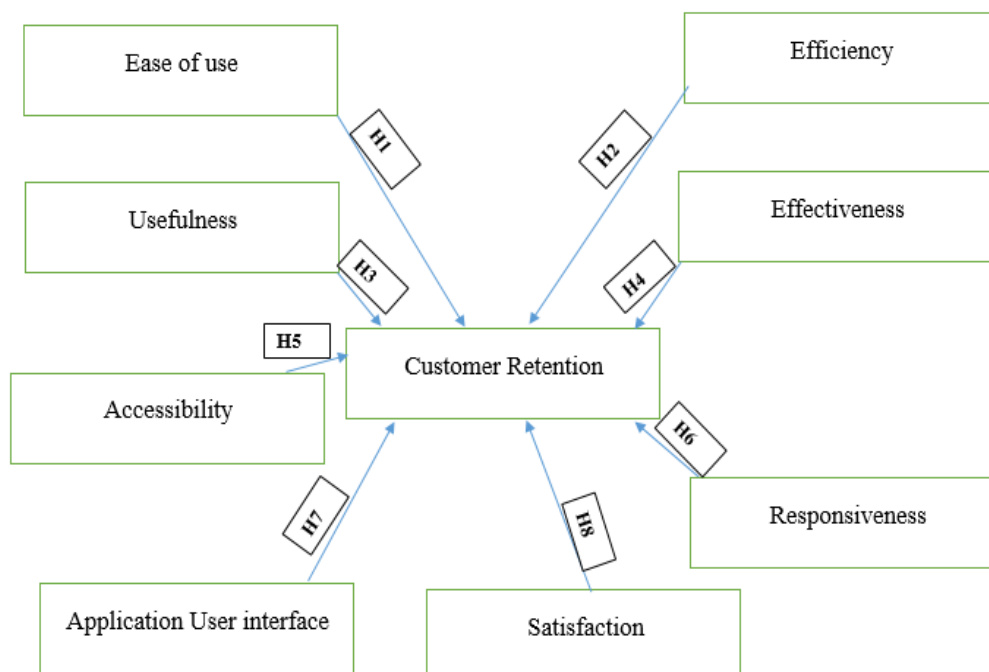


Figure 4.5 Research Model with Hypothesis Indicators

4.2.1 Pearson's Correlation Test

Output shows Pearson Correlation value, significance value and N that is sample size. If the significance value is more than 0.05 then it is insignificant. As all of the values are below 0.05 so they are all significant. The obtained value of Pearson Correlation is compared with the already given value mentioned in Critical Pearson's Correlation Table [Appendix C]. If the estimated Pearson's correlation coefficient exceeds the critical value from the table, the null hypothesis of no correlation is rejected.

$P \leq 0.05$ the test is significant.

N= sample size.

Degree of freedom=N-2

Obtained value > Critical Value in the Table.

Sample size=446.

Degree of Freedom=444

Check the critical value 444 DF in table.

444 DF (0.05) =0.09

Obtained value is 0.687 which is > Critical value of 0.09 and is highly significant so it is a valid question and it prove the hypothesis that it is positively correlated to customer retention.

H1: Perceived ease of use is positively related to customer retention.

Obtained value is 0.687 which is > Critical value of 0.09 and is highly significant so it is a valid question and it prove the hypothesis that it is positively correlated to Customer Retention.

Similar is the case with other values .459 and .463 which are > than critical value of 0.09 so it proves that this factor is positively related to customer retention as it is highly correlated.

H2: Perceived efficiency is positively related to customer retention.

0.583, 0.627, 0.702 as these all values are greater than critical value, it means that it proves the hypothesis that Perceived efficiency is positively related to customer retention.

H3: Perceived usefulness is positively related to customer retention.

0.648, 0.635 as these both values are also greater than critical value which means that there is positive correlation and perceived usefulness is positively related to customer retention.

H4: Perceived effectiveness is positively related to customer retention.

0.726, 0.703 these values are also greater than critical value which proves effectiveness is also positively related to customer retention.

H5: Perceived accessibility is positively related to customer retention.

0.584, 0.629 these both values also proves that Perceived accessibility is positively related to customer retention.

H6: Perceived responsiveness is positively related to customer retention.

0.665 as it is greater than critical value 0.09 so it means that responsiveness is positively related to customer retention.

H7: Perceived application user interface is positively related to customer retention.

0.738, 0.393, and 0.693 as these all values are greater than critical value so it means Perceived application user interface is positively related to customer retention.

H8: Perceived satisfaction is positively related to customer retention.

0.710, 0.638, 0.703, 0.708, 0.682. These all values are greater than critical value 0.09 so it proves that the perceived satisfaction is positively related to customer retention which is the hypothesis.

Table 4.9 Pearson Correlation Test Result

Hypothesis	Null Hypothesis	Pearson Correlation Value	Accept/Reject Hypothesis
H1: Perceived ease of use is positively related to customer retention.	Perceived ease of use is not positively related to customer retention.	0.5363	Accept
H2: Perceived efficiency is positively related to customer retention.	Perceived efficiency is not positively related to customer retention.	0.6373	Accept
H3: Perceived usefulness is positively related to customer retention.	Perceived usefulness is not positively related to customer retention.	0.6415	Accept

H4: Perceived effectiveness is positively related to customer retention.	Perceived effectiveness is not positively related to customer retention.	0.7145	Accept
H5: Perceived accessibility is positively related to customer retention.	Perceived accessibility is not positively related to customer retention.	0.6065	Accept
H6: Perceived responsiveness is positively related to customer retention.	Perceived responsiveness is not positively related to customer retention.	0.665	Accept
H7: Perceived application user interface is positively related to customer retention.	Perceived application user interface is not positively related to customer retention.	0.6080	Accept
H8: Perceived satisfaction is positively related to customer retention.	Perceived satisfaction is not positively related to customer retention.	0.6882	Accept

4.2.2 Discussion

The primary goal of this research is to find out those possible usability factors of mobile applications that could help in retaining customers. For this purpose literature review is conducted to list down all the usability factors already stated by the researchers. Usability evaluation of different mobile applications is studied in order to find out those usability factors that these researchers considers important and must in an application. Results of the literature review revealed 8 factors as an important usability factors that applications must have. Those factors are ease of use, efficiency, usefulness, effectiveness, accessibility, responsiveness, usability (interaction with interface) and satisfaction. As these factors got high frequency as the result of the literature review so it is concluded that these factors are important in retaining customers as these are the factors that customer seeks for while using any mobile application.

The second main objective is to determine the relationship between customer retention and usability factors in the context of ride hailing services. For this purpose, the derived factors are used as a base in developing the questionnaire for the survey. Survey is conducted online by using a sample size of 446. Results of the survey revealed that the mostly used online ride hailing application is Careem and the mentioned factors got positive response from the respondent. Through statistical analysis by using Pearson Correlation test, it is proved that these all factors have a positive relation with customer retention as all these factors have value greater than the critical value which proves this theory. So, it gives a positive answer to the second important research question of this study that there is a relationship between customer retention and usability factors in case of ride hailing services.

4.3 Reliability Test

Cronbach Alpha is a popular technique for measuring the reliability impact [53]. It is widely used to evaluate the internal consistency of a questionnaire (or survey) that has many Likert-type scales and items. Cronbach's alpha is a method of assessing reliability that compares the amount of shared variance, or covariance, among the items that comprise an instrument to the overall variance [58]. Reliability test is conducted using tool SPSS. Likert scale values are written and by using SPSS reliability test is conducted.

Table 4.10 Cronbach Alpha

Cronbach's alpha	Internal consistency
$a \geq 0.9$	Excellent
$0.9 > a \geq 0.8$	Good
$0.8 > a \geq 0.7$	Acceptable
$0.7 > a \geq 0.6$	Questionable
$0.6 > a \geq 0.5$	Poor
$0.5 > a$	Unacceptable

If the value of alpha is closer to 1 or greater than 0.7 than the data is reliable. Result of the reliability test shows the Cronbach alpha value that is 0.914 which is greater than 0.7 so it means that the data is reliable.

Table 4.11 Reliability Test

Cases	N	%	Cronbach' Alpha
Valid	446	100.0	0.914
Excluded	0	0	
Total	446	100.0	

4.4 Summary

In this chapter, data is analysed by using appropriate statistical tests and to prove our theory that whether there is a relationship between customer retention and usability factors in case of ride hailing services or not, hypothesis are formed based on the usability factors that were derived from literature review and were also act as a base to develop questionnaire for survey. Pearson Correlation method rejected the null hypothesis and critical value of the Pearson Correlation test proved that there is a relationship between customer retention and usability factors which also answers the second main research question of this study. Result of reliability test shows the reliability of the survey.

CHAPTER 5

CONCLUSION AND FUTURE WORK

In this chapter Section 5.1 contains the conclusion of this research, limitation and future work of this study is discussed in Section 5.2.

5.1 Conclusion

With the growth of IT industry and increasing popularity of mobile applications every company wants to develop best application for the growth of their business. Customer retention is critical to the success of any organisation. So in order to find out the possible usability factors that contributes to customer retention in case of these mobile applications and whether there is any relationship between customer retention and usability factors in case of ride hailing services or not this research is conducted. First question is answered by doing literature review and for the second research question survey is conducted. The usability factors that are deduced after doing literature review are used in developing questionnaires for the survey, those factors are ease of use, efficiency, usefulness, effectiveness, accessibility, responsiveness, usability(interaction with interface) and user satisfaction. And the result shows that those usability factors plays an important role in customer retention as those factors are the primary focus of customers while using the application as proved by Pearson correlation method so in order to retain customers developers must keep into consideration those usability factors while developing application.

In order to satisfy customers user interface plays an important role. If user interface is not interactive or according to user expectations then customer may not use that service or application again. So, in order to retain customers user experience factors must be taken into consideration. As this research helps in finding out the relationship between customer retention and usability factors and those usability factors are also deduced that helps in retaining customers so it could help the companies and developers to consider those factors while developing and designing the mobile applications.

5.2 Limitation

Findings from this study could enhance the currently lacking research area of online ride hailing services as well as help application developers to consider the results and recommendations for better future design. This research focuses on just ride hailing services application so further research can be done on different applications, it can be applied to other industries as well like food delivery, social media, shopping etc. Some usability factors are discussed in this research. In this research, only passengers were seen as the users of online taxis, and the drivers were considered as the service providers of the system.

5.3 Future Work

In future, further research can be done on different type of applications as this research targets just one type of applications that are ride hailing services. Other usability factors can be discussed in future research as this research focuses on just some usability factors. We can also conduct another research from the driver's point of view, and find out the usability factors that they consider important as they also use this application while providing the transportation service. It will be interesting for future research.

REFERENCES

- [1] F. Cheng, C. Wu, and B. Leiner, "The Influence of User Interface Design on Consumer Perceptions ;," *Comput. Human Behav.*, 2018.
- [2] Dongsong Zhang and Boonlit Adipat, "Challenges, Methodologies, and Issues in the Usability Testing of Mobile Applications," *Int. J. Hum. Comput. Interact.*, vol. 18, no. 3, pp. 269–292, 2005.
- [3] I. S. Engineering and B. Intelligence, "Customer Satisfaction Analysis of Online Taxi Mobile," vol. 5, no. 1, pp. 85–92, 2019.
- [4] N. A. N. Ahmad and M. Hussaini, "A Usability Testing of a Higher Education Mobile Application Among Postgraduate and Undergraduate Students," *Int. J. Interact. Mob. Technol.*, vol. 15, no. 9, pp. 88–102, 2021.
- [5] M. A. H. Mohammad, "Mobile Applications' Impact on Student Performance and Satisfaction," *Turkish Online J. Educ. Technol.*, vol. 14, no. 4, pp. 102–112, 2017.
- [6] R. Alturki and V. Gay, "Usability Testing of Fitness Mobile Application : Methodology and Quantitative Results," no. November, pp. 97–114, 2017.
- [7] K. Kalimullah and D. Sushmitha, "Influence of Design Elements in Mobile Applications on User Experience of Elderly People," *Procedia Comput. Sci.*, vol. 113, pp. 352–359, 2017.
- [8] M. Pautasso, "Ten Simple Rules for Writing a Literature Review," *PLoS Comput. Biol.*, vol. 9, no. 7, 2013.
- [9] M. A. Abdulla and A. M. Esmaeel, "Providing Information through Smart Platforms: An Applied Study on Academic Libraries in Saudi Universities," *J. Educ. Soc. Behav. Sci.*, no. June, pp. 1–24, 2019.
- [10] N. Arambepola and L. Munasinghe, "Empirical Analysis of User Factors that Affect the User Interface Design in Mobile Applications," 2020 20th International Conference on Advances in ICT for Emerging Regions (ICTer), Colombo, Sri Lanka, 2020.
- [11] M. A. H. Mohammad, "Mobile Applications' Impact on Student Performance and Satisfaction," *Turkish Online J. Educ. Technol.*, vol. 14, no. 4, pp. 102–112, 2017.

- [12] A. Hussain, E. O. C. Mkpojiogu, N. B. Yahaya, and N. Z. B. A. Bakar, "A mobile usability assessment of Carousell mobile app," *AIP Conf. Proc.*, vol. 2016, 2018.
- [13] S. Mortada and A. Hussain, "The evaluation of emgs mobile application: Users experience," *Int. J. Innov. Technol. Explor. Eng.*, vol. 8, no. 5s, pp. 246–250, 2019.
- [14] P. Weichbroth, "Usability of mobile applications: A systematic literature study," *IEEE Access*, vol. 8, pp. 55563–55577, 2020.
- [15] L. Punchoojit and N. Hongwarittorn, "Usability Studies on Mobile User Interface Design Patterns: A Systematic Literature Review," *Adv. Human-Computer Interact.*, vol. 2017, 2017.
- [16] L. Punchoojit and N. Hongwarittorn, "Age differences in menu item selection for smartphone: The effects of icon background colors and icon symbols," *ACM Int. Conf. Proceeding Ser.*, pp. 55–64, 2019.
- [17] A. Hussain, E. O. C. Mkpojiogu, N. Nabeel, and A. Alathwari, "Users perception of the mobile usability of a global bicycle sharing platform," *Int. J. Interact. Mob. Technol.*, vol. 13, no. 11, pp. 125–136, 2019.
- [18] A. Hussain and N. H. Jamaludin, "A Usability Evaluation of Lazada Mobile Application," vol. 020059, 2017, In *AIP Conference Proceedings (Vol. 1891)*. American Institute of Physics Inc.
- [19] A. Khamaj and Z. Kang, "Usability Evaluation of Mobile Weather Hazard Alert Applications," vol. 6, no. 1, pp. 21–40, *Industrial and Systems Engineering Review* 2018.
- [20] A. Hussain and J. Musa, "A User Experience Evaluation of Amazon Kindle Mobile Application," vol. 020060, *The 2nd International Conference on Applied Science and Technology* 2017.
- [21] A. Hussain and F. M. Kamal, "A Systematic Review on Usability Evaluation Methods for M-Commerce Apps," *Journal of Telecommunication, Electronic and Computer Engineering II*. vol. 8, no. 10, pp. 29–34, 1843.
- [22] G. Agrawal, D. Kumar, and M. Singh, *Evaluating Accessibility and Usability of Airline Websites*, vol. 1. Springer Singapore.

- [23] H. Fu, S. K. McMahon, C. R. Gross, T. J. Adam, and J. F. Wyman, "Usability and clinical efficacy of diabetes mobile applications for adults with type 2 diabetes : A systematic review," *Diabetes Res. Clin. Pract.*, vol. 131, pp. 70–81, 2017.
- [24] D. Hadrian Yohandy and D. Setyohadi, "Usability Evaluation Using Multi-Method for Improvement Interaction in M-Commerce," *MATEC Web Conf.*, vol. 218, pp. 1–7, 2018.
- [25] F. Zahra, A. Hussain, and H. Mohd, "Usability Evaluation of Mobile Applications ; Where Do We Stand ?," vol. 020056, 2017.
- [26] B. A. Kumar, "Usability of mobile learning applications : a systematic literature review," *J. Comput. Educ.*, 2017.
- [27] I. Dianat, P. Adeli, M. Asgari, and M. Ali, "User-centred web design , usability and user satisfaction : The case of online banking websites in Iran," *Appl. Ergon.*, vol. 81, no. June, p. 102892, 2019.
- [28] F. Cheng, C. Wu, and B. Leiner, "The Influence of User Interface Design on Consumer Perceptions ;," *Comput. Human Behav.*, 2018.
- [29] A. Hussain, E. O. C. Mkpojiogu, H. Almazini, and H. Almazini, "Assessing the usability of Shazam mobile app," *AIP Conf. Proc.*, vol. 1891, pp. 1–6, 2017.
- [30] A. Hussain, E. O. C. Mkpojiogu, H. Abubakar, and H. M. Hassan, "The usability evaluation of Mudah.my on mobile device," *AIP Conf. Proc.*, vol. 1891, 2017.
- [31] A. Hussain and E. O. C. Mkpojiogu, "The effect of responsive web design on the user experience with laptop and smartphone devices," *J. Teknol.*, vol. 77, no. 4, pp. 41–47, 2015.
- [32] N. F. Ilham, F. Azzahro, and P. W. Handayani, "The Effects of Pictures , Review Credibility and Personalization on Users Satisfaction of Using Restaurant Recommender Apps," *Second Int. Conf. Informatics Comput.*, vol. 4, no. 2, pp. 23–3, 2017.
- [33] R. N. Puteri and A. Widyanti, "E-commerce of Islamic fashion product: Usability and user acceptance," *2018 Int. Conf. Inf. Technol. Syst. Innov. ICITSI 2018 - Proc.*, pp. 143–147, 2018.
- [34] M. L. Tan, R. Prasanna, K. Stock, E. E. H. Doyle, G. Leonard, and D. Johnston, "Usability

- factors influencing the continuance intention of disaster apps: A mixed-methods study,” *Int. J. Disaster Risk Reduct.*, vol. 50, no. September, p. 101874, 2020.
- [35] N. Yu and Y. T. Huang, “Important factors affecting user experience design and satisfaction of a mobile health app—a case study of daily yoga app,” *Int. J. Environ. Res. Public Health*, vol. 17, no. 19, pp. 1–17, 2020.
- [36] Lan Nguyen, Thu Hatan and Thi Khanh Phuong, “An Empirical Study of Customers’ Satisfaction and Repurchase Intention on Online Shopping in Vietnam,” *J. Asian Financ. Econ. Bus.*, vol. 8, no. 1, pp. 971–983, 2021.
- [37] M. Gul, M. A. Shera, S. K. Shahzad, and H. U. Rahman, “A survey on emergent usability attributes to enhance the usefulness of websites and mobile applications,” *2020 Int. Conf. Eng. Emerg. Technol. ICEET 2020*, pp. 1–5, 2020.
- [38] A. Hussain, E. O. C. Mkpojiogu, and K. Suleiman, “A usability testing of a mobile print shop booking and design application,” *J. Adv. Res. Dyn. Control Syst.*, vol. 10, no. 10 Special Issue, pp. 1359–1365, 2018.
- [39] R. Girao-Silva, L. Martins, T. Gomes, A. Alashaikh, and D. Tipper, *Improving network availability - A design perspective*. Springer Singapore, 2018.
- [40] N. Elisa, “Usability, accessibility and web security assessment of E-government websites in tanzania,” *arXiv*, no. August, 2020.
- [41] A. S. Dahri, A. Al-Athwari, and A. Hussain, “Usability evaluation of mobile health application from AI perspective in rural areas of Pakistan,” *Int. J. Interact. Mob. Technol.*, vol. 13, no. 11, pp. 213–225, 2019.
- [42] Johannesson P., Perjons E. (2014) *Research Strategies and Methods*. In: *An Introduction to Design Science*.
- [43] M. Kasunic, “Designing an effective survey. Handbook. Carnegie Mellon University,” *Softw. Eng. Inst.*, no. September, p. 140, 2005.
- [44] Vagias, Wade M. (2006). *Likert-type scale response anchors*. Clemson International Institute for Tourism & Research Development, Department of Parks, Recreation and Tourism Management. Clemson University.
- [45] N. (2022). *Designing Surveys - A Guide to Decisions & Procedures* by [Paperback

(2004)].

[46] M. Ornstein, "Designing a Questionnaire," *A Companion to Surv. Res.*, vol. 1, no. 1, pp. 45–58, 2014.

[47] C. M. Barnum, *Usability Testing Essentials*. Morgan Kaufmann, 2020.

[48] W. Albert, T. Tullis, and D. Tedesco, *Beyond the Usability Lab*. Morgan Kaufmann, 2009.

[49] W. Albert and T. Tullis, *Measuring the User Experience*. Newnes, 2013.

[50] Zhou, L., Bao, J., Setiawan, I., Saptono, A., & Parmanto, The mHealth App Usability Questionnaire (MAUQ): Development and Validation Study. *JMIR mHealth and uHealth*, (2019).

[51] A. Lund, "Measuring Usability with the USE Questionnaire." Jan. 2001.

[52] "Cronbach." <https://statisticsbyjim.com/basics/cronbachs-alpha/> (accessed: Sep. 06, 2022)

[53] Collins, L.M. (2007). *Encyclopedia of Gerontology, Research Design and Methods*.

[54] "What Is Snowball Sampling? | Definition & Examples", Published on August 17, 2022 by Kassiani Nikolopoulou

[55] Fiona Middleton, "The four types of validity", Scribbr, <https://www.scribbr.com/methodology/types-of-validity/>, March 24, 2023.

[56] Boslaugh, Sarah and Paul Andrew Watters (2008.) *Statistics in a Nutshell: A Desktop Quick Reference*, ch. 7.

APPENDIX A

Calculating Sample Size

Solvin's formula is used to calculate an appropriate sample size from a population. It is used to calculate the sample size given the population size. It's usually impossible to survey every member of a population because of money, cost, time or effort.

Solvin's Formula:

$$n = \frac{N}{1 + Ne^2}$$

$$n = \text{sample size}$$

n= sample size

N= population size

e=margin of error

Population of Pakistan= 220.9 Million

Age wise population (15-64 years) = 60.2%

60.2% of 220.9 Million= 132981800

Confidence level of 95% (e)=1-0.95

=0.05

$$n = \frac{N}{1 + Ne^2}$$

$$= \frac{132981800}{1 + [132981800(0.05)^2]}$$

$$= \frac{132981800}{1 + 332454.5}$$

$$= \frac{132981800}{332455.5}$$

$$= 399.99 \sim 400$$

$$= 399.99 \sim 400$$

$$= 399.99 \sim 400$$

$$= 399.99 \sim 400$$

$$= 399.99 \sim 400$$

Sample size =400 but as mainly respondents of this survey is Youth and people having age ranging from 18-40 years old so sample size of this survey is 446.

APPENDIX B

Questionnaire for Survey

Survey about Online Ride Hailing Services

Please take a few minutes to complete this survey. This research data is being collected to produce an academic dissertation for the MS degree. Your participation in data collection is worthy and considerable. Your data would remain anonymous during research data compilation, but your views, in combination with those of others, are extremely important. So, your response will be very valuable to us.

1. What is your age?

- Less than 18 years old
- 18 to 40 years old
- 40 to 60 years old
- Older than 60 years old

2. Gender

- Male
- Female

3. Your qualification?

- Under Matric
- Matric
- Intermediate
- Graduation

4. Which one of the online ride hailing service do you mostly use?

- Careem
- Uber
- Limofied.
- Paxi.

- Shahi Sawari.
- Other

***Answer the questions below in context of the chosen application.**

5. Which factor is most important to you when choosing a form of transportation?

- Price
 - Safety and security
 - Application is easy to use
 - Other (Please specify)
-

6. Which of the following words would you use to describe this application?

- Buggy
- Fine, but there are some issues
- Great
- Life saving

7. How well does this application meet your needs?

- Badly
- Fine
- Well
- Very Well

8. How much effort did you have to put in to book a ride?

- I put in no effort to book the ride
- A reasonable amount of effort
- A small amount of effort

Ease of use:

9. This application was easy to use.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

10. The navigation was consistent when moving between the screens.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

11. Whenever I made a mistake using this application I recover easily and quickly?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

12. This application has all the functions and capabilities I expect it to have.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

13. This application made it convenient for me to use online ride hailing service.

- Strongly disagree
- Disagree
- Neutral
- Agree

- Strongly agree

Interface and satisfaction:

14.The information in the application was well organized, so I could easily find the information I needed.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Effectiveness:

15.This application help me manage my transportation effectively.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

16.I felt comfortable using this application.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

17.The application gave error messages that clearly told me how to fix problems.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

18.I could use this application even when internet connection was poor.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

19.The information (such as Driver's information, location, Transactions details etc) provided by the application was clear.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

20.This application adequately acknowledged and provided information to let me know the progress of my action.

- Strongly disagree
- Disagree

- Neutral
- Agree
- Strongly agree

21. The interface of this application was pleasant.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

22. I found the application unnecessarily complex.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

23. I think I would need the support of a technical person to be able to use this application.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

24. I found the various functions in this application were well integrated.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

25. I needed to learn a lot of things before I could get going with this system.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

26. I would use this application again.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

27. Overall I am satisfied with this application.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

28. Would you recommend this application to a friend?

- Strongly disagree
- Disagree

- Neutral
- Agree
- Strongly agree

APPENDIX C

Pearson Correlation Test

Usability Factors	Pearson Correlation Values		
Ease of Use	V10=0.687	V24=0.463	V26=0.459
Efficiency	V11=0.583	V12=0.627	V13=0.702
Usability(Interaction with Interface)	V22=0.738	V23=0.393	V25=0.693

Usability Factors	Pearson Correlation Values	
Usefulness	V14=0.648	V18=0.635
Effectiveness	V16=0.726	V17=0.703
Accessibility	V19=0.584	V20=0.629
Responsiveness	V21=0.665	

Usability Factor	Pearson Correlation Values				
User Satisfaction	V15=0.710	V27=0.638	V17=0.703	V28=0.708	V29=0.682

- *V9. This application is easy to use?
consistent when moving between the screens?
- *V10. The navigation is consistent when moving between the screens?
- *V11. Whenever I made a mistake using this application I recover easily and quickly?
- *V12. This application has all the functions and capabilities I expect it to have?
- *V13. This application made it convenient for me to use online ride hailing service?
- *V14. The information in the application is well organized, so I could easily find the information I needed?
- *V15. This application help me manage my transportation effectively?
- *V16. I felt comfortable using this application? *V17. The application gave error messages that clearly told me how to fix problems?
- *V18. I could use this application even when internet connection is poor?
- *V19. The information (such as Driver's information, location, Transactions details etc) provided by the application is clear?

*V20. This application adequately acknowledged and provided information to let me know the progress of my action?

*V21. The interface of this application is pleasant?
the application unnecessarily complex?

*V 22. I found

*V23. I think I would need the support of a technical person to be able to use this application?

*V24. I found the various functions in this application were well integrated?

*V25. I needed to learn a lot of things before I could get going with this system?

*V26. I would use this application again?
this application?

*V27. Overall I am satisfied with

*V28. Would you recommend this application to a friend?

Output shows Pearson Correlation value, Significance value and N that is sample size. If the significance value is more than 0.05 then we will say that it is insignificant. As all of the values are below 0.05 so they are all significant. We will compare the obtained value of Pearson Correlation with the already given value mentioned in Critical Pearson's Correlation Table. If the calculated Pearson's correlation coefficient is greater than the critical value from the table, then reject the null hypothesis that there is no correlation.

$P \leq 0.05$ the test is significant.

- N= sample size.
- Degree of freedom=N-2
- Obtained value > Critical Value in the Table.

Sample size=446.

Degree of Freedom=446-2

=444

We will check the critical value at 444 DF in table.

444 DF (0.05) =0.09

V10 Obtained value is 0.687 which is > Critical value of 0.09 and is highly significant so it is a valid question and it proves the hypothesis that it is positively correlated to Customer Retention.

H1: Perceived ease of use is positively related to customer retention.

V10, V24, V26.

V10 Obtained value is 0.687 which is $>$ Critical value of 0.09 and is highly significant so it is a valid question and it prove the hypothesis that it is positively correlated to Customer Retention.

Similar is the case with V24 and V26 both have values .459 and .463 which are $>$ than critical value of 0.09 so it proves that this factor is positively related to customer retention as it is highly correlated.

H2: Perceived efficiency is positively related to customer retention.

V11, V12, V13

V11=0.583, V12= 0.627, V13= 0.702 as these all values are greater than critical value, it means that it proves the hypothesis that Perceived efficiency is positively related to customer retention.

H3: Perceived usefulness is positively related to customer retention.

V14, V18

V14=0.648, V18=0.635 as these both values are also greater than critical value which means that there is positive correlation and perceived usefulness is positively related to customer retention.

H4: Perceived effectiveness is positively related to customer retention.

V16, V17

V16=0.726, V17= 0.703 these values are also greater than critical value which proves effectiveness is also positively related to customer retention.

H5: Perceived accessibility is positively related to customer retention.

V19, V20

V19=0.584, V20=0.629

These both values also proves that Perceived accessibility is positively related to customer retention.

H6: Perceived responsiveness is positively related to customer retention.

$V_{21}=0.665$ as it is greater than critical value 0.09 so it means that responsiveness is positively related to customer retention.

H7: Perceived application user interface is positively related to customer retention.

V_{22} , V_{23} , V_{25}

$V_{22}=0.738$, $V_{23}=0.393$, $V_{25}=0.693$ as these all values are greater than critical value so it means Perceived application user interface is positively related to customer retention.

H8: Perceived satisfaction is positively related to customer retention.

V_{15} , V_{27} , V_{17} , V_{28} , V_{29}

$V_{15}= 0.710$, $V_{27}=0.638$, $V_{17}=0.703$, $V_{28}= 0.708$, $V_{29}=0.682$. These all values are greater than critical value 0.09 so it proves that the perceived satisfaction is positively related to customer retention which is the hypothesis.