

Exploring Usability Issues of E-Government Websites in Bangladesh and Their Impact on Users with Limited Digital Literacy

by

Faiyaz Morshed Khan
21301040

Shreya Biswas
21301431

Sultan Mehedi Masud
22101071

Susmita Biswas
22101380

Sabbir Bin Abdul Latif
23341056

A thesis submitted to the Department of Computer Science and Engineering
in partial fulfillment of the requirements for the degree of
B.Sc. in Computer Science

Department of Computer Science and Engineering
Brac University
June 2025

© 2025. Brac University
All rights reserved.

Declaration

It is hereby declared that

1. The thesis submitted is my/our own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. We have acknowledged all main sources of help.

Student's Full Name & Signature:



Faiyaz Morshed Khan
21301040



Shreya Biswas
21301431



Sultan Mehedi Masud
22101071



Susmita Biswas
22101380



Sabbir Bin Abdul Latif
23341056

Approval

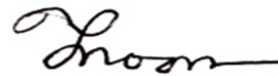
The thesis titled “Exploring Usability Issues of E-Government Websites in Bangladesh and Their Impact on Users with Limited Digital Literacy” submitted by

1. Faiyaz Morshed Khan (21301040)
2. Shreya Biswas (21301431)
3. Sultan Mehedi Masud (22101071)
4. Susmita Biswas (22101380)
5. Sabbir Bin Abdul Latif (23341056)

Of Spring, 2025 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of B.Sc. in Computer Science on June 20, 2025.

Examining Committee:

Supervisor:



Jannatun Noor
Associate Professor
Director, BSDS
Department of Computer Science and Engineering
United International University

Co-supervisor:



Anika Priodorshinee Mrittika
Lecturer
Department of Computer Science and Engineering
School of Data and Sciences
Brac University

Program Coordinator:
(Member)



Md. Golam Rabiul Alam, PhD
Professor
Department of Computer Science and Engineering
School of Data and Sciences
Brac University

Head of Department:
(Chair)



Sadia Hamid Kazi, Ph.D.
Associate Professor
Department of Computer Science and Engineering
School of Data and Sciences
Brac University

Ethics Statement

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of BRAC University on May 6, 2024. (REC reference no. 220240006)

Abstract

While Bangladesh is advancing with its “Digital Bangladesh” initiative, the success of e-government platforms in transforming public service delivery greatly relies on how such platforms are accessible and usable by all citizens, ranging from novice to proficient in digital skills. However, significant usability challenges for users with limited digital literacy create a digital divide that undermines the inclusivity and effectiveness of these platforms. This research explores the various usability challenges faced by users with limited digital proficiency, revealing the underlying factors contributing to these challenges and finally proposing solutions to promote inclusivity and bridge the digital divide. By incorporating a mixed-method approach like questionnaires, interviews, and heuristic evaluation, it seeks a deeper understanding of user experiences on those platforms. Data collection involved 293 survey respondents, 9 administrative interviews, and 19 mediator interviews. Through comprehensive data analysis, the study discovers a range of infrastructural and organizational challenges faced by users across the four selected e-service platforms. Notably, the analysis also unveils the underlying reasons for the prevalence of mediators, which emerged as a critical aspect of users’ coping mechanisms against the challenges. It reveals that high dependency on mediators stems from limited digital literacy, navigation struggles, infrastructural barriers, and user impatience. These findings put additional emphasis on user-centric design enhancements to mitigate these challenges. Thus, this study draws from global best practices to offer practical design solutions that enhance user experience and digital inclusion in Bangladesh’s e-government services.

Keywords: E-Government Usability, Accessibility, Digital Literacy, User-Centered Design, Digital Inclusion, Heuristic Evaluation

Dedication

- *Dedicated to the people of Bangladesh whose perseverance amidst digital barriers inspires the pursuit of inclusive, accessible e-government services for all.*

Acknowledgement

First and foremost, all praise and gratitude to Allah, the Most Gracious and the Most Merciful, for granting us the strength, patience, and perseverance to complete this thesis without any major obstacles. Without His divine guidance and blessings, this work would not have been possible.

We extend our heartfelt gratitude to our respected Supervisor, Jannatun Noor, Associate Professor and Director of BSDS, Department of Computer Science and Engineering, for her continuous support, insightful feedback, and inspiring mentorship throughout every stage of our research. Her encouragement and critical perspective have played a key role in shaping the direction and quality of our work.

We are also sincerely thankful to our Co-Supervisor, Anika Priodorshinee Mrittika, Lecturer, Department of Computer Science and Engineering, for her valuable guidance, constructive suggestions, and consistent motivation which have enriched our understanding and approach to this research.

We would like to express our deep appreciation to all the participants who took part in our survey and interviews—including users, mediators, developers, designers and administrative officials. Your openness and contributions were vital in helping us uncover the real-world challenges of navigating e-government services, especially for those with limited digital literacy.

A special thank you goes to our friends and peers for their encouragement and technical support during the more demanding phases of this journey. Your presence and positivity have made a lasting impact.

Lastly, we are immensely grateful to our parents and families, whose unwavering love, patience, and belief in us have been our constant source of strength. This accomplishment would not have been possible without your sacrifices and support.

Table of Contents

Declaration	i
Approval	ii
Ethics Statement	iv
Abstract	v
Dedication	vi
Acknowledgment	vii
Table of Contents	viii
List of Figures	xi
List of Tables	xii
1 Introduction	1
1.1 Problem Statement	1
1.2 Research Objective	2
1.3 Research Questions	3
1.4 Thesis Organization	4
2 Literature Review	6
2.1 Usability Challenges in E-Government Websites	6
2.2 Digital Literacy and Its Impact on E-Government Usage	9
2.2.1 Digital Literacy and Its Influence on E-Government	9
2.2.2 The Effects of Digital Inequality on e-Government Adoption .	11
2.2.3 Socio-Demographic Factors and Digital Divide	11
2.2.4 Challenges and Barriers to E-government Implementation	13
2.2.5 Digital Inclusion and Solutions For Marginalized Communities	15
2.3 E-Government Usability Evaluation Frameworks	17
2.4 Case Studies on The E-Government Implementation in Bangladesh	22

2.5	Research Gap	25
3	Methodology	27
3.1	Data Collection	27
3.2	Field Observations	27
3.3	Interviews	28
3.3.1	Mediators	28
3.3.2	Administrative Officials	29
3.4	Surveys	30
3.5	Interface Development and Expert Validation	32
3.6	Heuristic Evaluation	33
3.7	Data Analysis	33
3.7.1	Qualitative Analysis	33
3.7.2	Quantitative Analysis	33
3.8	Integration of Findings	36
3.9	Ethical Considerations	36
4	Findings	37
4.1	Challenges Faced by Users with Limited Digital Literacy	38
4.1.1	BRTA Admin	38
4.1.1.1	Digital Literacy and Behavioral Barriers Driving Mediator Dependency	38
4.1.1.2	Technical Infrastructural and Usability Challenges	39
4.1.2	Passport Admin	39
4.1.2.1	Navigational Barriers and Digital Proficiency Gaps	39
4.1.2.2	Challenges in Support Infrastructure and Accessibility	40
4.1.3	NID Admin	41
4.1.3.1	Barriers to Independent Usage	41
4.1.3.2	Addressing Server Reliability Misconceptions	41
4.1.4	BRTA Mediator	41
4.1.4.1	Technical Challenges and Process Complexity	42
4.1.4.2	Client Dependency	42
4.1.5	Passport Mediator	43
4.1.5.1	System Performance and Integration Issues	43
4.1.5.2	Mediator Reliance for Process Simplification	44
4.1.6	NID Mediator	44
4.1.6.1	Challenges in NID System Usability, Data Synchronization, and Accessibility	44
4.1.7	User Survey	45
4.1.7.1	Technical and Infrastructure Barriers	46
4.1.7.2	Interface and Navigation Complexities	48
4.1.7.3	Security and Trust Issues	53
4.1.8	Heuristic Evaluation	55
4.2	Recommendations for Improving E-Government Website Usability	59
4.2.1	BRTA Admin	59
4.2.1.1	User Support and Accessibility Initiatives	59
4.2.1.2	Security Measures and Future Development	59
4.2.2	Passport Admin	60

4.2.3	NID Admin	61
4.2.4	BRTA Mediators	61
4.2.4.1	Technical Enhancement	61
4.2.5	Passport and NID Mediators	62
4.2.6	User Survey	62
4.2.7	Technical and System Enhancements	63
4.2.8	User Support and Guidance	64
4.2.9	Process and Policy Improvements	66
5	Discussions	68
5.1	Connecting Findings to Existing Literature and Research Questions .	68
5.1.1	Usability Challenges for Limited Digital Literacy Users	68
5.1.2	Infrastructure and Technical Barriers	69
5.1.3	Mediator Dependency as a Systemic Response	69
5.1.4	Security and Trust Issues	70
5.2	Proposed Solutions: Building an Inclusive Digital Government Ecosystem	70
5.2.1	Addressing Informal Mediator Systems	70
5.2.1.1	Current Challenges and Risks	70
5.2.1.2	Model 1: One-Stop Digital Solution Centers	71
5.2.1.3	Model 2: Enhanced In-House Digital Support Systems	72
5.2.1.4	Economic and Employment Benefits	72
5.2.2	Creating Comprehensive Developer Guidelines	73
5.2.2.1	Understanding the Core Problems	73
5.2.2.2	The Bangladesh E-Government Development Framework	74
5.2.2.3	Implementation Strategy and Compliance Mechanisms	79
5.2.2.4	Expert Validation and Practical Validity	79
5.2.3	Critical Infrastructure Resilience	84
5.2.3.1	Systemic Server Dependencies and Single Points of Failure	84
5.2.3.2	Proposed Technical Solutions	85
6	Limitation and Future Works	87
6.1	Methodological Limitations	87
6.2	Geographic and Demographic Constraints	87
6.3	Future Research Opportunities	88
6.4	Comparative and Longitudinal Study Needs	88
7	Conclusion	89
	Bibliography	97

List of Figures

3.1	Workflow	28
3.2	The top two pictures are of tech support centers beside BRTA in Mirpur-13 while providing service to the users. The bottom two pictures feature computer service shops in Agargaon, outside Passport Office.	29
4.1	E-Government service usage rate heatmap by combined digital literacy level	46
4.2	Analysis of interface and navigation complexities across e-government platforms	49
4.3	Assistance required by different digital literacy level users	52
4.4	Correlation analysis between digital literacy and e-government service variables	53
4.5	Security confidence levels in e-government platforms	54
4.6	Bangladesh e-Passport portal homepage - unusual position of navigation menu	55
4.7	BRTA website registration process - error handling in NID verification process	56
4.8	NID profile editing page - invalid validation creating unnecessary barrier	57
4.9	Train seat selection interface showing inconsistent seat availability information between summary view and detailed compartment view. .	57
4.10	Train schedule display showing accessibility issues with time format, technical terminology and proper language support.	58
5.1	Civix UI: a government component guideline - Homepage	74
5.2	Component library - Password requirements	75
5.3	Civix UI - Checklist page	76
5.4	Civix UI - Templates page	77
5.5	E-Passport Re-imagined: privacy policy page	77
5.6	Civix UI: Guidelines page	78
5.7	E-Passport re-imagined portal homepage - Prototype	80
5.8	Streamlined application form with automatic NID data fetching and progress indicators	81
5.9	Real-time application tracking with clear status updates and guidance on next steps.	82
5.10	Transparent fee structures and multiple payment options	82
5.11	Documentation requirements displayed visually and by organized categories	83

List of Tables

3.1	Sample size overview	30
3.2	Digital literacy score conversion methodology	34
4.1	Demographic characteristics of survey respondents (N=293)	45
4.2	Correlation analysis between key variables	47

Chapter 1

Introduction

E-government has become an important factor in the last few years for modernizing governance and the delivery of public services. Digital platforms will allow the government to deliver services much more efficiently because not only will it provide transparency, but it will also eliminate a lot of administrative delays [77]. To obtain public information online, the “Digital Bangladesh” initiative provides citizens with access to several services, such as the National Portal of Bangladesh [7], Online Birth and Death Registration [12], E-Passport and E-Visa Systems [55], Online Tax Services [16], Digital Land Records System [8], Mobile Financial Services (Bkash [5], Rocket [19], Nagad [45]), and many more. Digital Bangladesh is an initiative that aims at modernizing the country through the use of technology, considering E-government as a key component. The E-government system in Bangladesh plays a vital role in achieving the goals of Digital Bangladesh. It involves the digitization of government services, which includes developing online portals, mobile applications, and digital infrastructures to make public services more accessible, transparent, and efficient.

Despite this advancement, the issue of usability is still a very real concern, particularly among people with limited digital literacy, as e-government services hold many promising areas. The term ‘Digital Literacy’ refers to the ability to use digital tools and technologies effectively to find, analyze, evaluate, create, and communicate information. Digital literacy is a main concern for the citizens to be able to fully utilize e-government services. Enhancing digital literacy is vital for ensuring that all citizens can fully engage with and benefit from E-government services by contributing to a more inclusive and equitable digital landscape in Bangladesh.

1.1 Problem Statement

Bangladesh’s push towards digitizing government services through e-government platforms, initiated in the early part of this century, aims to enhance usability and efficiency [47]. However, these initiatives require further improvement, particularly in terms of usability for users with limited digital literacy. A substantial portion of the population needs help navigating these digital platforms due to complex interfaces, unclear instructions, and insufficient support systems [66]. This digital divide not only limits access to essential public services but also increases social exclusion, as those with limited digital skills are unable to fully benefit from e-government services. The lack of technological skill is a critical barrier, preventing effective in-

teraction with these platforms and obstructing the overall success of e-government initiatives. Addressing these usability issues is crucial to ensuring that e-government services are inclusive and accessible to all citizens, regardless of their digital adeptness levels. This research aims to explore the specific usability challenges faced by users with limited digital literacy in Bangladesh and to provide insights and recommendations for improving the design and functionality of e-government websites. By doing so, the study seeks to bridge the digital divide and promote digital inclusion, ensuring that all citizens can access and benefit from government services online.

1.2 Research Objective

While the government of Bangladesh is trying to digitalize many of its services via e-government portals, many users with limited digital skills and knowledge are having a hard time using these services because of complicated interfaces, there are no clear instructions, and no real support. This digital divide restricts access to essential public services. Overcoming these usability hurdles is the main key to the success of e-government projects. The main purpose of this study is to define what exactly those barriers are for users with low digital literacy and also to give some design and accessibility suggestions that can be used for e-government sites to encourage digital inclusion.

To enhance the effectiveness and inclusivity of e-government services in Bangladesh, this research aims to systematically evaluate the usability of these platforms. The following goals will be emphasized to develop user-centric design improvements and provide policy recommendations to promote digital inclusion:

1. Assess E-Government Websites:

- **Usability Evaluation:** Examine the usability of selected e-government websites to identify design and functionality issues that hamper user interaction.

2. Identify and Address User Challenges:

- **User Challenges:** Investigate specific challenges faced by users with limited tech skills, such as navigation difficulties and comprehension issues.
- **Digital Literacy Influence:** Explore the role of digital literacy in the effective use of e-government websites and its impact on user experience.

3. Analyze User Satisfaction and Engagement:

- **Impact on Satisfaction:** Examine how usability issues affect user satisfaction and engagement with e-government services.
- **Privacy and Security Concerns:** Investigate user concerns regarding privacy and security and their impact on trust and usage.

4. Compare with Global Best Practices:

- **Benchmarking:** Compare the usability of Bangladeshi e-government websites with global best practices to identify areas for improvement.

5. Develop Recommendations:

- **Design Improvements:** Propose user-centric design improvements based on best practices to enhance usability for users with limited digital expertise.
- **Policy Recommendations:** Offer policy recommendations to government agencies to improve website usability and promote digital inclusion.

By obtaining these goals, the research will contribute to a more accessible and user-friendly e-government infrastructure in Bangladesh. The insights gained will guide the development of strategies to improve website design and functionality, ultimately enhancing user satisfaction and engagement. This will bridge the digital divide and support the broader vision of a Digital Bangladesh, ensuring that all citizens can benefit from efficient and transparent government services.

1.3 Research Questions

The research will address mainly the following questions:

- **RQ 1:** What usability challenges do users with limited digital literacy face while interacting with e-government websites in Bangladesh that obstruct them from completing key tasks successfully?
- **RQ 2:** How can the usability of the E-government websites in Bangladesh be improved, keeping digital literacy levels in mind?

To address the research questions, we used a mixed-methods approach, combining ethnographic observations, interviews, surveys, and heuristic evaluations to explore users' experiences with limited digital literacy on the four e-government websites: e-Passport[55], Bangladesh Road and Transport Authority Service Portal (BRTA BSP) [1], NID [78], Railway Sheba [76]. Data collection was carried out over two months, from November 2024 to January 2025, with a diverse group of participants, including mediators, administrative officials, and users of these websites. We collected quantitative data through surveys and qualitative insights from the interviews and observations. Statistical and thematic analyses [67] of the data identified key challenges and informed recommendations for improving these services. Additionally, a heuristic evaluation of the platforms was conducted, further validating the findings. We followed ethical guidelines throughout the research, including informed consent, confidentiality, and participant anonymity.

This paper is unique as it focuses on a specific and under-explored demographic—users with limited digital literacy—in Bangladesh's E-government usability context. Most of the existing research addresses general usability challenges but this study focuses on the unique difficulties faced by these users, who are lagging behind in using E-government websites due to poor design and non-intuitive navigation. This paper

highlights several key aspects that contribute to its uniqueness and relevance, particularly in addressing the usability challenges faced by users with limited digital literacy within Bangladesh’s E-government framework.

The study also emphasizes on Bangladesh’s specific socio-economic and technological context, ensuring that the proposed solutions are highly relevant to the country’s digital infrastructure and diverse socio-economic landscape. By emphasizing digital literacy as a key factor, the paper explores how varying levels of technological skills impact usability, offering solutions that cater to users with differing competencies.

A notable contribution of this paper is its user-centric approach, which offers tailored design solutions, such as simpler interfaces, the use of visuals, and auditory cues—that directly address real-world issues rather than relying on generalized design theories. Ultimately, this research brings out the connection between improved web usability and bridging the digital divide, showing how enhanced accessibility to E-government services can foster digital inclusion and make these services more available to underprivileged groups, thereby contributing to Bangladesh’s broader agenda of digital empowerment. Other key contributions include:

- **Focused Exploration of Usability Challenges:** The paper upholds the specific usability difficulties faced by users with limited digital literacy when interacting with E-government websites, a demographic often underrepresented in research.
- **Emphasis on the Needs of Low Digital Literacy Users:** It provides insights into how low digital literacy affects these users’ ability to access essential government services, highlighting the unique challenges they face.
- **User-Centered Analysis:** Through a user-focused approach, the study identifies key design and accessibility barriers that impact the usability of E-government platforms for this demographic.
- **Proposes Practical Solutions:** The research offers practical recommendations for improving usability, specifically in Bangladesh’s socio-economic context and digital infrastructure.
- **Bridging the Digital Divide:** By advocating for easy-to-use and accessible E-government platforms, the paper supports digital inclusion efforts, making government services more accessible to users with diverse skill levels.

1.4 Thesis Organization

To begin with, Chapter 1 of this report includes the introduction part, where we explain how usability issues can arise among people with limited digital literacy while using E-government websites. Furthermore, we state the problem along with the Research Objectives, Research Questions, the novelty of the study, and the contribution of this paper.

Then, Chapter 2 presents the literature review, where we highlight usability challenges in E-government websites, the concept and impact of digital literacy, evaluation of existing frameworks, and relevant case studies. This chapter also identifies the research gap that our study aims to address.

Moreover, Chapter 3 outlines the step-by-step research methodology. It provides a comprehensive explanation of the data collection and analysis process and describes the strategies used to ensure the validity and reliability of the research findings.

Following that, Chapter 4 presents the results and key findings derived from the analysis. It explores the major patterns and trends observed in the data and discusses their implications in the context of digital literacy and E-government usability.

More importantly, Chapter 5 offers an in-depth discussion of the findings. It connects the results to existing literature and research questions, and proposes practical, inclusive solutions to overcome identified challenges. This chapter also introduces conceptual models and strategies aimed at enhancing usability, infrastructure resilience, and trust in digital public services.

Subsequently, Chapter 6 discusses the limitations of the current study and outlines directions for future research. It reflects on methodological and demographic constraints and suggests opportunities for broader comparative and longitudinal studies to enrich this research domain.

Lastly, Chapter 7 concludes the study by summarizing the key findings on the usability challenges of Bangladeshi E-government websites, especially those related to digital literacy barriers. It reinforces the importance of inclusive design and emphasizes the potential impact of user-centered improvements in fostering trust and wider adoption of E-government services.

Chapter 2

Literature Review

2.1 Usability Challenges in E-Government Websites

Usability is one of the key aspects of e-government websites as it can directly affect citizens' ability and willingness to access information and services efficiently and effectively. As the topic has a high value, a growing number of works have been done focusing on evaluating the usability of e-government websites across various countries, revealing significant challenges that create a barrier to user experience.

User-centered design is one of the key aspects for e-government websites to improve usability as the more usable a website is, the more users will use it. A study conducted in Rwanda explored the possibilities of user-centered design approaches that can improve the implementation of e-government in the context of least-developed countries, focusing on Rwanda's efforts to digitize 100 government services [36]. The researchers proposed key success factors that would reduce the chances of rejection by emphasizing usability and early user involvement. The study did an interpretive case study on the e-government portal named 'IREMBO' in Rwanda, specifically focusing on the implementation of the portal by using the Usability and User-Centered Design Frameworks. Furthermore, they conducted semi-structured interviews with employees of Rwanda Online Platform (ROL) and government officials alongside participatory observations with the civil registration officers during their training sessions. These initiatives revealed the lack of user involvement in the early design process led to mismatched system functionality and user needs. It also emphasized the importance of public-private partnerships (PPP) to increase awareness and finally made suggestions for increasing usability and user-centered design practices to enhance usability and acceptance. Though this is a case study, it strengthened its arguments by focusing on user-based methods, practical insights, and real-world implementations to measure the effectiveness of user-centered design approaches.

A study by Paul & Das (2019), investigated the usability and accessibility issues of Indian e-government websites revealing significant usability issues that hinder the effectiveness of e-service delivery in India [62]. For this study, the researchers chose 65 Indian e-government websites and evaluated usability and accessibility using automated evaluation tools. To evaluate accessibility, they used tools like EvalAcces

2.0 and AChecker which followed the standard guidelines of WCAG 1.0 and WCAG 2.0. They used tools like WebSiteOptimization and a web service, checking broken links, download time, page size, and link integrity for usability testing. The result of these tools highlighted significant usability issues as 43% of websites had broken links and the downloading time exceeded 90 seconds, indicating low priority on usability and accessibility in e-government websites of India. Though the paper has a small sample size, it evaluated accessibility and usability in multiple stages which made the paper well delivered and strengthened their arguments. Similarly, research conducted in Pakistan, tested the usability of the Punjab Public Service Commission (PPSC) government website via the System Usability Scale (SUS) to identify the factors influencing experience and made suggestions for improvements to enhance user interfaces [71]. Dividing the selected 19 participants into three groups: expert users, intermediate users, and novice users, the researchers collected the data via a questionnaire that incorporated questions related to the SUS, a quick and effective usability measuring tool. The study shows that the website felt more user-friendly to experienced users while novice users found it challenging and suggested improvements to the website to accommodate newer users. Although this paper evaluated only one website, it successfully revealed the impact of users' personal experiences influencing these usability evaluations and emphasized the need for websites to be beginner-friendly.

Similar usability evaluations were conducted in Middle Eastern countries like Saudi Arabia and Turkey where the researchers tried to identify the key usability issues and propose suggestions to solve those challenges. The study by Aloboud et al. (2020), focuses on evaluating the usability and accessibility of Saudi e-government websites, identifying major issues that hinder the user experience of these websites [50]. It also emphasized the importance of meeting international standards to facilitate online transactions for the citizens. The researchers assessed five e-government websites from the Ministry of Labour and Social Development. They used both automated and manual methods to conduct their research. They used common tools like AChecker and Total Validators to check the accessibility of these websites as these tools follow the WCAG standards. For the usability, they assigned three expert reviewers to review the website usability following Nilsson's 10 heuristics. These tests revealed that none of the websites met the minimum WCAG 2.0 accessibility standards with 441 violations in this field, with fewer usability issues like problems like inconsistencies in navigation and error prevention. Finally, they highlighted that improved design practices could enhance the accessibility and usability of these e-governance websites. Though the paper focused on a limited number of websites, it provided well-defined evaluation and results on usability and accessibility. Another study in Turkey explored the accessibility, usability, quality, and readability of the Turkish Local and State government websites, identifying severe shortcomings and highlighting the websites' need for improvements to make the services accessible and usable for all citizens including those with disabilities [41]. The study evaluated the homepages of 77 state and 247 local government websites using a combination of automated and manual methods and evaluated usability based on the 19 dichotomous standards and readability using six different indices. The evaluation results highlighted that though most websites followed the basic design standards, issues like inconsistent links, overloaded navigation, and cluttered interfaces were present

in the systems. This signified the necessity for promoting the use of heuristics to guide website development strategies and enhance the usability of the websites. As the paper had multiple evaluations combined, it produced detailed results that provided a holistic view of the current situation of Turkish e-governance. But at the same time, the study only focused on homepages limiting the representation of the websites tested in the evaluation process.

The countries in the African continent, mainly Libya, Tanzania, and Ethiopia showed a good amount of work in the field of usability and accessibility [65, 32, 42]. The study based on Libya explored the usability and accessibility of their government websites and highlighted various usability issues [42]. They also suggested improvements to meet international standards and enhance service to citizens including those with disabilities. The study examined ten government websites using WCAG 2.0 guidelines and heuristic evaluation methods, choosing 32 evaluators to evaluate usability through Neilson's 10 heuristics and automated tools like Achecker and TAW for assessing accessibility. The findings show that except for Management of Scholarships, all the other websites failed the accessibility evaluation, highlighting some common issues such as a lack of non-text elements and poor system status visibility. In addition, the usability problems were severe, with more than half of the websites rated as catastrophic, especially in areas like error recovery and user control. Though the study focused on a limited number of websites, it successfully highlighted the situation of the Libyan websites and suggested improvements to enhance the user experience. Similar to the study of Libya, a study conducted in Tanzania focused on the usability and accessibility evaluation of these systems, identifying the main issues and scopes of improvement in their websites [32]. The study evaluated 22 government websites, checking through WCAG accessibility standards and section 508 guidelines, and evaluated usability based on the US Federal guidelines by scanning 100 pages per website to identify the problems. From the evaluation process, the study shows that nearly 50% of websites had more than 50 web pages with various accessibility issues and over 100 accessibility problems were found in 82% of the total evaluated websites. Among these problems, the most common ones were missing text alternatives, poor contrast, and large images affecting download speed. Usability issues were also prevalent as many websites had over 50 violations such as substandard navigation and slow loading time. The study captured the common problems quite well but the issues found by automated testing couldn't address the difficulties related to website functionality.

The study by Zeleke, Y., assessed the usability and accessibility of Ethiopian government websites and developed a model for the Ethiopian e-governance to improve their usability and accessibility [65]. The researchers conducted the study in 4 stages combining both qualitative and quantitative approaches and evaluated five government websites with forty participants participating in this study. The data was collected via interviews and questionnaires and a heuristic evaluation was conducted to test the usability of these websites. The results from analyzing these data identified issues like insufficient user requirement gatherings, inadequate usability and accessibility standards, and limited awareness of organizations which hindered the website's improvement efforts. The user perspective study also highlighted problems like poor navigation, inconsistent design, unreadable fonts, and language issues which pose

significant usability problems and hinder the overall user experience. Even though the study only used one approach for usability testing, it was able to highlight the different experiences of users in terms of familiarity which strengthened the findings of this study. Moreover, a comparative study was conducted to assess the usability and accessibility of the government websites across four countries, Kyrgyzstan, Azerbaijan, Kazakhstan, and Turkey highlighting the differences in website performance and adherence standards [31]. The study assessed 16 ministry websites from each country using various online automated tools. For the accessibility evaluation, they used the WCAG 2.0 standards, and the ‘quality in use’ was examined through metrics like user engagement and site traffic. It revealed that Turkish websites generally performed better with the highest visibility and user engagement and websites from Azerbaijan were slow, with higher instances of broken links which disrupted user experience. This research provides a comparative analysis of various countries that highlights the common issues and improvements in usability and accessibility standards. However, the paper lacked user-based methods and only relied on automated evaluation which failed to identify the issues more directly related to user experience.

Usability is one of the key features that make e-government websites usable for all, but for some certain disadvantaged communities usability plays an even bigger role in giving a better user experience and setting equity among all. Older adults fall into this category as they struggle to use digital devices, and thus fail to avail the benefits of e-government [53]. A study was conducted, focusing on the usability challenges faced by older adults in e-government websites [4]. The study assessed 50 state and 50 federal e-government websites’ homepages, evaluating them through Neilson and Tahir’s homepage guidelines and National Institute of Aging guidelines for senior citizen-friendly websites. The study found usability issues like small font size, poorly differentiated links, cluttered interfaces, complex navigation schemes, long download times, and inadequate translations creating usability barriers for older users to access information from these websites. Moreover, it emphasized the importance of better design practices like simple navigation and better readability to help older citizens navigate through the systems. Though this paper only explores homepages, it provided valuable insights into the challenges and improvements in the e-government websites to provide better user experience to older adults bringing digital inclusion to this community.

2.2 Digital Literacy and Its Impact on E-Government Usage

As technology adaptation is becoming widespread, governments worldwide are also shifting their focus toward building e-government systems. Due to this sudden surge of digitalization, the importance of digital literacy has increased as it helps citizens use electronic government systems to access various services and needed information.

2.2.1 Digital Literacy and Its Influence on E-Government

A study by Tomaszewicz, A. A., explains digital literacy and its influence on the level of e-governance achieved in various countries [27]. It measures this level of

development across the European Union (EU) countries with the digital proficiency of their citizens. The paper employs a comparative exploration of the e-Government Index (eGDI) across the EU nations, correlating the results with the level of digital literacy of the citizens of those nations. It synthesized the existing data and literature to demonstrate the relationship between digital skills and the effectiveness of e-government. The findings of this study reveal a positive correlation between the level of digital literacy among the citizens and e-service development. The paper also highlights two other factors, infrastructure, and public service complexity, which play a key role in the success of e-government services. The study significantly provided a comprehensive overview of the correlation between digital literacy and e-government development, supported by the data from multiple EU countries which increases the validity of its conclusion, but an absence of original empirical research can be recognized as a drawback for this study. Another study was done on the significance of digital literacy in the adoption and use of e-governance in India which is a developing nation [22]. The research argues that digital literacy and e-governance are intertwined as the citizens require digital literacy to avail the benefits of e-governance. To test this argument, they focused on a literature review and a case study approach where they extensively reviewed previous studies and government reports on the impact of digital literacy on e-government and the associated socio-economic impacts. For the case study, they selected real-life projects like the E-District Mission Mode Project in India, prioritizing the effects of digital literacy programs in rural India. From these tests, the researchers concluded that digital literacy is essential for citizens' effective use and access to e-services, while inadequate knowledge of information technology and insufficient digital literacy are the main reasons behind the failures of many e-government projects in India. Furthermore, it revealed the impact of digital literacy in reducing the digital divide and leading towards more transparency, efficiency, and responsive government services. Though the discussion is highly focused on India, this study produced in-depth insights on the impact of digital literacy on developing countries which is the main standout point of this study.

The study done by Lee et al., discusses the impact of digital literacy on citizen's trust and the success of e-services, focusing on the user perspective and the importance of digital skills [58]. It explores how a person's literacy can affect their trust in government websites, mediated by their perceived information overload and perceived usefulness of the website. Researchers conducted an online survey in Korea, a country with high internet penetration and government website usage using stratified sampling to choose the participants keeping a balance in gender and age. Additionally, they measured three variables, digital literacy, perceived information overload, and the perceived usefulness of the websites to understand the effects of these variables on the usage of e-government websites and services. The findings suggested that the increase in information literacy and perceived usefulness can create a positive impact, while information overload creates a negative impact on trust by decreasing the usefulness of the websites. Even though the study utilized a large number of samples providing robust empirical evidence on the connection between trust and literacy, one drawback is that the study used self-administered measures that could introduce potential biases and failed to include the elderly population who face challenges with modern-day technologies and digital devices.

2.2.2 The Effects of Digital Inequality on e-Government Adoption

The topic of digital literacy also brings forth a significant issue like digital inequality which has a strong correlation with e-government usage. A study was conducted to investigate the determinants of e-service usage, highlighting the contribution of socioeconomic and digital divide and unequal access to e-government services in Uruguay [28]. The data for this study was derived from the World Internet Project + Uruguay 2013 survey focusing on 1047 internet users across the country from age 15 and above. The research model mainly examined various predictors like demography, socioeconomic status, digital divide variables, and ownership of electronic ways of payment. The findings show that the critical determinants for internet usage were education level, internet seniority, and the frequency of e-service usage where citizens with higher education levels tend to use more e-services. This phenomenon indicates the presence of socio-economic inequalities in e-government service usage.

Another study by the same author in 2018 examined how digital inequalities could affect the adoption of e-services across multiple stages of e-government development in Uruguay [37]. For this study, the researchers used a nationally representative sample of 1,626 internet users aged 18 or above, collected from the EUTIC 2016 survey conducted by the National Statistical Office and the National E-government agency of Uruguay. The researchers used three binary logistic regression models to examine the impact of three C2G (citizen-to-government) interactions, information searching, file downloading, and making online payments. The findings suggested that among all other predictors, digital skills emerged as the most stable predictor across all the C2G interaction tests as education played a more significant role in interactive stages. At the same time, income inequality was found to be a critical aspect in transactional stages. It also highlighted that older adults tend to engage in more C2G interactions than younger individuals and that the impact of the gender divide was only seen in the information-searching activities. Both studies were conducted in a similar pattern which included a large national representative sample creating a strong argument for these studies even though they are focused on one country.

2.2.3 Socio-Demographic Factors and Digital Divide

Another term that is associated with both digital literacy and digital inequality is called the ‘digital divide’. A study done by Bélanger, F., & Carter, L., investigated the effects of the digital divide on e-government service usage [9]. According to them, disparities in access and skills may affect the citizens’ ability to use e-services which could significantly hinder the potential benefits of government. The researchers surveyed a diverse group of citizens with different demography that differentiates users and non-users. They conducted two separate surveys on the Commonwealth of Virginia: the state’s income tax online payment service and the state’s Department of Motor Vehicle sites where users renewed their licenses, paid bills, etc. The findings indicate that income, education, and age are significant predictors of the

willingness to use e-services while factors like ethnicity and gender were uninfluential. The study also identified that the frequency of internet usage and experiences with online searching were critical predictors for e-government adoption, suggesting that people with higher digital skills tend to be more engaged with e-government websites and services. Though the study considered various demographic factors that allowed the results to provide a more in-depth understanding of the factors that influence the usage of e-governance, conducting the study in a limited region might not be able to represent a broader population's experience with these kinds of services. Similarly, another study was conducted to evaluate the impact of digital skills and the nature of interaction on citizens' choice of communication channels when engaging with e-government services [29]. The researchers conducted an online survey with 779 citizens from the Netherlands to test the hypothesis on the connection among digital skills, nature of interaction, and choice or usage of channels to engage with these e-services. The findings show that channel choice is significantly influenced by the nature of interactions like registration, consultation, etc. However, digital skills do not influence citizens' choice of channels, even though they create a positive influence and a sense of satisfaction among citizens using these services. The study involved a large sample size that strengthened their argument. However, self-reported measures that are only conducted in one country could limit the generalizability of the results to other countries with different digital divide contexts.

Furthermore, a different study examined the effects of the digital divide and the factors that influence the adoption of e-government services [15]. The study conducted a path analysis of publicly available data from a national random-sampled survey conducted by the Pew Internet and American Life Project in 2009, which had 1199 respondents and focused on the connections among factors like socio-demographic conditions, perceived usefulness, trust in government, and the intensity of the usage of the internet. The analysis revealed that socio-demographic conditions are strong predictors for e-service usage as younger individuals and those with higher socioeconomic status tend to use e-services more frequently. In addition, perceived usefulness influences actual usage, and trust in government, indirectly, affects the adoption of e-government through perceived usefulness. This study worked with a large sample which increased the comprehensiveness of the findings but at the same time, it couldn't give an in-depth insight into the situation and gave a more general overview of the findings which can be a drawback to this study.

A systematic review of e-government adoption was conducted in the context of developing nations to identify the major factors influencing the adoption of e-government services [61]. The study consists of an intensive literature review which included papers from reputed sources like IEEE and Scopus. The researchers identified 451 articles and recognized 41 studies directly addressing the factors of e-service adoption. The studies revealed that the factors influencing e-service uptake vary in the context of the countries and therefore couldn't be classified. In addition, the study revealed that trust was the most frequently studied factor, while some barriers like security, and awareness were given less importance. Eventually, the study stated the importance of understanding these factors for productive strategies to enhance e-government adoption in developing countries. Though it provided a comprehensive analysis, the secondary data dependency might be insufficient to capture the current

trends of the issues. In 2009 a study based on the context of Bangladesh revealed the factors critically influencing e-government adaptation in developing countries [10]. It conducted a combinational study of literature review and empirical survey to develop an e-government adoption model. A total of 800 respondents participated in the study expressing their perceptions and intention on e-government via the surveys. The researchers designed the model integrating constructs of the theories of TAM (Technology Acceptance Model), DOI (Diffusion of Innovation) and TCA (transitional Cost Analysis). They focused on factors like technological acceptance, user motivation, user perspective, ease of use, and security reliability to find out the key determinants. Among these security and reliability emerged as significant in the context of Bangladesh as the citizens feel concerned about privacy and have a lack of trust in digital transactions. This study gave a great analogy in the context of developing countries though the sample failed to capture the marginalized community as it felt biased towards the upper-middle class and middle class.

2.2.4 Challenges and Barriers to E-government Implementation

A comparative study by Weerakkody et al., was done to compare the challenges regarding e-government implementation between the UK and Sri Lanka where the researchers emphasized the unique obstacles faced by each country and revealed the key lessons for developing countries to enhance their e-governance service adoption [11]. The researchers introduced a case study approach where they conducted semi-structured interviews with the key stakeholders in both countries involved in various e-government initiatives, which allowed direct comparison with the experiences and challenges faced by the countries. From these interviews, the researchers found that political, financial, and technological constraints had a notable impact on e-government implementation in both countries, highlighting specific issues like language barriers, and limited ICT literacy which were more severe in Sri Lanka than in the UK. Finally, the researchers signified the need for ICT training to improve the uptake of e-government services. Though the study had a limited focus on user-specific challenges, it provided a high-quality comprehensive analysis showing the similarities and differences between e-government adoption challenges.

Three different studies were done in India to understand the barriers and drivers in the adoption of e-governance [39, 63, 35]. In 2017, research was done on the e-District system in Bihar, investigating the factors impacting e-government usage and validating a unified model of e-government adoption that will explain the behavioral intentions in using the systems [35]. They employed a survey-based approach with 1,000 respondents from four districts of Bihar, testing nine theoretical models of technology adoption and developing a unified model to evaluate the adoption of electronic governance. The results revealed that the unified model outperformed other models by showing a 77% variance in behavioral intention, emphasizing the role of social influence, attitude, and facilitating conditions. Furthermore, the research shows that performance expectancy, effort expectancy, and social influence greatly influenced attitude which affected behavioral intention and factors like anxiety created negative influence highlighting the emotional challenges to adopting e-government. The paper successfully showcased the psychological aspects influenc-

ing e-government adoption even though the study was focused on only one region of India.

A study conducted in 2017 explored the citizens' experiences of e-government services and their behavior and attitudes towards adopting such services [33]. The study employed semi-structured interviews with 31 participants from students to professionals with various levels of digital competence and prior experience with e-services. They analyzed the data following a thematic approach conducted via MAXQDA software to identify key themes in user experiences. They found that efficient timing and ease of use were the primary motivators, while poor website performance, unreliable internet connectivity, and outdated info were barriers to using e-services. Finally, the researchers highlighted the importance of transparency and corruption reduction to increase the adoption of e-government systems. Though the sample size was small, the study delivered an in-depth qualitative analysis, highlighting the behavioral aspects of users toward e-government adoption. Another study in 2018 explored the factors that enable citizens to take on e-government services in India [39]. The study employed a qualitative approach by conducting semi-structured interviews with 49 participants aged between 18 to 16. Among these 49 individuals, 36 had prior experience with e-government services. The findings revealed 23 different factors and decided upon 6 factors as novel factor-like attitudes to use, such as perceived value, assurance to use, service characteristics, external factors, and personality. The findings suggest that factors like awareness, perceived value, and ease of use could greatly influence the willingness of citizens to adopt e-government websites, while the common barriers were the security and reliability of the services. The paper provides a robust analogy in the context of India which can help to predict the barriers and drivers in the adoption of e-government in Southeast Asian countries. However, if the population of India and the sample size are compared the sample size is deemed small which may limit representation of the broader population and the impact of the findings.

A more recent study was conducted in 2020 which investigated the awareness and adoption levels of e-governance and identified the key drivers and barriers to the adoption of these services [63]. A primary survey was conducted in the four cities of India - Ahmedabad, Surat, Rajkot, and Vadodara and 450 respondents were finalized from each of these cities. To collect the data the researchers targeted four common user services such as property payment and professional taxes, requests for birth and death certificates, complaint registration, and shop licenses. The findings suggest that though a reasonable level of awareness is present on e-government services, the actual usage rate remains low as barriers like digital literacy and the mindset to prefer offline services over online services, are highly present among the citizens. Furthermore, variables like trust, perceived usefulness, civic mindset, preference, and ease of use influenced the adoption of e-services while socio-norm variables like education level, higher income level, tendency to have a civic mindset, and digital literacy influenced availing these services. Though the study was conducted only in India, it provided a highly comprehensive data analysis which strengthened the claims of this study. In addition to e-governance adoption, many factors influence the visitation of e-government websites. One such study was done in the USA where the researchers tried to identify the determinants of e-service

website visitation in the context of a digitally disadvantaged community [23]. The study surveyed a technologically disadvantaged community in William Penn Housing Development in Chester, Pennsylvania and a total of 37 residents participated in this study responding to the survey. The researchers looked at variables like years of internet experience, e-governance awareness, visitation, and perceived access barriers to assess the determinants of e-service website visitation. The findings from the survey analysis revealed that more than fifty percent of respondents were aware of or visited e-government websites, as awareness is deemed a critical determinant for future visitations. Furthermore, factors such as internet experience and perceived access barriers were not found to have any significant correlation with e-government website visitation and suggested that simply having internet access does not guarantee high e-government service visitation. This paper specifically focused on digitally disadvantaged communities in a first-world country like the United States, strengthening its findings even more. However, one particular aspect of this paper could be a drawback, which is the limited number of participants that took part in the study which was also mentioned by the researchers in the paper.

A study in China addresses the influence of e-government service quality and perceived value on the citizens' continuous use intention for these services [59]. Researchers collected data from 1650 citizens across five major cities, focusing on the perception of the quality of e-government services, and analyzed the relation between perceived value, service quality, and continuous-use intentions through Partial Least Square and Structured Equation Modeling. Moreover, they used the Service Quality Model to evaluate system quality, reliability, security, accessibility, information quality, service capability, interactivity, and responsiveness to understand the determinants that influence the usage of e-government services. The findings show that the quality of e-government services highly impacts the continuous use intention of the citizens, with efficiency, democracy, and inclusiveness being important factors as citizens tend to use services with higher service value, convenience, better information quality, and user interaction. The paper gives a very compact and in-depth insight into the factors that influence the e-governance systems in China, though there was a limited focus on government portals which may not cover all types of e-services.

2.2.5 Digital Inclusion and Solutions For Marginalized Communities

Previous studies highlighted that issues like the digital divide and inequalities exclude certain groups of people from the mainstream which ultimately brings digital inclusion into play. A recent study done by Chohan, S. R., & Hu, G., explored the effect of ICT training programs on the success of e-government services, providing digital inclusion to its citizens by improving their digital competence and skills [69]. The study is based on Pakistan, a country with low e-government adoption. The researchers did a quasi-experimental study with 438 trainees, to test the impact of a 7-module ICT training program on digital literacy and the usage of e-government. The results revealed that the training program significantly enhanced the participants' digital skills, reducing the digital divide which also made a positive impact on the usage of e-government websites. Though the study was based in a single country,

it was able to include participants from marginalized communities with poor digital skills and provided strong empirical evidence for their claim on the role of digital literacy training in enhancing engagement with e-governance. A different research conducted in Bangladesh, discussed the contribution of the National Information and Communication Technology Policy (NIP), to digital inclusion as part of the ‘Digital Bangladesh’ initiative [51]. The study took a qualitative approach called ‘goal-means tree analysis’ which analyses the connections among goals, objectives, and means in policy text. It did a qualitative analysis of the newest National ICT Policy (NIP) of Bangladesh with the previous version as additional consultation. The study suggests that this policy emphasizes more on infrastructural development to meet the international standards for ICT access, but fails to address the needs of the disadvantaged communities. Due to the inadequate initiatives to increase engagement and skill enhancement, the marginalized population is falling behind leading to a substantial digital divide. Finally, even though the study lacked empirical data, it was able to provide a strong insight into policies regarding the digital divide in the context of Bangladesh.

One such study by Taoufik et al., took the initiative to design an e-government portal that can be used and accessed by all citizens, including citizens with no literacy [6]. The study focused on the creation of user-friendly graphical interfaces that will allow all users regardless of their literacy level, to interact with the static content and avail online services. The researchers tried to make the design more inclusive and usable by incorporating various cultural and sociological considerations. The study was conducted in the city of Fez located in Morocco. For this study, the researchers conducted participatory design sessions with the citizens to gather insights and upgrade the GUI of the portal. The study involves prototype creation which was tested in real-world settings and was adjusted as per the users’ feedback. From this process, the study highlighted that illiterate people tend to depend on auditory instructions and the researchers incorporated this feature alongside the visual contents of the portal. At the end of the study, the researchers were able to get a satisfactory result with a significant amount of positive feedback from users expressing their willingness to use this in the future. With these findings, this paper successfully proved that building user-friendly designs is possible and user feedback is a huge factor while making these designs. There are some limitations to the study as well as the study had some potential bias as the initial testing was done in a more sophisticated area of Morocco which might not be able to represent the experiences of all the illiterate citizens of Morocco.

Another study was done focusing on the usage of the internet and e-government services among older adults who lived in the countryside of Brazil [75]. They surveyed over 143 participants ages ranging from 50 or above. The participants were deemed eligible only if they lived in the countryside or towns with no more than 400,000 residents and they selected these participants via snowball and purposive sampling. The results of this study revealed that a significant number of older adults in Brazil struggle to use e-government services due to having low computer literacy. Though the websites provided quality content, the older adults struggled to navigate the websites due to having complex interfaces and low digital literacy. The study also indicated that factors like education level, gender, and sociocultural backgrounds

also contributed to the digital divide affecting the ability to effectively use e-services of these older citizens of Brazil. Though the study is only in Brazil, it is evident that the study tried to understand the digital divide from the rural people’s perspective which can pave the way for other similar types of work in developing countries where the rural citizens are more in number than the urban citizens.

2.3 E-Government Usability Evaluation Frameworks

E-government initiatives in Bangladesh represent a critical aspect of the country’s broader push towards digitalization, aimed at improving governance, public service delivery, and socio-economic development. While the potential for e-government services is significant, their implementation has been fraught with challenges, ranging from infrastructural deficits to issues of digital inequality. A study explored a government website’s usability and design issues, focusing on how they affect user satisfaction, ease of access, and the intention to use. It aimed to identify specific usability problems and offer insights for improving the design of government websites overall [24]. The researchers conducted an online survey based on 16 usability dimensions following guidelines from usability.gov. The sample included 374 U.S. citizens, gathered six months after the website’s launch. The study used Partial Least Squares (PLS) modeling to approximate a structural equation model, evaluating the relationship between different accessibility features. Incomplete or time-constrained responses were excluded from the analysis to ensure data quality. The findings revealed that six out of the 16 usability issues were particularly critical. These included user experience, content organization, navigation, screen layout, and the use of graphs, and lists. A significant number of users reported difficulties navigating and finding essential information, with some missing important details due to an overflow of content. Notably, 62% of respondents expressed satisfaction with the website, while 18% were willing to use it again in the future. The study used a comprehensive usability framework, which can be applied to other e-government platforms. Additionally, the large sample size and use of video and screenshots in the survey helped improve response accuracy. However, the study had several limitations. It relied on self-reported data, which is susceptible to bias, and the sample was skewed toward younger users, limiting its generalizability to older or less digitally literate populations. The research was also conducted shortly after the website’s launch, which may not have captured long-term issues, and it did not cover mobile usability. Overall, this study has given valuable insights into citizen-centric design for e-government platforms and provided recommendations that could be useful for improving the usability of government websites, especially in developing countries like Bangladesh.

Another study evaluated the usability of local-level e-government websites in Taiwan, aiming to identify key usability issues and recommend improvements for more user-friendly digital services [54]. The researchers used Nielsen’s 10 usability heuristics as a framework for their heuristic evaluation and focused on elements like error prevention, flexibility, and consistency. To evaluate usability perceptions and identify significant differences, a quantitative survey was implemented to collect user

feedback. The data was subsequently analyzed using statistical techniques such as one-way ANOVA and one-sample T-tests. The findings identified numerous advantages, including the availability of assistance documentation and the visibility of the system. However, they also identified challenges such as the difficulty in identifying information and the confusion of link colors. Users emphasized the need for greater control and flexibility, along with better alignment with their expectations. The study's structured approach and use of usability heuristics provide valuable insights, but it does not address how limited digital literacy affects users' ability to navigate these websites or how demographic factors like age or education affect usability perceptions. Moreover, an existing research has evaluated the effectiveness of heuristic evaluation as a usability testing methodology for detecting defects in e-government websites, demonstrating how it can optimize these platforms for better user experiences [17]. The study used both traditional and modified heuristic evaluation methodologies, with expert evaluators independently examining websites to find usability issues. The testing was conducted in multiple iterative cycles, allowing evaluators to detect, resolve, and re-evaluate issues in each round. It was found that heuristic evaluation was a good way to find major usability problems. Traditional heuristics worked well for finding common problems, while changed heuristics helped find problems that were unique to the situation. The findings emphasize that combining both traditional and tailored heuristics is a comprehensive approach to identifying usability challenges. Additionally, the research was limited by its reliance on expert evaluations without incorporating real user feedback. Although expert assessments are valuable for detecting usability issues, user testing, especially with those with little digital proficiency, could provide more thorough insights into genuine user difficulties. However, the iterative approach used in the study did demonstrate improvements in usability with each cycle.

Next, there is research focused on evaluating the usability of e-government websites in Sub-Saharan Africa (SSA), assessing the region's e-government development and its correlation with website usability [40]. A sample of 279 websites from 31 countries was selected for evaluation, with sites available in either English or French. The usability assessment was conducted using a heuristic evaluation as the dominant method, supplemented by automated usability evaluations. Secondary data sources, such as the E-Government Development Index (EGDI) and E-Participation Index (EPI), were used to explore the relationship between usability and e-government development, particularly in terms of citizen engagement. The findings revealed low usability scores in key dimensions, including online services, user help and feedback, navigation, legitimacy, information architecture, and accessibility. The research identified a strong correlation between website usability and e-government development. This shows the importance of enhancing usability to boost citizen engagement. While the study's large sample size strengthens its conclusions, its limitations include the lack of user-based testing methods and language restrictions. Additionally, some websites were still being updated during the study, meaning their usability may have improved since. This study's focus on a developing region like SSA can be insightful for other developing nations, such as Bangladesh, where similar infrastructural and literacy challenges impact e-government services.

As a further exploration of this topic, a study systematically reviewed the usability

challenges of e-government websites, aiming to help government developers choose effective methods for improving user satisfaction with limited resources [43]. The research followed a systematic literature review, collecting data from databases such as ACM and IEEE, covering literature from 2014 to 2018. Initially, 519 articles were identified, but after applying inclusion and exclusion criteria, 22 articles were selected for further analysis. The selected studies were analyzed using NVivo software for content analysis, employing both inductive and deductive coding approaches. The study compared usability evaluation methods from various countries, revealing that usability testing, inspection, and inquiry are the most common methods used, to assess e-government platforms. Real-time feedback and automated usability testing were prevalent in usability testing, while heuristic evaluation was frequently used in the early stages of development. Surveys, interviews, and focus groups provided valuable user perspectives. The findings highlighted significant usability issues in countries like Bangladesh, Brazil, and Uganda, largely due to low digital literacy. One strength of the research is its comprehensive approach, covering multiple countries and contexts, and offering actionable guidance to improve e-government usability. However, a key limitation is the exclusive reliance on secondary data, which may not fully capture the unique challenges faced by developing countries. Additionally, the study did not address the growing use of mobile devices in accessing e-government services.

Furthermore, another study evaluated the usability of web-based e-government services from the perspective of users, aiming to identify how usability issues affect user satisfaction and task performance [14]. The research employed a heuristic evaluation based on Nielsen's usability principles to assess various e-government websites. Participants were engaged in performing specific tasks on selected websites, and their performance was measured using a usability questionnaire that gathered their perceptions on different usability aspects. The findings highlighted significant usability problems, including confusing navigation links, inconsistent page layouts, and unclear labeling, which adversely impacted user satisfaction and efficiency. Users encountered challenges related to system feedback and control, particularly concerning navigation and error recovery. The results indicated a strong correlation between perceived usability and user performance, suggesting that improved usability could lead to increased user engagement and satisfaction. One notable thing about the study is its comprehensive evaluation, which offers concrete recommendations for enhancing e-government websites based on usability metrics. However, a limitation is its lack of focus on specific user groups, such as those with limited digital literacy, which restricts the applicability of its findings to a broader range of users. Overall, the study emphasizes the importance of addressing usability issues to improve user interaction with e-government services, thereby promoting their more frequent usage.

In continuation of this analysis, a research investigated the relationship between e-government performance and citizen satisfaction, focusing on how e-government rankings relate to user perceptions across various European countries [44]. The study used multilevel modelling to analyse data from more than 28,000 respondents across 32 European countries. And facilitated an investigation of both country-level and individual-level determinants of e-government satisfaction. The researchers

evaluated e-government performance based on established benchmarks, such as the United Nations e-Government Survey, and compared these objective performance indicators with subjective user satisfaction data. The findings revealed a positive correlation between e-government performance and citizen satisfaction, with the strongest relationships observed in e-services and e-participation. Citizens reported higher satisfaction and perceived benefits when these services were well-developed and accessible. Although e-government rankings were found to be partially predictive of citizen satisfaction, the study highlights that these metrics do not fully encompass the citizen experience. A key strength of the study is its comprehensive analysis across multiple countries, offering insights into how objective performance correlates with user satisfaction. However, a notable limitation is the lack of attention to the specific challenges faced by users with limited digital literacy, as well as a failure to explore usability and accessibility issues for populations with lower ICT skills. In short, this paper provides valuable context regarding the interplay between e-government performance and citizen satisfaction, which can inform future research and structural improvements in e-government services.

Further developing these themes, an existing systematic literature review examined various usability evaluation methods for e-government services, aiming to provide insights into their effectiveness and application contexts [43]. The researchers analyzed papers from 28 countries, focusing on different e-government contexts. The evaluation was conducted in several phases, beginning with a high-level analysis of relevant literature, followed by iterative processes to refine the findings using specialized software. The study categorized usability evaluation methods into three classes. The first class, Usability Testing, includes techniques such as automated testing, which, while popular, is limited in providing user-based insights. In contrast, the System Usability Scale offers a simpler approach to capturing user perspectives, and performance measurement focuses on observing user behavior. The second class, Usability Inspection, involves expert evaluations using established criteria, with heuristic evaluation being the most common, though it is not user-based. The final class, Usability Inquiry, collects user perspectives through focus groups, interviews, and questionnaires. The findings highlighted the strengths and weaknesses of each method, guiding when and how to apply them effectively in different contexts. A notable strength of the study is its comprehensive overview of usability evaluation methods, making it a valuable resource for researchers and practitioners. However, a limitation is that it does not explore in-depth case studies or real-world applications of these methods, which could provide further insights into their practical implications. Overall, this review offers essential knowledge for improving e-government usability evaluation processes, and it will be particularly useful as a foundation for developing the methodology for our research.

As an extension of the work mentioned above, another study investigated the influence of government capacity and e-government performance on the adoption of e-government services, integrating these factors into the Technology Acceptance Model (TAM) [60]. The research emphasized the significance of perceived usefulness in encouraging the adoption and recommendation of e-government services that ultimately enhance public service delivery. For the research, a questionnaire was distributed to 500 Chinese students, resulting in 256 usable responses for analysis. The

study adopted constructs from prior research, measuring variables such as perceived usefulness and government capacity using a five-point Likert scale. Data analysis was conducted using SPSS, which included validity and reliability tests, correlation analysis, and hypothesis testing. The findings revealed that both government capacity and e-government performance significantly impacted perceived usefulness, with perceived usefulness strongly predicting the intention to recommend e-government services. The study highlighted the essential role of government in successfully implementing e-government initiatives through effective policy and infrastructure. This research was in its robust theoretical foundation in TAM, which provides valuable insights into the factors driving the adoption of e-government services. However, a limitation is its focus on government capacity while neglecting usability issues that affect users with limited digital literacy, a crucial aspect in developing countries. Furthermore, the sample drawn from Chinese students may not reflect the broader population, particularly in contexts like Bangladesh. This paper's insights on the relationship between government capacity and e-government adoption can strengthen our research, allowing us to explore how improved design and educational interventions can better support users with varying levels of digital literacy in our country.

Moreover, another research assessed the concept of e-government by proposing a comprehensive framework that examines various essential factors, including citizen orientation, channel orientation, and technology orientation [68]. It focused on how these factors contribute to the effective implementation of e-government, especially in developing countries. The study utilized qualitative research methods, gathering data from 168 interviews conducted with various stakeholders, such as government officials, intermediaries, and citizens. The researchers employed grounded theory methodology to analyze the data, supported by thematic content analysis using the Gioia method. Findings indicated that citizen orientation is the most critical factor in the success of e-government initiatives which highlights the importance of user readiness and socio-cultural contexts. Additionally, while channel orientation is vital for ensuring effective service delivery, particularly through intermediaries, technological and managerial capabilities are crucial for developing adaptive e-government systems. The study was conducted in its interdisciplinary framework, which integrated multiple stakeholder perspectives. However, a notable limitation is the limited attention given to usability challenges faced by individuals with low digital literacy, which is essential in the context of developing regions. Altogether, this research provided valuable insights that can guide the design and implementation of more user-centered e-government platforms.

An existing paper explored the impact of digital skills on e-government channel choices and user satisfaction, focusing on the context of developing countries [38]. The research primarily explored how the digital divide influences citizens' interaction with online government services. A survey was conducted with 245 participants in The Hague to analyze their preferences for accessing government services through various channels, such as websites, phones, and front desks. The researchers utilized multiple regression analysis to assess the influence of agile accessibility, trust, and awareness on the intention to adopt e-government services, achieving a significantly adjusted R-squared value of 95.8%. Findings revealed that while digital skills did not predict channel choice, they significantly affected user satisfaction and users with

higher digital skills reported greater satisfaction with online services. Moreover, the nature of the interaction such as registration or consultation was shown to impact channel preferences. The study provided a detailed analysis of how government task types influence channel choice, contributing valuable insights into user interactions with e-government. However, a limitation is its focus on a developed country, which may not apply to developing regions like Bangladesh where access and digital literacy barriers are more pronounced.

2.4 Case Studies on The E-Government Implementation in Bangladesh

The development of e-government applications in Bangladesh has made notable progress over the years, but the journey has been filled with challenges. E-government initiatives are integral to the country's vision for improved public service delivery, enabling more efficient interaction between government and citizens. Studies examining the development of e-government initiatives in Bangladesh from a supply-side perspective. For instance, a study evaluated how public sector efforts have been structured to deliver online services, particularly focusing on the early stages of e-government in the country [13]. It was a literature review-based work of national and international reports, focusing on public websites and the Digital Innovation Fair 2010. The study found that many public websites suffer inconsistent updates and lack fully developed e-services. In the results, the paper noted that despite efforts, Bangladesh remained in the early stages of e-government, ranking 134th in the E-Government Development Index 2010 and 60th in the Online Service Index. Public websites, while growing in number (316 by 2010), still showed inconsistencies in updates and accessibility. The paper pointed out that although 91% of public offices in Dhaka have websites, they are mostly informational and do not support advanced interactions or transactions, which limits their utility. On the other hand, major challenges include the digital divide, frequent power outages, limited technological expertise, and inadequate infrastructure for online transactions. District-level cities are especially affected by these issues, creating a gap between urban and rural areas. The study showed an early assessment of Bangladesh's e-governance efforts. However, the lack of a user-based study limits insights into public usability.

A key concern in the deployment of e-government services is the digital divide, which affects a large portion of the population in Bangladesh. The digital divide, defined as the gap between individuals who have access to information and communication technologies (ICTs) and those who do not, is particularly pronounced in rural areas and among lower socio-economic groups. Despite the growing availability of ICT infrastructure, disparities in access persist, leaving many citizens, especially in remote areas, needing more resources to benefit from e-government services. Prior studies indicated that inadequate legal frameworks and policy support have further worsened this divide [30]. The study was conducted through a literature review and a questionnaire-based survey of 50 ICT entrepreneurs from Dhaka, analyzing ICT infrastructure, policies, and the relationship between ICT development and socio-economic outcomes using statistical methods like chi-square and bivariate correlation analysis. The study's findings indicated a significant digital divide between

rural and urban areas due to inadequate infrastructure and limited access to affordable ICT services in rural regions. Government policies have been progressive but need to meet the national targets for ICT deployment, particularly in disadvantaged areas. The paper showed a comprehensive overview of the ICT landscape in Bangladesh, combining both qualitative and quantitative analysis. However, its focus on infrastructure and policy leaves gaps in addressing user experience and usability challenges, especially for users with limited digital literacy.

Digital inequality remains a pressing issue in Bangladesh, with multiple factors contributing to the divide between different regions and social groups. Previous research has identified the factors that contribute to digital inequality in Bangladesh, particularly in rural and underdeveloped areas, using a mixed-methods approach [66]. The study combined qualitative data from focus group discussions (FGDs) and semi-structured interviews with 30 participants, along with quantitative data from a survey of 326 respondents. It identified 23 factors grouped into educational, infrastructural, social, and economic categories, with key findings highlighting that low levels of general and digital education, inadequate ICT infrastructure, and high internet costs limit digital access in rural areas. Similarly, another study focused on digital literacy among rural households in Bangladesh, using stratified sampling of 20 rural households and mini-focus group discussions to gather additional insights [64]. This study showed that while mobile phone usage is widespread, internet access and computer use are minimal, and digital literacy rates remain low, particularly among older adults and those with limited formal education. Both papers emphasized the importance of improving ICT infrastructure, digital education, and user-friendly design to enhance access and usability.

In the development of e-government services in rural Bangladesh, the role of Union Information and Service Centers (UISCs) has been particularly significant in bridging the digital divide and promoting socio-economic progress. The study showed the role of Union Information and Service Centers (UISCs) in advancing e-government services for rural development in Bangladesh, focusing on their impact on socio-economic progress in underserved communities [25]. Using a qualitative research approach, the study applied a case study method across three Union Parishads, utilizing on-site observations, semi-structured interviews, and group discussions with 50 participants, including farmers, students, and small business owners. The data analysis involved content analysis and the Most Significant Change (MSC) technique, which captured behavioral and socio-economic changes resulting from UISC services. Key findings showed that UISCs have significantly improved access to information in agriculture, education, healthcare, and law, resulting in enhanced skills, higher productivity, and increased incomes among rural users. However, challenges such as the digital gender divide and inconsistent internet access were noted. When the study used real-life stories to highlight the personal and community-level impacts of ICT interventions, the small sample size and cross-sectional nature limit the generalizability of its findings across broader rural populations.

Research into the usability and accessibility of government websites in Bangladesh has revealed significant barriers that disrupt their efficiency. One comprehensive research study looked at the usability and accessibility of government websites in

Bangladesh, identifying critical barriers that hinder their effectiveness in providing digital services [57]. The study evaluated 140 government websites using the Website Optimization Tool, IDI Web Accessibility Checker, and 2bone Link Checker to assess HTML, CSS, scripting errors, and broken links. Findings revealed a concerning 37% usability error rate due to coding issues, leading to poor user engagement and functionality. Moreover, accessibility barriers were prominent, with a staggering 92% of websites failing to meet necessary standards, making navigation difficult for users with disabilities, including those using assistive technologies. Additionally, around 5% of the websites had broken links which complicate user navigation and reduce the reliability of government services. The study emphasized an urgent need for improved technical specifications and user-centered design to enhance access to essential government services. While the paper provided valuable insights into technical shortcomings, it did not address the challenges faced by users with limited digital literacy. Overall, this study underscored the critical need for reforms in the usability and accessibility of Bangladeshi government websites to better serve all citizens.

The accessibility challenges are further increased by the fact that many web developers in Bangladesh are not fully aware of international accessibility standards, such as the Web Content Accessibility Guidelines (WCAG). A study focused on the accessibility of government websites using both automated and manual evaluation methods [18]. This research assessed 10 government websites of Bangladesh against WCAG criteria and included feedback from visually impaired users to gain deeper insights into the practical challenges faced by people with disabilities. The study used a variety of evaluation tools, such as automated services like AChecker and NVDA to simulate user interactions, as well as tools like the WAVE Toolbar for human evaluations. The results were concerning. Because none of the tested websites met the basic WCAG conformance level ‘A,’ which represents the minimum level of accessibility. Common issues included missing alternative text for images, which makes it difficult for screen readers to interpret the content, and non-navigable menus that prevent users from effectively moving through the website. Also, 10 participants, mostly with visual disabilities, were invited to provide feedback on the websites. They used NVDA to browse the sites, and their experiences were collected through questionnaires and interviews. Participant feedback revealed that many websites were not user-friendly for individuals with disabilities due to frequent errors, such as the absence of alt attributes. Furthermore, a survey of web designers indicated a profound lack of awareness about web accessibility, compounded by the absence of government policies mandating such practices. These results showed that there is a significant gap in how people understand and use accessibility features. It seems that website authors either don’t know about these needs or don’t put them first when they make government websites.

Moreover, the limited public awareness about the availability and functionality of e-government services also plays a role in the under-utilization of these digital platforms. A separate study investigating the usability of e-governance services through a survey of 600 participants revealed that only a few of the services provided by the government were widely recognized or used by the public [20]. Even though the government is still trying to get people to use these services, the fact that most

people don't know about them or know how to use them effectively is still a big problem. The study claimed that even though improvements in technology, like the growth of 3G networks, could make access to e-government services much better, these efforts won't work as well if people aren't properly educated and able to use digital platforms. This gap in public awareness, along with the technical issues related to usability and accessibility, restricts the success of e-governance initiatives in the country. User acceptance of Open Government Data (OGD) is essential for the success of digital governance initiatives, particularly in developing countries like Bangladesh. According to a study, important things that affect people's decision to use and accept OGD include their expectations of performance and effort, their social influence, and the quality of both the system and the information it provides. [49]. Using a quantitative, cross-sectional survey method, the researchers got information from 385 valid responses from OGD users in Dhaka, such as professionals and app developers. The Information Systems Success Model and the Unified Theory of Acceptance and Use of Technology (UTAUT) were used together in the study to look at how these two theories affect the acceptance of OGD. The results showed that people are more likely to use OGD if they think it is useful and easy to use. High-quality tools and correct data also make people happier with OGD. A key strength of this research is its comprehensive model that combines UTAUT and the IS Success Model, providing valuable insights for improving OGD systems. However, the reliance on cross-sectional data limits the ability to capture long-term trends and variations across different regions. Overall, enhancing digital inclusion and maintaining user engagement with OGD is crucial for the success of digital governance initiatives in Bangladesh.

2.5 Research Gap

We encountered several papers that worked with digital literacy, usability, and the digital divide while doing the literature review. Most studies on usability evaluation discuss the general usability problems in the systems tested via automated tools [42, 31, 62, 71, 32]. Some studies tried to connect usability issues and users' needs with user-centered data, but they primarily focused on finding the general problems [36, 41, 65, 4]. This approach only revealed broad usability concerns and failed to address more intricate issues that arise during product use and their connection with digital literacy. Our research aims to bridge this gap by incorporating a user-based perspective.

Additionally, if we look at the work done on literacy and e-government adoption challenges, we can see that, though most studies have large sample sizes, they did not discuss how usability can impact users with different digital literacy levels [37, 29, 15, 29, 59]. In Bangladesh, intermediaries form a significant portion of the regular e-service users and they often act as intermediaries to help citizens access the services. Even though these intermediaries have limited digital literacy levels themselves, a huge number of general people in the country tend to rely on them because of their regular website navigation-related struggles [52]. To our knowledge, no prior research has examined this mediator community in Bangladesh, presenting us an opportunity to explore the usability factors from their perspectives which could give us new insights. We also want to explore why citizens prefer using medi-

ators rather than completing the tasks independently at home. This study aims to fill up these gaps by providing design recommendations that will work for all users regardless of their digital literacy levels. As existing literature does not cover all these aspects comprehensively, and given the lack of recent research on this topic in the Bangladeshi context, our study is uniquely positioned to offer valuable contributions.

Chapter 3

Methodology

This study employed a mixed-methods approach integrating surveys, interviews, and heuristic evaluation to comprehensively explore and analyze users' experiences with limited digital literacy on four selected e-service websites in Bangladesh. Combining qualitative and quantitative research methods allowed us to gather detailed analysis and validate our findings across multiple data points. The methodology was carefully designed to ensure representativeness, ethical compliance, and relevance to the context of e-government platforms in Bangladesh.

3.1 Data Collection

We conducted an intensive seven-month-long study in Dhaka, Bangladesh, from November 2024 to May 2025. This research mainly focused on four e-government platforms: E-Passport, Bangladesh Road Transport Authority (BRTA), Railway e-ticketing, and National Identity (NID). To capture a diverse range of perspectives, the data collection process incorporated snowball sampling [34] that was primarily for administrators, a combination of convenience [70] and random sampling [72] for mediators and users. These methods were selected to ensure a rich and diverse dataset while maintaining practicality and inclusivity in participant selection.

To ensure comprehensive representation across all demographic groups, particularly elderly users and individuals with limited digital literacy who might face barriers in completing online surveys independently, our research team adopted a mixed approach for data collection. We conducted both online survey distribution and in-person assisted data collection sessions. For participants who required support, researchers assisted in filling out survey forms, ensuring that users with varying levels of digital comfort could participate fully in the study. This approach was essential for capturing authentic experiences from users who are often underrepresented in digital research due to accessibility barriers. The overall research workflow is summarized in Figure 3.1.

3.2 Field Observations

The observational component of the research involved immersive field observations to understand how users and mediators interacted with the selected platforms. Two researchers, native to Bangladesh and fluent in Bangla, were responsible for con-

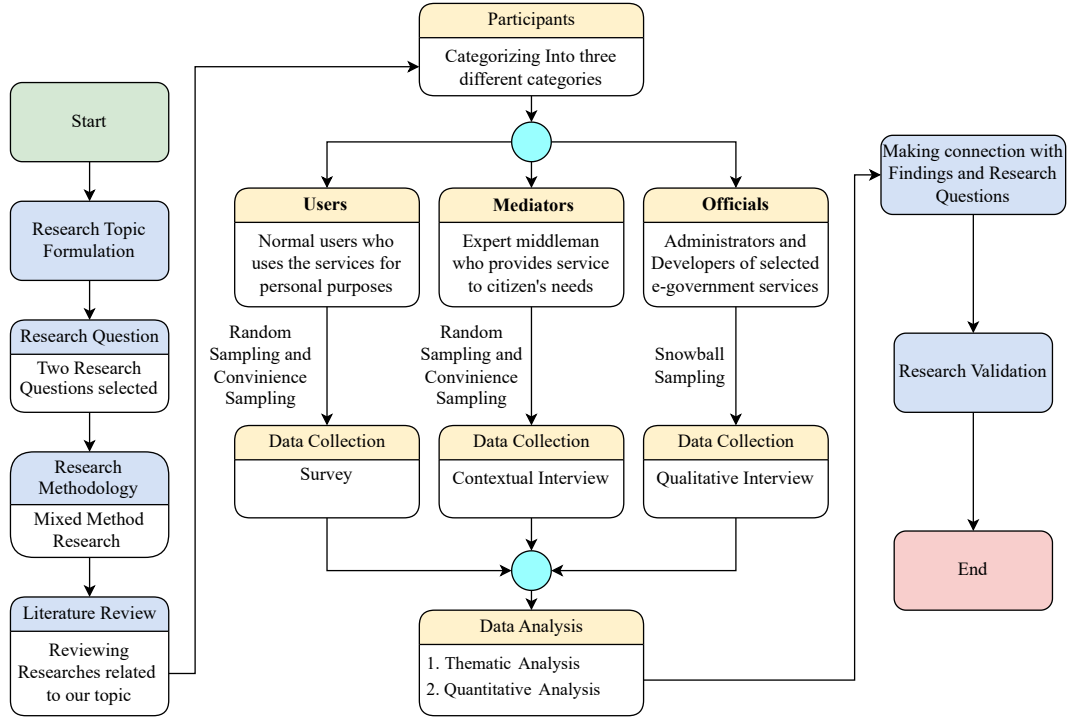


Figure 3.1: Workflow

ducting the fieldwork. Their familiarity with the region’s cultural, social, and technological landscape enabled them to navigate the research environment effectively and build connections with participants. These observations helped contextualize the findings and identify the systemic challenges faced by users with limited digital literacy.

3.3 Interviews

The study’s qualitative component heavily relied on interviews with two key participant groups: mediators and administrative officials. Additionally, these interviews were designed to provide an in-depth understanding of the usability, accessibility, and practical challenges associated with the platforms.

3.3.1 Mediators

In Bangladesh, mediators, commonly known as ‘Computer service shops’ workers, play a pivotal role in assisting citizens with various e-governance services. These individuals help users navigate e-service platforms in exchange for monetary compensation [56]. Their proximity to passport and visa offices, BRTA headquarters, and NID centers makes them an integral part of the e-government ecosystem.

Our demographers decided to conduct contextual inquiries [3] with mediators as show in Figure 3.2, offering services for BRTA, NID, and Passport websites due to the nature of their work. Mediators working with BRTA, NID, and Passport websites were targeted for these inquiries. A total of 14 BRTA mediators, 1 NID

mediator, and 4 Passport mediators (Table 3.1) were engaged across key locations, including Mirpur BRTA, computer service shops near Agargaon Passport Offices, and Banani Super Market. Rail Sheba does not involve mediators. Therefore, no mediator-related data is available for this platform.



Figure 3.2: The top two pictures are of tech support centers beside BRTA in Mirpur-13 while providing service to the users. The bottom two pictures feature computer service shops in Agargaon, outside Passport Office.

The mediators, predominantly male and aged between 35 and 40, had an average of 5 to 7 years of experience in their respective roles. They assisted clients from diverse demographic backgrounds, with BRTA mediators handling the highest number of users. Our ethnographers conducted interviews in Bangla, with discussions ranging from 20 to 50 minutes based on the participants' availability and engagement levels. The mediators were asked about their demographic information, educational backgrounds, and their perceptions of the usability of the platforms for users with low digital literacy. Detailed notes were taken during the interviews, and audio and video recordings were made with the participants' consent for further analysis.

3.3.2 Administrative Officials

Administrative officials, as key stakeholders in the operation and maintenance of the e-service platforms, provided valuable insights into the design, usability, and challenges of these systems. To ensure comprehensive coverage, the research team

Table 3.1: Sample size overview

Category	BRTA	Passport	NID	Railway
Admin	5	3	1	0
Mediator	14	4	1	0
User [*]	64	138	168	140
Total	77	135	163	130

^{*} The total number of users across all four platforms exceeds 293 because many respondents used multiple platforms.

conducted both individual interviews and focus group discussions [21] with officials associated with BRTA, Passport, and NID services. We were unable to reach any administrators from Rail Sheba. However, we have scheduled future appointments and will incorporate additional data into the research as it becomes available.

Appointments were scheduled with officials based on their convenience, and interviews were conducted upon obtaining their consent. A focus group discussion with five BRTA officials was held at the BRTA headquarters in Chairmanbari, Banani. Individual interviews were conducted with three Passport officials at the Agargaon Passport Office, and an online interview was arranged with one NID official. The choice of interview medium—in-person or online—was determined by the participants’ preferences and schedules.

To maintain confidentiality, particularly with government officials who preferred not to be recorded, documentation methods were adapted accordingly. Ethical guidelines were strictly followed, and participant anonymity was prioritized. In total, 28 interviews (Table 3.1) were conducted with mediators and administrative officials, providing a robust dataset for qualitative analysis.

3.4 Surveys

To gain comprehensive insights from the user perspective, we implemented a detailed quantitative research approach through an extensive survey methodology. This methodological choice was driven by the need to understand how users interact with and experience various e-government websites in Bangladesh, particularly focusing on their usability challenges and accessibility concerns. The survey was designed to capture both broad patterns in user behavior and specific challenges faced by different demographic groups.

Our survey was carefully designed using Google Forms, incorporating a sophisticated structure that allowed for both breadth and depth in data collection. The questionnaire began with essential demographic inquiries, gathering information about participants’ age, gender, and educational background. This demographic section was particularly crucial as it helped establish the context for understanding how different population segments interact with e-government services. Beyond basic demographics, we included questions to assess participants’ digital literacy through

self-evaluation and their comfort levels with digital tasks, digital devices, and internet usage patterns. This provides valuable context for interpreting their experiences with e-government platforms.

The core of our survey focused on four major e-government websites: the Bangladesh Road Transport Authority (BRTA), E-Passport services, National ID (NID) services, and the Railway E-ticketing platform. We implemented an intelligent skip-logic system in the questionnaire design, ensuring that participants only responded to sections relevant to their experience. This approach not only improved the quality of responses but also respected participants' time and reduced survey fatigue.

For each website, we included a comprehensive set of questions using various response formats, including five-point Likert scales [26] to measure satisfaction and agreement levels, multiple-choice questions for categorical responses, and extensive open-ended questions to capture detailed feedback and suggestions for improvement. The open-ended questions were strategically designed to function similarly to mini-interviews, encouraging participants to provide in-depth narratives about their experiences, challenges, and suggestions. This approach was particularly valuable as we recognized that while we had conducted detailed interviews with administrators and mediators, obtaining comprehensive qualitative insights directly from end users would be essential for understanding the complete user experience landscape.

The inclusion of these interview-style open-ended questions proved to be exceptionally beneficial for our research. Users provided thoughtful and detailed responses about specific usage issues they encountered, sharing personal anecdotes about their struggles with navigation, form completion, and system understanding. These responses yielded rich qualitative data that complemented our quantitative metrics, revealing nuanced insights about user frustrations, workarounds they developed, and specific features that either facilitated or hindered their task completion. The depth of feedback we received through these questions provided us with actionable insights that would have been difficult to capture through structured questions alone.

The survey distribution strategy was carefully planned to ensure broad representation across different demographic groups. We utilized multiple distribution channels, including social media platforms, professional networks, academic institutions, and local community centers. Recognizing that certain demographic groups, particularly elderly users and individuals with limited digital literacy, might face challenges in accessing or completing online surveys independently, our research team adopted a hybrid approach that included both digital distribution and in-person assistance.

For participants who required support, research team members visited community centers, government service locations, and other public spaces where potential participants naturally congregated. During these in-person sessions, researchers provided assistance to elderly participants and others who needed support in understanding questions or navigating the digital form. This approach ensured that we captured perspectives from users who might otherwise be excluded from purely digital data collection methods, thereby enhancing the representativeness and inclusivity of our findings.

Our enhanced data collection efforts delivered responses from 301 participants (Table 3.1), with 293 providing valid consent and complete responses that were included in the final analysis. The survey remained active for 7 months, allowing adequate time

for responses to accumulate across different demographic segments. The response pattern revealed a rich demographic diversity, with participants spanning various age groups, education levels, and digital literacy backgrounds.

This comprehensive survey approach provided us with rich, multi-layered data about how users interact with e-government websites in Bangladesh. The combination of structured responses and extensive open-ended feedback gave us both broad patterns of user behavior and specific insights into the challenges faced by users with varying levels of digital literacy. The interview-style open-ended questions were particularly valuable in uncovering detailed user perspectives that might not emerge through traditional survey methods. This information proved invaluable for understanding the current state of e-government website usability and identifying specific areas where improvements could enhance the user experience for all citizens, regardless of their technical proficiency.

3.5 Interface Development and Expert Validation

To address the usability issues identified in our research, we developed a unified interface design guideline aimed at improving accessibility and user experience across e-government platforms in Bangladesh. This intervention was conceived as a system-level alternative to building multiple separate prototypes for individual platforms, allowing us to create a scalable framework that could be applied across different services such as BRTA, e-Passport, NID, and the Railway e-ticketing platform.

The design system was developed through a user-centered process informed by WCAG (Web Content Accessibility Guidelines) 2, survey data, heuristic evaluations, and interview findings. Our team held a series of internal collaborative design workshops to identify recurring usability barriers experienced by users with limited digital literacy. From these sessions, we abstracted common interface pain points and mapped them to design principles for components such as form inputs, validation flows, error messaging, authentication steps, and multilingual toggling.

The outcome was a structured design system that includes component guidelines, interaction patterns, and an implementation checklist. This checklist is segmented into six core domains: Security & Privacy, Accessibility, Localization, Performance, User Experience, and Content & Support. Each item within these domains was assigned a priority level and accompanied by implementation instructions, allowing developers to track progress and assess readiness for deployment. The checklist system also includes real-time scoring and report export features to support iterative development.

To assess the feasibility and applicability of the proposed interface design system, an expert validation procedure was conducted involving two professionals with extensive experience in software development and user interface design. The participants included one Senior UI/UX Designer with prior involvement in a government web-based health portal and one Senior Software Engineer with experience delivering component-based front-end systems.

The experts were presented with the design framework consisting of modular interface components, design tokens, and a structured usability checklist. A semi-structured interview protocol was used to guide the evaluation, focusing on four primary dimensions: (1) consistency of visual and interaction patterns, (2) development scalability and implementation effort, (3) alignment with current practices in

government digital services, and (4) support for accessibility and inclusion. Each participant independently reviewed the framework materials and provided qualitative feedback through structured interviews. Data collection emphasized identifying perceived strengths, potential implementation barriers, and opportunities for refinement. Interviews were conducted using guided prompts related to component clarity, accessibility compliance, token usage, and the checklist’s applicability in agile development environments.

This validation procedure allowed triangulation of the proposed design with professional development standards. It ensured that the system was not only theoretically grounded but also implementable within real-world government service delivery environments. Feedback from the experts was used to iteratively refine the system’s documentation and prioritization schema, enhancing its utility for future institutional adoption.

3.6 Heuristic Evaluation

To further validate the findings from the interviews and surveys, a heuristic evaluation was conducted to assess the usability of the four e-service platforms. This evaluation was based on Nielsen’s 10 heuristic principles [2], which focus on key aspects such as visibility, user control, error prevention, consistency, and system efficiency.

Three independent researchers reviewed the platforms, commenting on every issue related to any usability problem. Individual evaluations were followed by a group discussion to identify repeating patterns and consolidate findings. Recommendations for actionable improvements for the platforms were synthesized and correlated with qualitative and quantitative findings from interviews and surveys in the heuristic evaluation.

3.7 Data Analysis

The data collected through interviews, surveys, heuristic evaluations, and expert consultations underwent rigorous analysis to ensure reliability and validity.

3.7.1 Qualitative Analysis

The researchers transcribed and translated all the interviews into English. Three researchers conducted a thematic analysis [67] to identify recurring themes and patterns in the qualitative data. Each researcher independently generated thematic codes and grouped them under broader themes. These initial codes were compared, and discrepancies were resolved through discussion and consensus. The final set of themes was then used to structure the findings and draw conclusions.

3.7.2 Quantitative Analysis

To understand the underlying patterns and relationships in user experience across e-government platforms, we undertook a detailed quantitative analysis based on survey responses from 293 participants who met our inclusion criteria. The analysis began

with a careful data preparation process. Of the 301 responses initially collected, we excluded entries that lacked valid consent. The retained data were then cleaned and standardized, which included harmonizing text entries, removing Bengali characters or translating into English where appropriate, and ensuring internal consistency across variables.

Digital Literacy Score Calculation

A critical component of our quantitative analysis involved converting qualitative digital skill assessments into reliable numerical values. Rather than relying solely on participants' self-assessed digital literacy levels, which can be subject to subjective bias and overconfidence effects, we implemented a task-based competency scoring system. This approach aligns with established measurement principles in digital literacy research, where performance-based assessments provide more accurate skill evaluations than self-reported measures.

Our scoring methodology was grounded in validated academic frameworks, particularly the European Digital Competence Framework (DigComp 2.2) and OECD's Programme for International Assessment of Adult Competencies (PIAAC), which provide hierarchical skill classifications based on cognitive complexity and task demands [73] [46].

Table 3.2 presents the detailed conversion methodology used to transform survey responses into quantitative digital literacy scores.

Table 3.2: Digital literacy score conversion methodology

Digital Competency	Assigned Weight	Academic Framework Justification	Cognitive Complexity Rationale
Browsing websites and searching for information online	1 point	DigComp Level 1-2 (Foundation) PIAAC Level 1 (241-290 points)	Basic navigation requiring minimal cognitive load and simple recognition tasks
Sending and reading emails	2 points	DigComp Level 2-3 (Foundation/Intermediate) PIAAC Level 1-2 (241-340 points)	Communication competency requires interface understanding and message composition
Filling out online forms	3 points	DigComp Level 3-4 (Intermediate) PIAAC Level 2 (291-340 points)	Multi-step processes requiring data validation and form logic comprehension
Downloading files from the internet	4 points	DigComp Level 3-4 (Intermediate+) PIAAC Level 2-3 (291-400 points)	Technical operations requiring file system knowledge and security awareness
Installing and using mobile or computer applications	4 points	DigComp Level 4-5 (Advanced Intermediate) PIAAC Level 3 (341-500 points)	Advanced technical knowledge requiring system understanding and troubleshooting
Using online payment systems	5 points	DigComp Level 5-6 (Advanced) PIAAC Level 3+ (341-500+ points)	Complex integration requiring security literacy, financial understanding, and multi-platform coordination

This weighting system is consistent with cognitive load theory applications in digital literacy assessment, where task complexity correlates with the number of cognitive elements users must process simultaneously [48].

Statistical Analysis Framework

Before conducting any statistical analysis, we performed normality testing using the Shapiro-Wilk test on all continuous variables to determine the appropriate analytical approach. Given the expected non-normal distribution of user experience data in digital government services, this step was crucial for selecting valid statistical methods.

Descriptive statistics were first calculated to summarize user demographics, platform usage rates, and satisfaction levels. These figures provided an initial view into how different groups interact with services such as BRTA, NID, E-Passport, and Railway Sheba. To explore the relationships between digital literacy and platform-specific experiences, we conducted a series of cross-tabulations, with a particular focus on assistance needs, task completion success, and mediator reliance. These were visualized through heatmaps and comparative bar plots to highlight disparities across digital skill levels.

Based on the results of normality testing, we employed non-parametric statistical methods throughout our analysis. The Kruskal-Wallis test was used to assess variation in mediator dependency across digital literacy levels, selected specifically for its robustness with non-normal data and resistance to outliers. This test was appropriate given the expected violation of normality assumptions in user experience data.

Correlation analysis played a central role in uncovering relationships between variables. Both Spearman's rank correlation coefficient (ρ) and Pearson's correlation coefficient (r) were computed to measure associations between digital literacy, satisfaction, task success, interface confusion, and security confidence. The dual approach allows for comparison between rank-based and parametric relationships, providing a more comprehensive understanding of variable associations even when data distributions are non-normal.

Integrated Analysis Approach

Throughout the analysis, we maintained an integrated approach by complementing quantitative findings with qualitative insights drawn from open-ended survey responses. These responses were systematically coded using thematic analysis principles to identify recurring user frustrations, support system gaps, and interface-level design issues. The integration of mixed methods follows established protocols in digital inclusion research, where quantitative patterns provide breadth while qualitative insights offer depth and context. Together, these methods enabled us to construct a comprehensive, data-driven understanding of how digital literacy, usability, and institutional trust intersect to shape user experience on Bangladesh's e-government platforms. The robust statistical foundation, combined with validated measurement instruments and appropriate analytical techniques, ensures the reliability and validity of our findings in addressing the research questions regarding usability challenges

for users with limited digital literacy.

3.8 Integration of Findings

The integration of qualitative and quantitative data, combined with insights from expert consultations and prototype development, allowed for a holistic understanding of the challenges faced by users with limited digital literacy. The thematic analysis of interview data provided context and depth to the survey findings, while the heuristic evaluation offered practical insights into platform design and usability. The expert feedback sessions helped validate our proposed solutions and guided implementation strategies. Together, these methods enabled the research team to identify systemic issues and propose targeted, technically feasible recommendations for improving e-service platforms in Bangladesh.

3.9 Ethical Considerations

Ethical considerations were integral to every stage of the study. Informed consent was obtained from all participants before data collection. The survey included a digital consent form, which participants were required to sign before proceeding with the questionnaire. Similarly, interview participants were provided with detailed information about the study's purpose, their rights as participants, and how their data would be used. Consent was obtained in writing or verbally, depending on the context, and participants were assured of their right to withdraw at any time.

To ensure confidentiality, all collected data was de-identified, and unique random identifiers were assigned to each participant. Audio and video recordings were securely stored, and access was restricted to the research team. The research protocol was reviewed and approved by the Institutional Review Board (IRB) of BRAC University under reference number 220240006, dated May 6, 2024.

Chapter 4

Findings

Bangladesh’s journey toward digital transformation through e-government services represents a critical shift in how citizens interact with government institutions. Our comprehensive analysis draws from three distinct perspectives: survey responses from 293 participants representing the general public, in-depth interviews with administrators of the respective government platforms, valuable insights from mediators who bridge the gap between citizens and digital services, and a heuristic evaluation of the usability and accessibility of these platforms. This multi-stakeholder approach provides a unique and holistic understanding of both the challenges and opportunities in Bangladesh’s e-government ecosystem.

This findings section presents a detailed examination of user experiences across four key e-government platforms: the BRTA Service Portal, E-Passport Services, NID Services, and Railway E-Ticketing. The inclusion of administrator perspectives offers crucial insights into the technical and operational challenges these platforms face, while mediators’ experiences illuminate the practical difficulties citizens encounter and the reasons behind their dependence on intermediary assistance. By analyzing these platforms through the lens of our research questions—understanding usability challenges for users with limited digital literacy and identifying potential improvements—we uncover patterns that illuminate both the current state of e-government accessibility and opportunities for enhancement.

Our analysis particularly benefits from the contrasting viewpoints of administrators, who emphasize the technological advancements and security measures implemented in these systems, and mediators, who deal daily with the practical challenges of helping users navigate these platforms. This dual perspective helps highlight the gap between intended functionality and actual user experience, especially for those with limited digital literacy.

Through careful analysis of these multiple perspectives— administrator perspectives, mediator insights, and the results of our heuristic evaluation—we aim to present a comprehensive picture of the current state of e-government services in Bangladesh while offering practical insights for improvement. This structured approach allows us to understand not just what challenges exist but why they persist and how they might be effectively addressed to create more inclusive and accessible digital government services.

4.1 Challenges Faced by Users with Limited Digital Literacy

Administrators across Bangladesh’s key e-service websites—BRTA, Passport, and NID—highlighted the transformative role these services play in simplifying citizens’ lives. According to one BRTA administrator,

“BSP portal is updating with time, and about 10 million people are using it for their license, and about 6 million people are using the portal for their vehicle-related information.” - A4

Similarly, passport administrators emphasized that the new online system has significantly reduced the hassle of the traditional passport application process. One admin remarked,

“Previously, making a passport was a long, monotonous work. Currently, people can apply online, make appointments, and then visit their respective passport offices during their designated timeslot. They do not have to spend a whole day for a passport anymore.” - A6

Furthermore, the NID admin described the platform as “very easy to use” for the younger generation and digitally skilled users. However, despite these advancements, admins across all three platforms also observed various challenges that hinder users from using these e-service platforms.

4.1.1 BRTA Admin

Our analysis of the BRTA admin interviews revealed new insights, leading to the identification of two distinct themes: Digital Literacy and Behavioral Barriers Driving Mediator Dependency and Technical Infrastructure and Usability Challenges.

4.1.1.1 Digital Literacy and Behavioral Barriers Driving Mediator Dependency

According to the admins, “Users who use the portal themselves or take help through mediators both groups are getting benefited,” indicating the presence of single users and mediators in the user eco-system. This presence stems, as one admin pointed out,

“Users generally appreciate the online service. But they often face barriers due to a lack of limited digital literacy or overlooking the available information due to being impatient.” - A1

These observations from the admins indicate that the BRTA system’s reliance on mediators arises from key factors like limited digital literacy and behavioral barriers, such as impatience with the system’s processes.

Users with no literacy are dependent on mediators, Union Digital Centers [74], and relatives to access the BRTA portal services. While collecting data, we have found that mediator dependency here is the most prominent compared to other e-services. This high reliance comes with added risks, as users can be deceived by them. One admin remarked,

“People with no literacy take help from the mediators or third parties to use the portal and often get deceived and they misuse the opportunity.”
- A4

Furthermore, users with limited digital literacy struggle to understand website instructions, causing them to seek additional assistance, which mostly involves mediator assistance. According to the officers, challenges such as confusion around the validation process increase users’ dependency on mediators. Some of them stated, “NID validation by personal contact number is not clear to them, and they are often not aware of that,” highlighting how these barriers hinder adoption, particularly for users with limited education or digital literacy.

4.1.1.2 Technical Infrastructural and Usability Challenges

The website faces interrelated challenges in technical, infrastructural, and user interface design. When asked about the specific usability challenges and the effectiveness of the portal’s layout, the developers remarked,

“The portal provides basic accessibility, but the navigation and information layout may not always be intuitive for users with low digital literacy.”
- A2

The usability challenges are also connected to technical limitations, including connectivity issues with BRTA and NID validation systems disrupting the service, increasing frustration, and mediator dependency among users. Furthermore, multiple validations and technical complexities discourage users from using the system, creating a digital divide. Regarding this matter, they also emphasized the critical importance of usability and accessibility, stating,

“Usability directly influences public perception. Effective online service delivery enhances trust and satisfaction, while challenges such as navigation issues or insufficient support can lead to frustration and a negative impression.” - A5

This situation is further aggravated by inadequate organizational structures, such as insufficient manpower, to accommodate the huge number of users and the need for a mobile application for the system.

4.1.2 Passport Admin

Insights from the Passport admin interview highlighted key challenges such as Navigational Barriers and Digital Proficiency Gaps, where users face difficulties understanding and using the system, and Challenges in Support Infrastructure and Accessibility, reflecting inefficiencies in assistance and service accessibility.

4.1.2.1 Navigational Barriers and Digital Proficiency Gaps

Interviews with the passport office administrators provided valuable insights into their perspectives on the behavioral and digital literacy barriers while using the e-passport website. While the portal has successfully modernized the application process, significant behavioral barriers exist, particularly with users with limited

digital literacy. In their opinion, the website is easy to use for digitally skilled users and young people. The officers noted the presence of bilingual support, making sure that the websites were “thorough and easy to understand.” However, a notable paradox in users’ behavior emerges despite having bilingual support and extensive documentation present for dependency on intermediary assistance driven by a “fear of errors” rather than system complications. According to them, mostly elderly individuals and users with limited literacy face challenges like navigating the system and misunderstanding information during application. Admin, A7 stated, “I have seen the elderly and people with limited education face most of the challenges.”

Furthermore, one admin explained the reasons behind the reliance on mediator assistance,

“These issues will last as long as all the people are not used to using digital devices. They will have the fear of errors. So they take help from others, such as family members and mediators.” - A9

They also described that many users simply do not want to take the hassle of doing these tasks and seek mediator help, further strengthening the influence of behavioral challenges impacting mediator dependency. One officer remarked,

“Many people do not want to do something that they can do with someone’s help by spending a little amount of money and time.” - A9

4.1.2.2 Challenges in Support Infrastructure and Accessibility

The admins addressed usability and infrastructural challenges like the payment confirmation process and rescheduling option during the interviews. Throughout the user and mediator interactions, a significant number of participants in this study mentioned the absence of a rescheduling process. In this regard, the admins said,

“People addressed issues about rescheduling, but I think once you confirm your application schedule and go to the payment section, rescheduling should not be available.” - A8

On the topic of the payment procedure, the admins admitted the issue of a lengthy payment procedure, saying, “Payment confirmation takes a while sometimes.” However, despite these issues, most admins claimed the portal to be intuitive, and anyone experienced with the internet and browsing can use this website without any issues. One admin remarked, “I don’t think any simplification is needed.” When discussing organizational and technical issues, most admins stated that apart from the NID server being down sometimes, there aren’t many challenges or issues that hinder the service delivery. The admins claimed that the website is well maintained, saying, “The portal is always getting updates. Our engineers are working on it every day.” The admins further addressed the security measurements of the website and mentioned,

“We use VPN while accessing sensitive information, so it is very secure. To build trust, we need more advertising and letting people know their data is safe.” - A7

4.1.3 NID Admin

The admin interview addressed digital literacy challenges, misconceptions about NID servers, and the role of mediators assisting users with limited digital proficiency.

4.1.3.1 Barriers to Independent Usage

The interview with the district election officer highlighted his duties, including handling new voter registrations, biometric data, and revision applications, emphasizing the role of mediators in assisting users. When asked about the users' interaction with the NID websites, he stated,

“The website is very easy to use, but there is a part of the population who don’t understand the technical stuff like the website and networking. So for them, it will be a bit hard, but they can get help. People with basic knowledge or the younger generation easily use this website and can easily submit their applications.” - A7

His statement indicated that while there is a digital divide among users, this type of assistance can enable limited digital literacy users to avail the benefits of this website like any other digitally literate user, creating a ground for digital equity.

4.1.3.2 Addressing Server Reliability Misconceptions

When questioned about the claims regarding frequent NID server downtime, the officer firmly denied these allegations, stating,

“I would like to oppose what the BRTA associates said. Our server is never down, and we easily provide all the services. Compared with other departments, our servers are excellent and never down. We notify you if it is down for about one or a half hours. Otherwise, our server is never down.” - A9

This response highlights the significant miscommunications between various organizations, which create usability and accessibility barriers for users. Such inconsistencies in views and information can create frustration and a lack of confidence in both users and stakeholders. Finally, when asked about any changes he wanted to make in this system, he said the current system is completely fine and well-equipped. Mediators of these three platforms also revealed several key struggles that the limited digital literacy users face as well as the factors that make them seek mediator help. They highlighted navigation, understanding instructions, behavioral barriers, and many technical difficulties as some common factors contributing to users' reliance on mediators.

4.1.4 BRTA Mediator

The BRTA mediator insights focus on system inefficiencies and user struggles, where technical difficulties and digital literacy gaps drive users to rely heavily on mediator assistance.

4.1.4.1 Technical Challenges and Process Complexity

BRTA mediators revealed several usability, accessibility, and technical issues such as cumbersome payment processes, complex ownership transfer systems, frequent server downtime, and slow performance. One mediator, M10 said, “The website is often slow and sometimes goes down, which causes frustration.” They also complained that server-related issues cause task delays as there is no alternative way to process, disrupting their work. Furthermore, all BRTA mediators mentioned two major issues: (1) payment procedures and (2) ownership-transfer complexities. According to them, the payment process is inefficient, with issues like delayed and unprocessed receipts despite successful transactions, missing cancellation mechanisms, and requiring physical visits to resolve such errors. One mediator stated,

“The payment takes the amount but does not process it properly, and we have to contact the authorities, which takes a few days.” - M5

Additionally, in cases where a wrong transaction ID is entered, the payment process is disqualified with no automated refund system, which creates stress and inconvenience for users. The ownership transfer procedure is also hectic, with slow document uploads and manual approvals with an offline dependency that makes the process frustrating and time-consuming for users. One mediator said,

“Malikana poriborton (ownership transfer) is a particularly time-consuming process. It often gets delayed due to the dependency on BRTA’s approval, which can take several days or even weeks.” - M12

Both of these problems undermine the main idea of online services and create accessibility barriers for users. They also highlighted issues like a lack of online editing and canceling options. One of the mediators pointed out,

“If someone has an account and wants to edit some details, like a change in current address, they cannot do it. There is no edit option in the account.” - M2

Furthermore, they mentioned inadequate synchronization of NID and BRTA servers, as one mediator stated,

“While renewing the driving license, there are some people whose name does not match with the NID card. They must go to BRTA physically, but it could be done online with scanned documents.” - M9

Mediators also expressed their concerns about the slow service and inadequate manpower of the BRTA help center by saying,

“The help center is not as effective as it should be. There is a lack of sufficient manpower, and the call center support is limited.” - M4

4.1.4.2 Client Dependency

While mediators found navigation and information organization relatively clear and improved over time, they stated that clients, particularly those with limited digital literacy, struggle to navigate and understand the information. According to one mediator,

“Typically, people with digital literacy issues, those who cannot use a computer, cannot use the website themselves and come for our help.” - M13

Moreover, the clients struggle to understand the website’s instructions, as another mediator stated,

“The clients do not understand the instructions clearly. Those who do not understand come to us, while those who understand do not.” - M14

The BRTA mediators also pointed out that users get overwhelmed by the website and reach out to mediators for assistance. According to them, users prefer convenience and efficiency, which leads to mediator dependency. The mediators stated,

“They usually take the service from us because they do not want to go through the hectic process. Even if the client knows how to use the website, they still want the luxury of not doing it themselves when they can pay us.” - M7

Clients oftentimes forget login and other credentials and face several payment processing issues, which also makes them seek mediator assistance. According to the mediators, the payment process is one of the key challenges of the website, and often users face issues like failed transactions, missing receipts, and wrong transaction IDs. One mediator remarked,

“If the payment is done but not processed properly, we have to contact the authorities through the hotline, which takes a few days.” - M3

Finally, the website’s offline dependency is also a crucial reason for mediator reliance, as tasks like ownership transfers need in-person visits, making it easier for the clients to rely on mediators. They said,

“The biggest barrier to making the BRTA website accessible and user-friendly is the offline approval. It should be made fully online.” - M11

4.1.5 Passport Mediator

Passport mediators highlighted the performance and integration issues of the system, alongside addressing users’ mediator dependency for process simplification.

4.1.5.1 System Performance and Integration Issues

Passport mediators strongly indicated slow and frequent server-down incidents by saying, “The server should always be working”. Furthermore, the highlighted issues, like lack of rescheduling options and no refund policies, are the most prevalent on the website. One mediator remarked,

“The server accessing speed is very low. No rescheduling, and no payment return option if any mistake is made.” - M15

Their dissatisfaction with server issues was common, as most mediators complained about slow passport servers as well as poorly synchronized NID servers. They also mentioned the absence of a correction process after submission, which creates a hassle as there is no cancellation system either. One mediator said,

“Once information is submitted, there is no way to correct it. You will have to go to the office and apply for cancellation, but there is no way to do it online.” - M18

Furthermore, all mediators expressed their concerns about the absence of a rescheduling process, which prevents them from rescheduling their appointments before the scheduled date or after a missed appointment. As a result, users have to undergo the same application and payment process, which causes significant inconvenience to the users, creating frustration among them.

4.1.5.2 Mediator Reliance for Process Simplification

When asked about mediator reliance, the mediators emphasized behavioral barriers like fear of making mistakes and the lack of motivation to do the tasks themselves. They also highlighted facts like “Time and Reliability” and simplicity influence mediator dependency. Mediator M16 said, “At every level, who wants to waste time?” This indicates that users prioritize efficiency, which is why they seek mediator assistance. According to mediator M17, many users turn to them for assistance because they have “Bilashita” or luxury and fear making mistakes.

4.1.6 NID Mediator

Our NID mediator interview analysis gave insights into the usability challenges, data synchronization, and accessibility issues that hinder users from independently using the system.

4.1.6.1 Challenges in NID System Usability, Data Synchronization, and Accessibility

We had one NID mediator who pointed out the server issue just like the rest of the mediators, saying, “NID servers are down maximum time,” giving a firm idea of the server issue across platforms. They also mentioned usability and accessibility issues like the edit or cancel option. He stated,

“Once information is submitted, there is no way to correct it. You will have to go to the office and apply for cancellation, but there is no way to do it online.” - M19

He also mentioned that the English translation option for parents’ names and addresses is absent, which results in poor synchronization with the passport server and user frustration. He stated,

“NID doesn’t have the address, father, and mother’s name in English while applying. No English option for parents’ names and addresses. So cannot sync fully with the passport.” - M19

Furthermore, he highlighted critical modification barriers, particularly the inability to edit or cancel a submitted application online, which causes users to visit the offices for correction.

4.1.7 User Survey

Our comprehensive statistical analysis of survey responses from 293 participants who provided valid consent reveals profound insights into the digital divide affecting Bangladesh’s e-government services. The findings demonstrate a significant digital divide among users, with 51.5% considering themselves advanced digital users while 23.2% identify as beginners. This disparity becomes particularly concerning when considering access to essential government services, as our statistical tests confirm these differences are not merely coincidental but represent systematic barriers to digital inclusion. Some important demographic information of our study can be found in Table 4.1.

Table 4.1: Demographic characteristics of survey respondents (N=293)

Characteristic	Category	Count	Percentage (%)
Age	18-24	124	42.3
	25-34	77	26.3
	35-44	34	11.6
	45-54	27	9.2
	55+	31	10.6
Gender	Male	194	66.2
	Female	97	33.1
	Prefer not to say	2	0.7
Education Level	Below High School	6	2.0
	High School/SSC	19	6.5
	College/HSC	78	26.6
	Diploma	13	4.4
	Bachelor’s Degree	118	40.3
	Master’s Degree	58	19.8
	PhD Degree	1	0.3
Digital Literacy	Beginner	68	23.2
	Intermediate	74	25.3
	Advanced	151	51.5
Daily Internet Usage	More than 5 hours	152	51.9
	3-5 hours	66	22.5
	1-3 hours	61	20.8
	Less than 1 hour	14	4.87
Total		293	100.0

To further illustrate how digital literacy impacts access, we analyzed platform-specific usage rates across different skill levels. As visualized in Figure 4.1, the heatmap reveals a clear gradient: Users with advanced digital literacy are significantly more likely to use e-government services than those with beginner-level skills. For instance, 80.8% of advanced users access the NID platform, compared to only 8.8% of beginners. Similar disparities exist across the E-Passport (62.9% vs. 17.6%) and Railway platforms (60.3% vs. 17.6%), while BRTA shows a stark contrast as well (29.8% vs. 7.4%). These findings underscore how digital literacy functions as a gateway to platform access, and how current e-government design and delivery mechanisms are disproportionately serving the digitally privileged. The usage rate differentials reveal the structural barriers that prevent low-literacy users from even reaching the point of interface engagement, reinforcing the necessity of both

technical simplification and inclusive design.

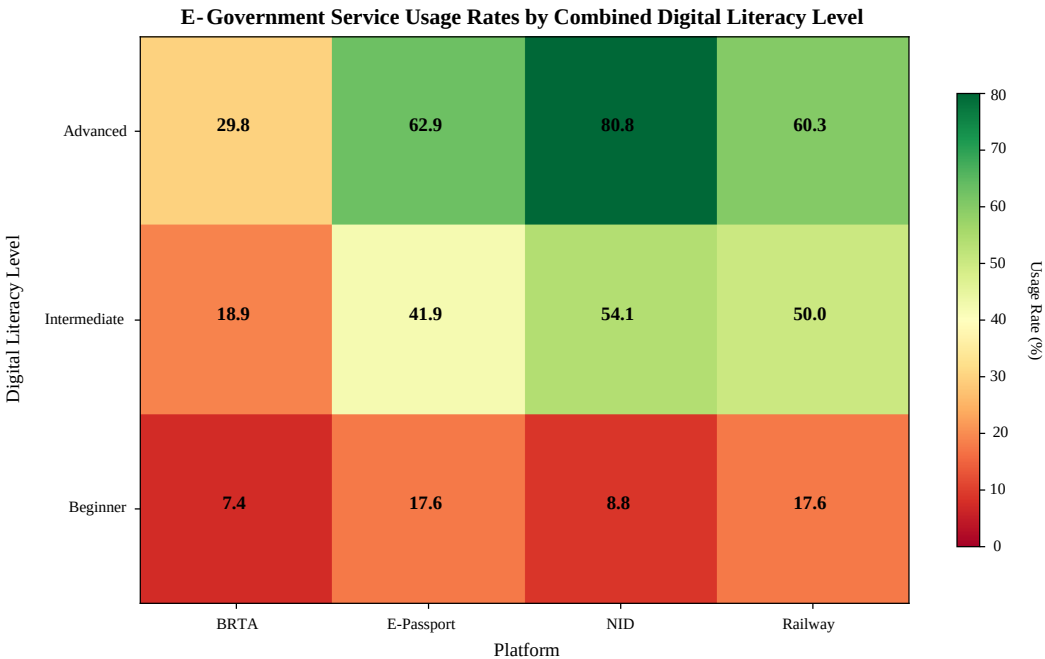


Figure 4.1: E-Government service usage rate heatmap by combined digital literacy level

Understanding the educational composition of our respondents provides crucial context for interpreting these findings. The concentration of users with higher education (40.3% with bachelor’s degrees, 19.8% with master’s degrees) suggests that these services may be inadvertently designed for more educated users, potentially excluding those with limited formal education. This educational skew indicates a significant barrier for less educated citizens attempting to access these services, creating what researchers call a ‘digital stratification’ where educational attainment becomes a prerequisite for digital service access.

Our statistical analysis employed rigorous testing methodologies to ensure reliability and meaningful interpretation. Normality tests using Shapiro-Wilk revealed that all continuous variables in our dataset exhibit non-normal distributions ($p < 0.001$ for all variables), necessitating the use of non-parametric statistical tests for meaningful analysis. This finding itself is significant from a research perspective, as it indicates that user experiences with e-government platforms do not follow typical bell-curve patterns but instead show more complex, skewed distributions that reflect the uneven nature of digital access and literacy in Bangladesh’s population.

4.1.7.1 Technical and Infrastructure Barriers

The e-government services in Bangladesh face significant technical challenges that affect user experience across all platforms, creating what we might call a ‘digital infrastructure crisis’ that undermines the foundational promise of accessible digital governance. Our survey reveals widespread connectivity issues, with an overwhelming 88.8% of respondents reporting challenges in accessing these services. These infrastructure limitations create a foundational barrier affecting users across all digital

literacy levels, a finding that our statistical analysis confirms through sophisticated correlation testing.

To understand the depth of this problem, we must recognize that technical barriers operate differently across user groups. Our correlation analysis reveals that technical issues are not randomly distributed but show systematic patterns that amplify existing inequalities. As shown in the Table 4.2, the relationship between digital literacy and technical problem-solving capabilities demonstrates a moderate positive correlation (Spearman $\rho = 0.422$, $p < 0.001$), indicating that users with higher digital literacy are better equipped to navigate around technical barriers when they occur. However, this correlation also highlights how technical infrastructure problems disproportionately affect users with limited digital skills, creating a compounding effect where those least equipped to handle technical problems encounter them most frequently.

Table 4.2: Correlation analysis between key variables

Variables Compared	Spearman ρ	p-value	Pearson r	p-value
Digital Literacy vs Mediator Dependency	-0.395	0.000	-0.434	0.000
Digital Literacy vs Overall Satisfaction	-0.067	0.314	-0.069	0.294
Digital Literacy vs Task Completion Success	0.422	0.000	0.521	0.000
Mediator Dependency vs Navigation Difficulty	-0.195	0.001	-0.336	0.000
Overall Satisfaction vs Interface Confusion	-0.088	0.182	-0.058	0.378

The BRTA portal exemplifies these challenges, experiencing frequent server downtimes and slow response times that test user patience and technical capability. With 59.4% of users reporting pages taking too long to load, we see how technical inefficiency becomes a usability barrier. The cascading effect of these problems becomes evident when we consider that users with limited digital literacy may interpret slow loading as personal failure rather than system inadequacy, leading to frustration and abandonment of service attempts.

Similarly, the E-Passport portal’s performance issues emerged as the most prevalent concern among our 293 respondents, with 90 individuals reporting slow loading times or errors. This represents more than a quarter of our total respondent pool experiencing fundamental access problems. As one user, P9 succinctly expressed, “Server needs to be more speedy and secure,” capturing the dual nature of infrastructure concerns that encompass both performance and security.

The NID portal demonstrates comparable technical constraints, with 65.5% of users encountering technical issues during their last visit. This statistic is particularly troubling given the NID portal’s role as a foundational digital identity service upon which other e-government services depend. One user emphasized this challenge with particular clarity, stating:

“Server size needs to be upgraded as soon as possible. Because ‘server down’ and slowness are the most prominent issues I’ve faced.” - P194

This user’s frustration reflects a broader pattern where technical inadequacy undermines citizen confidence in digital governance initiatives.

The Railway E-Ticketing platform, despite being one of the most frequently accessed services among our 293 participants, faces severe performance issues that become

especially acute during peak usage periods. Slow page loading was reported by 106 respondents, representing approximately one-third of our survey population. One user, P204, captured the severity of the situation by describing it as “The site is slow as turtle.” These issues become especially critical during high-demand periods, such as Eid season, when users report complete system failures that can affect millions of citizens trying to arrange travel.

Payment processing emerges as another significant technical barrier across all platforms, representing a critical failure point in the digital service delivery chain. Users frequently report transaction failures, delayed confirmations, and complicated refund processes that create financial anxiety and erode trust in digital transactions. This is particularly problematic for the Railway E-Ticketing system, where users P194 and P226 highlighted the need for systematic upgrades, stating, “Payment system should be upgraded” and calling for the implementation of a “Prompt refund system,” respectively.

The integration challenges between different government databases represent a more complex technical barrier that reflects broader issues in digital governance coordination. As one user noted regarding the NID-Passport integration disconnect:

“I had trouble selecting an option because I have X data in a particular field in my NID and there was no X option in the E-Passport site.” - P105

This lack of seamless data integration forces users to navigate complex reconciliation processes that require advanced digital literacy to resolve, effectively excluding users who lack such skills.

Mobile responsiveness presents another dimension of technical inadequacy that affects the majority of our respondents. Despite 97% of users owning smartphones and 53.7% preferring mobile access for railway ticketing, the platforms struggle to provide consistent mobile experiences. Users report interface elements not rendering properly on mobile screens and functionality limitations when accessing services through smartphones, creating a disconnect between user preferences and system capabilities.

These technical barriers significantly impact user confidence and willingness to engage with digital services, creating what researchers call ‘learned digital helplessness’ where repeated negative experiences discourage future attempts at digital service use. The infrastructure limitations not only affect basic accessibility but also contribute to broader issues of trust and reliability in e-government services. As one respondent, P158, noted regarding the Railway platform, “Website crash and Eid situation not able to book tickets. 100% worst” (The website crashes due to the Eid rush, I couldn’t book tickets. It was the worst experience), highlighting how technical failures can completely obstruct access to essential services during critical periods when citizens most need reliable digital access.

4.1.7.2 Interface and Navigation Complexities

The survey findings reveal significant challenges in how users interact with and navigate through Bangladesh’s e-government platforms, creating what interface design experts call ‘cognitive load barriers’ that particularly affect those with limited digital literacy. These interface-related issues create systematic barriers to effective service

utilization, and our statistical analysis provides compelling evidence for these challenges through a detailed examination of assistance needs across different digital literacy levels.

Understanding the relationship between digital literacy and interface navigation requires examining how design complexity affects different user groups. Our comprehensive analysis of digital literacy versus assistance needs across all four major e-government platforms reveals stark disparities in user independence that follow predictable but concerning patterns. The Kruskal-Wallis test confirms that mediator dependency differs significantly by self-assessed digital literacy category ($H = 57.855$, $p < 0.001$), providing statistical validation for what users experience daily when attempting to navigate these platforms.

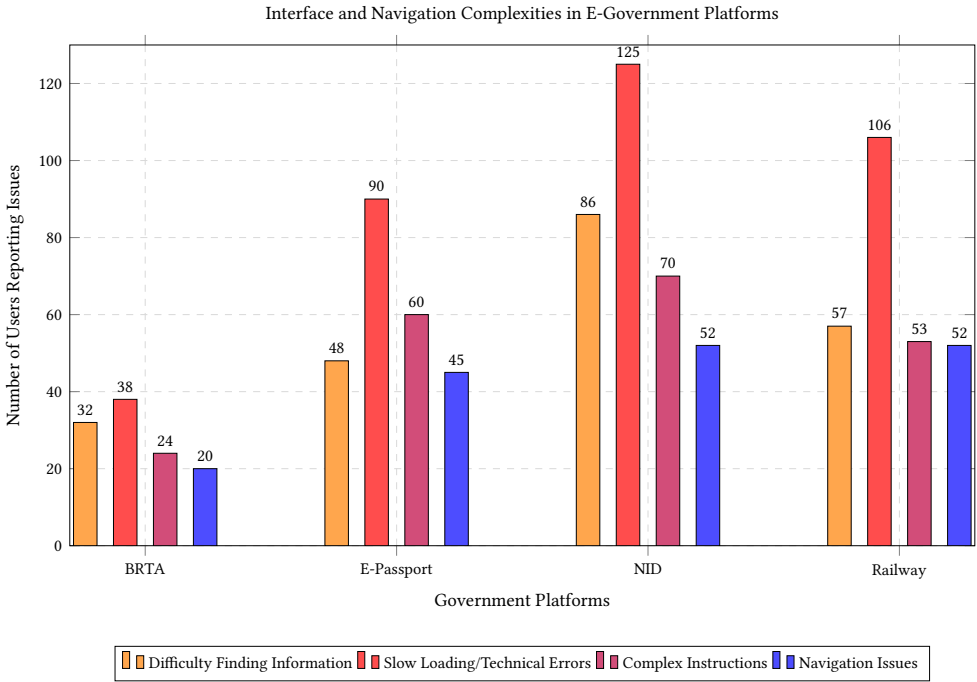


Figure 4.2: Analysis of interface and navigation complexities across e-government platforms

To fully grasp the implications of these findings, we must consider how interface complexity creates cascading effects throughout the user experience. The Figure 4.2 demonstrates that the BRTA portal faces significant interface challenges that manifest across multiple dimensions of user interaction. Of our 293 surveyed participants, 32 individuals (representing 50%) reported difficulty finding information on the portal, while the complexity of instructions posed another substantial barrier, with 24 users (37.5%) indicating they struggled to understand and follow the portal's guidance. These difficulties are not isolated incidents but represent systematic design failures that affect substantial portions of the user population.

The statistical breakdown of assistance frequency reveals troubling patterns that illuminate the depth of the digital divide in practical terms. For the BRTA platform specifically, our analysis shows that 80% of beginners frequently need help navigating the system, whereas only 31.1% of advanced users require such assistance. This represents one of the steepest digital literacy gradients observed across all platforms,

suggesting that the BRTA portal presents particularly acute usability challenges for users with limited digital skills. This gradient effect demonstrates how interface design can either bridge or widen the digital divide, with current designs clearly widening the gap.

The visual design aspects of the BRTA portal received particularly critical feedback from our respondents, with 29 users (41.4% of respondents to this specific question) rating it as either ‘Below Average’ or ‘Very Poor’ in terms of layout and visual appeal. These ratings align with the technical performance issues we observed, where 33 users reported slow loading and technical errors, suggesting that interface problems compound with technical performance challenges to create a particularly frustrating user experience. This assessment is reinforced by user comments calling for ‘Modern and planned UI, UX’ and noting ‘Bad UX, UI’ as a significant issue. One user articulated a specific challenge in Bangla that captures the intersection of interface and technical problems:

“Portal er page gula user-friendly kora lagbe, dropdown e shomossha kore. Mobile responsiveness totota user-friendly na.” (The portal pages need to be made user-friendly as there are problems with dropdowns. Mobile responsiveness isn’t user-friendly enough.) - P238

The E-Passport service exhibits similar navigation difficulties that create systematic barriers for users with limited digital literacy. Among our 293 participants, 60 respondents reported unclear instructions and 48 users expressed confusion about application processes. Our statistical analysis reveals that 75% of beginners require frequent assistance with E-Passport services, compared to just 13.7% of advanced users. This dramatic difference demonstrates how interface complexity creates systematic exclusion patterns that prevent equitable access to essential government services.

This disparity becomes particularly significant when we consider the critical nature of passport services for international mobility and economic opportunity. A particularly telling user comment highlights the real-world consequences of these interface failures:

“Website a ki ki mandatory, ki ki kora jabe na clear bola thake na, then office a hoyrani kore.” (The website doesn’t clearly state what is mandatory and what cannot be done, leading to harassment at the office.) - P202

This user’s experience illustrates how digital interface failures translate into offline bureaucratic difficulties, creating a cycle where digital inadequacy leads to increased burden on physical service centers.

While 46.4% of users found navigation straightforward, the visual layout primarily received average ratings from 107 respondents, suggesting significant room for improvement in design clarity and user guidance. The persistence of navigation difficulties even among moderate users indicates that current interface designs fail to accommodate the full spectrum of user capabilities and preferences.

The NID portal’s interface presents its own set of challenges that reveal how fundamental digital identity services can become barriers rather than enablers. Among our respondents, 51.2% reported difficulty finding specific services or information,

while navigation ease shows a concerning distribution: while 39.3% found it easy or very easy, 26.8% reported difficulty, and a substantial 33.9% remained neutral. This neutral response pattern is particularly significant as it suggests user uncertainty and lack of confidence rather than clear positive or negative experiences.

The visual design and layout ratings for the NID portal cluster around average (50%) or below (21.4%), indicating significant usability issues that affect user confidence and task completion. Remarkably, even among advanced users who heavily utilize the NID platform (80.8% usage rate), over 60% still require assistance sometimes or rarely, suggesting interface complexity that persists even among digitally literate users. This finding challenges the assumption that digital literacy alone can overcome poor interface design.

The Railway E-Ticketing platform presents a more encouraging pattern while still revealing significant challenges. Despite having 55.7% of users finding navigation easy or very easy, the platform still faces interface challenges, particularly in its visual layout and design. However, this platform emerges as the most accessible service in our statistical analysis, with 61.5% of advanced users and 33.3% of beginners able to navigate without any assistance. This suggests better user-centric design and usability compared to other platforms, providing evidence that improved interface design can meaningfully reduce assistance needs across all user groups.

Users frequently mention the need for interface improvements, with specific suggestions for a “more colorful interface with easy navigation.” - P239. This feedback indicates that users can identify and articulate specific interface improvements, suggesting that user-centered design approaches could effectively address current limitations.

A common thread across all platforms is the challenge of unclear error messages and insufficient user feedback, creating what usability experts call ‘error recovery barriers.’ When users encounter problems, the interfaces often fail to provide clear guidance on how to resolve issues or proceed. This lack of clear communication leads to increased dependence on external help, with many users requiring assistance from family members, friends, or mediators to complete their tasks.

The complexity of these interfaces particularly affects users with limited digital literacy, often forcing them to seek mediator assistance that compromises privacy and creates financial burden. This dependency on external help contradicts the fundamental goal of making government services more accessible through digital platforms. As one respondent succinctly captured this contradiction:

“Please make it so there’s no need for mediators in all govt services, improve the UX and design with proper research.” - P229

To investigate how users with limited digital literacy navigate e-government platforms and the extent to which they rely on external assistance, we conducted a cross-tabulation analysis comparing digital literacy levels with reported assistance needs across these platforms. The results, visualized in Figure 4.3, reveal a consistent and significant pattern: as digital literacy increases, the need for help sharply decreases. This trend validates our Kruskal-Wallis test result ($H = 57.855, p < 0.001$), which confirms a statistically significant association between literacy category and mediator dependency.

For example, on the BRTA portal, 80% of beginner users require frequent assistance, while this drops to 31.1% for advanced users, with 26.7% of them needing no help

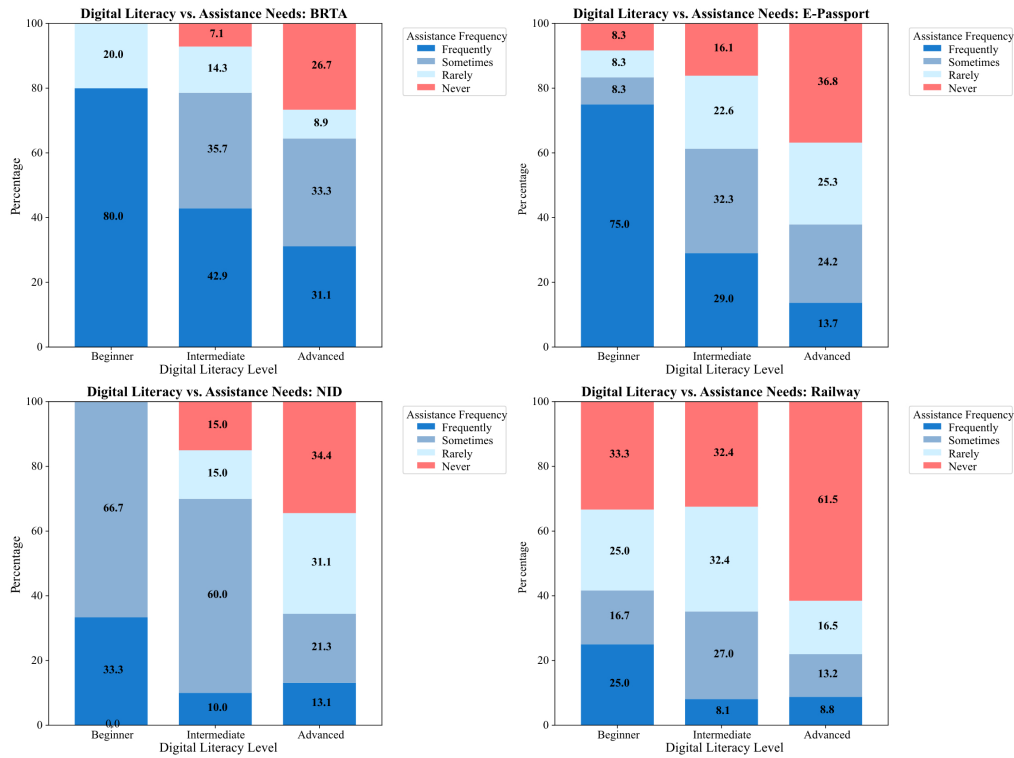


Figure 4.3: Assistance required by different digital literacy level users

at all. The E-Passport platform reflects a similar divide, with 75% of beginners needing frequent help, in contrast to just 13.7% of advanced users. Even the NID platform, despite its high usage among advanced users, sees over 65% of them still requiring some assistance, indicating persistent interface limitations. The Railway Sheba platform stands out as relatively more accessible: 61.5% of advanced users and even 33.3% of beginners report navigating it without any help, suggesting better design practices.

This comparative visualization emphasizes that usability challenges are not uniformly distributed, and that users with lower digital skills face systematic barriers stemming from interface complexity, unclear guidance, and lack of responsive feedback. These findings reinforce the argument that inclusive design, not merely user training, is essential for reducing mediator dependency and achieving equitable digital access. Our statistical analysis underscores this concern, revealing that digital literacy is indeed a strong predictor of user independence in navigating e-government platforms. However, the varying assistance needs across platforms also indicate that design quality plays an equally important role. Even literate users may struggle if the design lacks clarity, accessibility, or consistency.

Further strengthening this point, our correlation analysis indicates that higher digital literacy does not translate into higher satisfaction. As visualized in Figure 4.4, satisfaction scores across platforms show weak or negligible correlations with digital literacy: NID (0.06), E-Passport (0.03), Railway (-0.01), and BRTA (-0.05). This flat trend suggests that interface and navigation frustrations are not confined to low-skill users; even experienced users find the platforms lacking in usability, responsiveness, or clarity. In effect, usability issues are systemic, not just skill-based. This breaks the common assumption that digital literacy alone can ensure success-

ful or satisfying use, and instead points to the urgent need for user-centered design improvements that benefit all citizens, regardless of technical skill.

The comparison across platforms demonstrates that more intuitive, inclusive design can reduce assistance needs, thus enhancing usability for users with limited digital skills and moving toward the democratic ideal of equal access to government services.

4.1.7.3 Security and Trust Issues

The survey findings reveal deep-seated concerns about security and data protection across Bangladesh’s e-government platforms, significantly impacting user confidence and willingness to engage with these digital services. These security apprehensions manifest differently across each platform but collectively represent a major barrier to digital service adoption that goes beyond simple technical concerns to encompass fundamental questions of institutional trust and digital sovereignty.

Our statistical analysis, as shown in the Figure 4.4 provides particularly revealing insights into the relationship between digital literacy and security confidence that challenge conventional assumptions about digital knowledge and trust. Surprisingly, our correlation analysis reveals negative correlations between digital literacy and security confidence across all platforms (BRTA: -0.18, E-Passport: -0.12, NID: -0.10, Railway: -0.14). This counterintuitive finding suggests that users with higher digital literacy are actually less confident in the security of these platforms, likely due to heightened awareness of privacy risks and cybersecurity threats that come with digital knowledge.

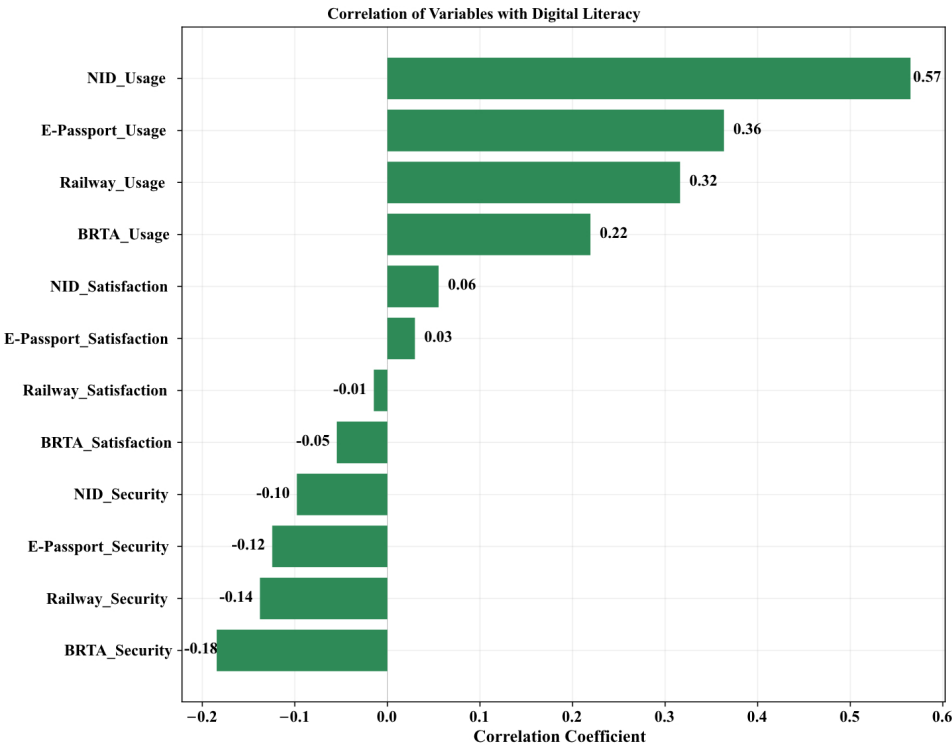


Figure 4.4: Correlation analysis between digital literacy and e-government service variables

For the BRTA portal, security concerns emerge as a significant barrier to adoption,

with only 10.3% of users expressing confidence in the portal’s security. The majority (51.7%) reported low or no confidence in the security of their shared information. This trust deficit becomes particularly concerning given the sensitive nature of vehicle registration and licensing data that users must submit through the platform. The E-Passport service, despite handling highly sensitive personal information, faces similar trust challenges. Only 16.8% of users expressed confidence in the platform’s security measures for handling personal and payment information, while 35.9% reported low confidence. The concerns primarily center around two aspects: privacy of personal data (88 respondents) and payment security (66 respondents). This lack of trust is particularly problematic for a service that requires comprehensive personal information for international travel documentation.

The NID portal faces perhaps the most critical security challenges, given its role as a fundamental digital identity infrastructure. The survey reveals that only 17.4% of users expressed confidence in the platform’s security, while a substantial 60.2% reported low or no confidence. This trust deficit becomes particularly alarming in light of recent security incidents, as reflected in user P239’s observation, “Nid database is already compromised. Security should be increased.” Given that NID data serves as a foundation for accessing other government services, these security concerns have far-reaching implications.

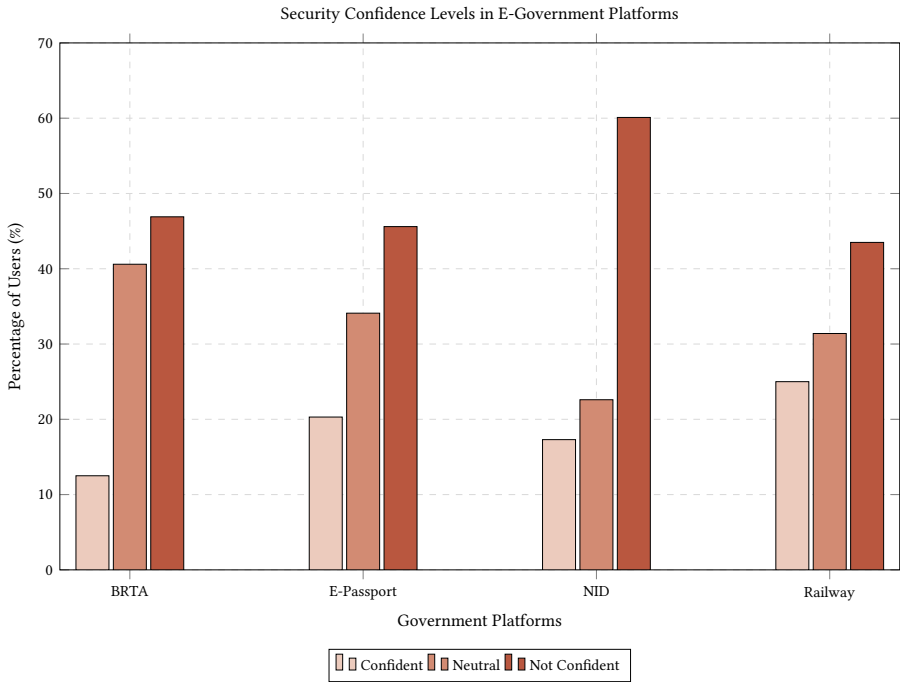


Figure 4.5: Security confidence levels in e-government platforms

The Railway E-Ticketing platform shows similar patterns of security concerns. As shown in the Figure 4.5 only 20.8% of users expressing confidence in their personal and payment information security, while 34.6% reported low confidence levels. Privacy of personal data (81 respondents) and security of payment transactions (80 respondents) emerged as primary concerns. These security apprehensions particularly affect users’ willingness to store payment information or make repeat transactions on the platform.

Across all platforms, payment security emerges as a common concern. Users express particular anxiety about online transactions, leading many to prefer in-person payments despite the convenience of digital options. This hesitation significantly impacts the overall adoption of e-government services, as financial transactions are often integral to these services.

These security concerns often intersect with and amplify other usability issues. For instance, unclear error messages during payment processing or lack of immediate transaction confirmation increase users' anxiety about the security of their financial information. As one respondent noted regarding the E-Passport system, the combination of security concerns and technical issues often leads to a complete loss of trust in the system.

The findings suggest that addressing security concerns requires not just technical improvements but also better communication about security measures and data protection protocols. Users need more transparency about how their data is handled, stored, and protected across these government platforms. The current lack of such transparency contributes to a cycle of distrust that hinders the broader adoption of e-government services in Bangladesh.

4.1.8 Heuristic Evaluation

A systematic heuristic evaluation was also conducted on the three service platforms we have selected. The evaluation revealed several critical usability and interface design issues across all platforms. The portals show significant navigation complexities with a non-intuitive menu structure. For example, Figure 4.6 shows the unusual positioning of the navbar here.



Figure 4.6: Bangladesh e-Passport portal homepage - unusual position of navigation menu

Essential functions like license applications and vehicle registrations are buried under multiple layers of navigation. The system lacks proper error prevention mechanisms - forms accept invalid data formats without real-time validation, leading to submission failures. Error messages are technical and cryptic, failing to guide users toward solutions. For instance, in Figure 4.7 if we provide invalid NID information, it takes

us to the next step, and after completing the next step, it shows a cryptic error message that users won't be able to understand in the first place.

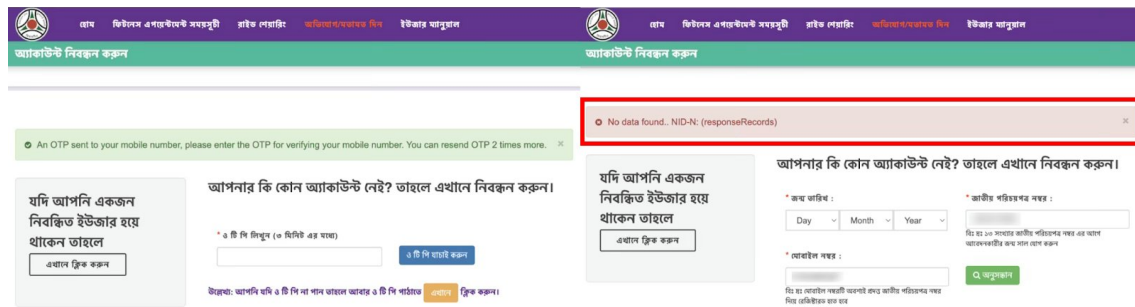


Figure 4.7: BRTA website registration process - error handling in NID verification process

The interface uses inconsistent terminology between Bangla and English versions, creating confusion for users switching between languages. The E-Passport system, while having better organization, shows critical issues in system status visibility. During application submission and payment processing, users receive inadequate feedback about their progress. The system timeout settings are inappropriately short, causing session expiration during document uploads. Help documentation exists but is poorly integrated into the workflow, requiring users to leave their current task to access guidance. The NID portal demonstrates major shortcomings in error handling and recovery. The system's form design lacks proper field validation, allowing the submission of incorrectly formatted data only to fail later in the process.

For example, in Figure 4.8 when entering address details in the NID portal, the holding number field is marked as mandatory (*), however, many rural residences in Bangladesh do not have formal holding numbers. The system provides no guidance, instructions, or alternatives for users from rural areas without holding numbers. This forces users to either enter incorrect information or be unable to complete their application. The form design fails to accommodate a common real-world scenario, creating an unnecessary barrier, particularly for rural residents who constitute a significant portion of users. Almost all of the interfaces also suffer from inconsistent visual hierarchy, making important information and actions difficult to identify. The Bangladesh Railway E-ticketing website exhibits several critical usability violations when evaluated against standard usability heuristics. The most significant issues relate to system status visibility, the match between the system and the real world, and error prevention.

In terms of visibility of system status, there is a major inconsistency in how seat availability information is presented. For example, in Figure 4.9, the system initially shows '10 seats available' in the summary view, but upon entering the seat selection interface, users encounter an empty first compartment. This violates the fundamental principle of system status visibility by providing contradictory information, potentially confusing users about actual seat availability. Regarding error prevention, the system lacks crucial features to prevent booking conflicts. Without a seat reservation timer, multiple users can attempt to book the same seat simultaneously, potentially leading to failed transactions and user frustration. This is particularly

Figure 4.8: NID profile editing page - invalid validation creating unnecessary barrier

Figure 4.9: Train seat selection interface showing inconsistent seat availability information between summary view and detailed compartment view.

problematic during high-traffic periods when many users are trying to book tickets concurrently.

The language consistency throughout the interface is also problematic. The exclusive use of English, combined with occasionally complex terminology, creates accessibility barriers for users who may be more comfortable with Bangla or simpler English phrases. This violates the heuristic of matching the system to the user’s language. Also, there is no support for the local languages, like Bangla. Moreover, the match between the system and the real world is poorly implemented in several areas. As the Figure 4.10 shows, the website uses technical terminology like ‘BST’ (Bangladesh Standard Time) and military-style time formats (e.g., ‘1438min’) instead of more user-friendly alternatives that match how people naturally think about time. This creates an unnecessary cognitive burden, especially for users who may not be familiar with these formats. Additionally, the compartment selection process doesn’t follow the natural mental model of how passengers typically think about selecting train seats—users must first notice and interact with a dropdown menu before seeing the actual seat layout.

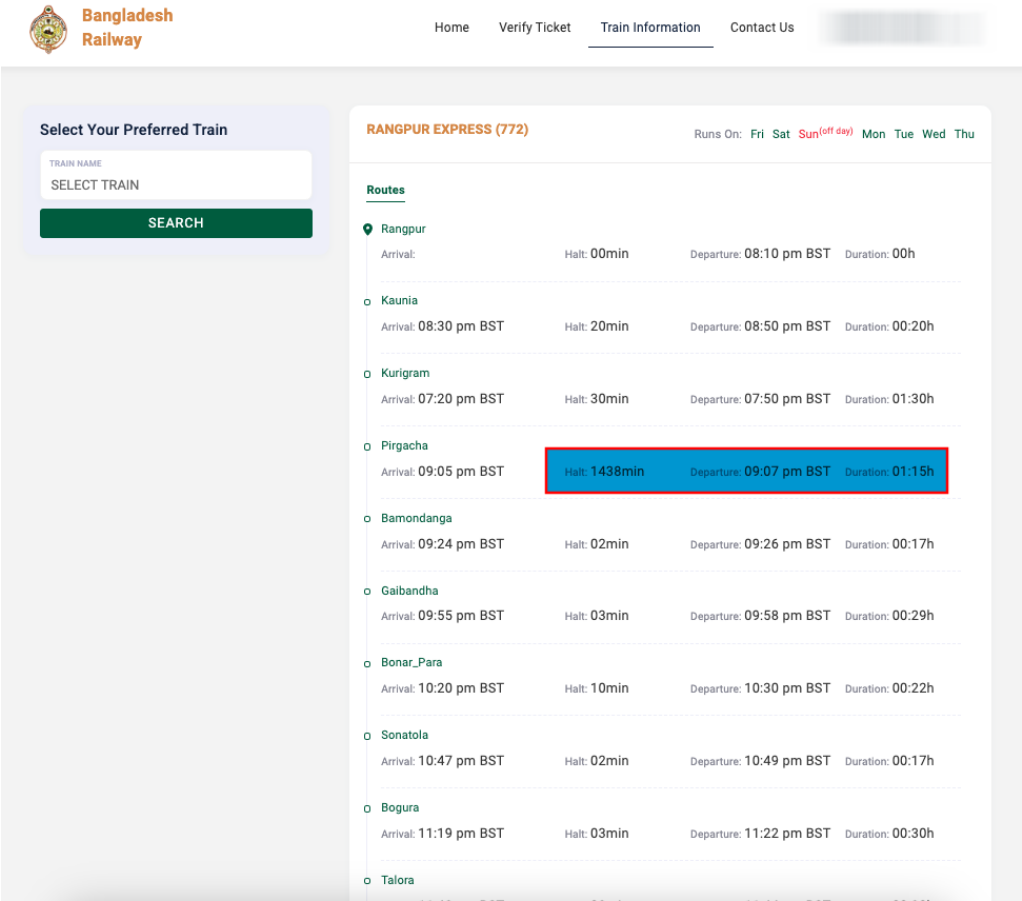


Figure 4.10: Train schedule display showing accessibility issues with time format, technical terminology and proper language support.

These issues collectively impact the user experience and could potentially deter users, especially those with limited digital literacy, from successfully using the online booking system.

4.2 Recommendations for Improving E-Government Website Usability

Through our ethnographic studies, admins and mediators provided several recommendations addressing both common challenges across platforms as well as unique issues specific to each service. Their recommendations highlight several technical and user support enhancements as well as process simplifications to increase the usability and efficiency of the systems.

4.2.1 BRTA Admin

While admins across all three platforms gave similar kinds of suggestions to tackle the challenges discussed in the previous section, BRTA admins also gave targeted suggestions to tackle the challenges present on their website and enhance user engagement.

4.2.1.1 User Support and Accessibility Initiatives

One of the BRTA officers stated, “Features like step-by-step tutorials and simplified interfaces could significantly improve usability,” indicating the importance of visual navigation guidance for this system. When further asked about user assistance, they stated that,

“They can get help from the Union Digital Center or their relatives in this regard. Regardless of this, they can contact BRTA directly.” - A5

However, the direct support system faces severe challenges due to a lack of manpower, as one admin stated,

“Manpower should be allocated 4x to 5x to deliver smooth service. According to the vast resources and users, the organizational structure isn’t sufficient. It is essential to develop. Otherwise, in the future, BRTA won’t be able to give service on their own.” - A3

To address the difficulties faced by limited digital literacy users, the officers suggested a possible collaboration with non-governmental organizations like NGOs for BRTA and users, as they won’t have to pay mediator fees for additional assistance. According to them, almost all limited digital literacy users highly rely on third-party mediators due to their insufficient understanding of the system. They noted,

“They can be someone who doesn’t have a smartphone. Even if she has a button phone, he/she can make a call and ask for immediate help. If any organization helps, it will be grateful and bring something very good.” - A1

4.2.1.2 Security Measures and Future Development

Further discussion revealed their steps on robust security measures like firewalls, VPNs, and IT audits, essential for maintaining user trust. According to one officer,

“Not fully, as there are many flexibilities. But all the data is not open like before. To get any information, the user has to submit documents. Until or unless the user gives his or her information to any other person, there is no opportunity to get the information openly.” - A5

Moreover, they emphasized their commitment to enabling independent portal access, stating

“We still try so that one can access and use the portal by themselves without third-party help. So measurements like NID validation, OTP, and Number validation are introduced so that BRTA can securely give service.” - A4

At the end of the session, they were asked about the most significant improvements and they emphasized the need for a BSP mobile application, stating,

“The organization is determined to conduct all the services fully online draw BSP portal. If there are any developed apps of the BSP portal to avail all the services in Android or iOS, it will be a great benefit as there are many differences between the BSP web version and app version.” - A2

Finally, Recognizing all these challenges and opportunities for improvement, the administrators emphasized the need for a comprehensive approach to enhancement and concluded that,

“Increasing manpower for hotline and user support, partnering with digital literacy programs, and prioritizing mobile app development could make the portal more user-friendly and inclusive.” - A1

4.2.2 Passport Admin

Passport admins gave similar types of suggestions where they highlighted the importance of visual content for guidance, recommending available video resources on YouTube for further assistance. One admin, A7, stated, “Videos are always helpful, and there is always video available on YouTube.” Regarding digital literacy issues, the admins acknowledged that mediator dependency cannot be fully reduced until users become familiar with digital devices and digital systems. However, they also stated that for those who are unfamiliar with the internet, seeking help from mediators remains the most practical option. Furthermore, they addressed the trust issues of users regarding security by stating,

“To build trust, we need more advertising and letting people know their data is safe.” - A6

This further indicated the need for visual content to create awareness among users with limited information and digital skills so that they can avail the benefits of this system. Moreover, they addressed issues like lengthy payment procedures and rescheduling systems. According to them, while the payment procedure needs updating, they viewed the rescheduling option as unnecessary once users reached the payment stage. When asked about the operational challenges, the passport admins similarly mentioned the NID server being down (although described as an isolated event).

4.2.3 NID Admin

One NID official, A9, primarily emphasized the website’s ease of use for younger generations. Regarding the users with limited digital literacy, he suggested that seeking mediators’ help can create an atmosphere of equity, which may be beneficial for this community of users. He also stated that the website in its current state is very easy to use and doesn’t need many changes. Finally, similar to the other website admins, he too emphasized the importance of visual content for users to have further assistance. On the contrary, he denied the claims made on NID websites being down, stating, “Our server is never down; we easily provide all the services.” To conclude, the administrator highlighted the importance of visual guidance and acknowledged mediator assistance as a practical solution for users with limited digital literacy.

4.2.4 BRTA Mediators

BRTA mediators gave critical recommendations to address the technical challenges and user experience gaps, emphasizing system stability and process efficiency.

4.2.4.1 Technical Enhancement

BRTA mediators identified various issues and suggested several improvements regarding these issues. One of the major challenges was technical issues like lack of server stability, and according to them, “The server should be always working”. They also suggested prioritizing website performance and website downtime reduction to enhance the user experience. Additionally, they emphasized the importance of fixing payment procedures and introducing automated refund systems and instant receipt-generating systems. As one mediator said,

“The payment rollback should not happen easily, and the payment cancellation process should be online.” - M9

Furthermore, they recommended newer features like online editing and a cancellation process, which will help users avoid the hassle of in-person visits to the BRTA offices. The mediators also suggested improving the complex ownership transfer process and license renewal for efficiency and better accessibility. Finally, they all agreed that the BRTA and NID data synchronization needs to be improved as it can help users avoid manual corrections. One mediator remarked,

“If I wanted to change something on the website, then I would have made the approval automatic. I would have connected the national ID server and BRTA server strongly and would have implemented such a feature that the application is approved automatically by cross-checking the databases.” - M6

The mediators emphasized the enhancement of the Frequently Asked Question (FAQ) section and step-by-step visual guidelines that can assist users in understanding the website instructions. As one mediator said,

“A live chat feature or an interactive FAQ section could greatly improve user support. This would give users quick access to answers and reduce the burden on the help center.” - M7

They also recommended adding an option where users can choose the nearest BRTA centers instead of being assigned automatically. One mediator said,

“If I could choose the preferred BRTA branch, that would be very helpful. There can be a user whose home is in Mirpur but office is in Uttara. They would most certainly prefer to attend their driving exam at Uttara BRTA, but we do not have that option to choose our preferred BRTA center.” - M6

Mediators also suggested implementing a mediator account system where they can have verified accounts to increase efficiency. One mediator said,

“If BRTA gave us an official account that is registered then it would be very helpful for us so we can provide service to customers from our accounts and they will also be relieved that we are certified by BRTA.” - M8

They also suggested improvements like “better support options,” Automated Vehicle retrieval options, and a “Contact Us” section for further usability enhancements.

4.2.5 Passport and NID Mediators

Both passport and NID mediators shared several key suggestions to improve the usability and efficiency of these e-government services. A primary concern among passport mediators was the frequent server downtime, which disrupted their work, causing frustration for both users and themselves. One mediator, M18, highlighted the fact by saying, “The server should be always working.”

Furthermore, they explained the poor synchronization between Passport and NID systems, which causes verification delays, and suggested a seamless integration to prevent errors and speed up the process. They strongly recommended a rescheduling option, as users need to undergo the same application process if they somehow miss the appointment. Finally, given that many users struggle to understand the system due to limited digital literacy, mediators advocated for visual content and live chats for better understanding and assistance. One mediator, M15, recommended, “Video tutorials would help clients become more independent.”

Similarly, the NID mediator, M19, revealed severe modification barriers and suggested the implementation of an online editing or cancellation feature to increase efficiency and reduce the hassle of in-person visits. He also highlighted critical language and data synchronization barriers and suggested, “NID should be provided after the SSC exam to make passport application easier,” to optimize a future passport application and ensure more seamless digital identity management.

4.2.6 User Survey

From the survey data we have seen the age distribution of users (42.3% aged 18-24, 26.3% aged 25-34, and 19.8% over 45) indicates the need for interfaces that accommodate different levels of digital comfort. While younger users may adapt more easily, the significant presence of older users (19.8% over 45) suggests the

need for more inclusive design approaches. Also, despite high device ownership (97% smartphones, 70.6% computers), connectivity remains a major challenge, with 88.7% reporting connectivity issues. This suggests that improvements must address both interface design and infrastructure reliability. The varying levels of online engagement (51.9% spending more than five hours daily online, while others report limited usage) indicate the need for systems that work effectively even for infrequent users.

4.2.7 Technical and System Enhancements

Based on our survey findings, several critical technical improvements are needed to enhance the usability of Bangladesh's e-government services. These enhancements focus on creating more robust and reliable platforms that can serve all citizens effectively, regardless of their digital literacy levels.

Server infrastructure emerges as a primary area requiring enhancement. The overall reports of server downtime and slow performance across all platforms indicate the need for significant capacity improvements. For the Railway E-Ticketing system in particular, users strongly emphasize the need for better server capacity to handle peak loads, especially during high-demand times. As one respondent noted regarding BRTA services, "Server needs to be more speedy and secure," - P190 highlighting how fundamental these improvements are for user experience.

Database integration between government services requires substantial enhancement. The current disconnect between various systems, particularly evident in the NID-Passport integration, creates unnecessary complications for users. One respondent, P105's experience, illustrates this need. He shared, "The service should incorporate proper guidelines. Alongside, they have to make sure that their data is up-to-date with other government databases." Implementing better database synchronization would streamline processes and reduce the need for repeated data entry.

Payment systems across all platforms need significant upgrades. Users consistently report issues with transaction processing and refund mechanisms. The Railway E-Ticketing platform particularly needs improvements in this area, as evidenced by user comments like, "Make ticketing system easy and refund system easier and less time-consuming" (P240). Implementing more reliable payment gateways and automated refund processing would enhance user confidence in digital transactions.

Mobile responsiveness requires comprehensive enhancement across all platforms. With 97% of users owning smartphones and many preferring mobile access, the platforms must be optimized for mobile devices. As one E-Passport user suggested,

"The portal needs better optimization for mobile devices; certain buttons and forms were difficult to interact with on smaller screens." - P112

This enhancement should include a responsive design that maintains functionality across all device types.

Real-time status updates and notifications emerge as another critical area for improvement. Users expressed frustration with the lack of immediate feedback on

their transactions and applications. Implementing automated notification systems would keep users informed about their application status, payment confirmations, and processing timelines, reducing anxiety and the need for frequent manual status checks.

Error handling systems need significant enhancement to provide more useful feedback to users. Current error messages often fail to guide users toward solutions, leading to frustration and increased dependence on external help. One user, P112, noted about the E-Passport system, “When there is a submission error, the error messages could be more specific to help users resolve the issues quickly.” Implementing more informative error messages with clear resolution steps would empower users to solve problems independently.

Load balancing and queue management systems require particular attention, especially for high-traffic services like Railway E-Ticketing. During peak periods, platforms need better mechanisms to manage user load and maintain service stability. This enhancement would address issues like those described by P158, “Website crash and Eid situation not able to book tickets. 100% worst (The website crashes due to the Eid rush, I couldn’t book tickets. It was the worst experience.” These technical enhancements should be implemented with a focus on maintaining simplicity and accessibility for users with limited digital literacy. The goal is not just to add features but to create more reliable, responsive, and user-friendly platforms that serve all citizens effectively.

4.2.8 User Support and Guidance

Our survey findings strongly indicate the need for comprehensive support systems and improved guidance across all e-government platforms. The data reveals that while many citizens attempt to use these services independently, they often require assistance due to insufficient support resources.

The BRTA portal exemplifies this need for enhanced support, with 84.4% of users indicating that additional guidance through tutorials and help videos would improve usability. The current support infrastructure shows significant gaps, with 31.3% of users reporting difficulty in accessing help options. This situation frequently leads to dependency on external assistance, as evidenced by the substantial portion of users requiring help from family members, friends, or mediators to access government services. The survey data reveals concerning levels of reliance on intermediaries across different e-government platforms. Approximately 7% of BRTA service users reported requiring mediator assistance, while the figures stand at 11% for e-Passport services, 9% for NID services, and 6% for railway e-ticketing services. This number is even higher for users with lower digital literacy. This widespread dependence on third-party assistance raises significant privacy concerns, as users must share sensitive personal information with intermediaries to complete their transactions. One user’s suggestion captures the common sentiment:

“The BRTA website should introduce a dedicated help section for editing information and establish an active call center for assistance.” - P179

For the E-Passport service, users overwhelmingly support the introduction of additional guidance resources, with 85.9% indicating such materials would enhance usability. The preferred forms of support show a clear pattern: step-by-step video tutorials (87 respondents), visual guides with screenshots (79 respondents), and live chat support (69 respondents). This diverse preference for support options suggests the need for a multi-faceted approach to user assistance, accommodating different learning styles and comfort levels with technology.

The NID portal's support requirements are particularly critical given its fundamental role in digital identity verification. Users express strong preferences for help videos (29.09%), visual guides with screenshots (26.87%) and FAQs (21.33%). The high demand for additional support resources (81.3% favoring their introduction) indicates that current guidance materials are insufficient. As one user noted, clear guidelines are essential, especially when dealing with data verification across different government services.

The Railway E-Ticketing platform, despite showing relatively high user independence (54.6% reporting never needing assistance), still demonstrates a strong demand for additional support resources. Users express particular interest in step-by-step tutorials (85 respondents) and help videos (58 respondents), suggesting that even confident users value comprehensive guidance materials.

Across all platforms, several key support improvements emerge as essential:

- The need for multi-language support is evident, ensuring instructions are clear in both Bangla and English. This becomes particularly important for services like e-passports, where accurate information is crucial for international travel.
- Interactive guidance systems, such as live chat support, emerge as a highly requested feature. This would provide real-time assistance without requiring users to visit physical offices or rely on mediators.
- Context-sensitive help features are needed to provide immediate assistance at specific points in various processes. Users expressed frustration with having to search extensively for help with particular steps or requirements, suggesting the need for more intuitive support integration.
- The findings also highlight the importance of proactive support mechanisms. Instead of waiting for users to encounter difficulties, platforms should anticipate common challenges and provide guidance preemptively. This could include automated prompts, tooltips, and interactive tutorials that guide users through complex processes step by step.

These support enhancements must be implemented with consideration for users of all digital literacy levels, ensuring that assistance is accessible and helpful regardless of technical expertise. The goal is to create an environment where users feel supported and confident in their ability to navigate these essential government services independently.

4.2.9 Process and Policy Improvements

Our survey findings reveal crucial areas where process refinement and policy adjustments could significantly enhance the accessibility and effectiveness of Bangladesh's e-government services. These improvements would particularly benefit users with limited digital literacy who currently struggle with complex procedures.

The BRTA portal requires fundamental process simplification. Users consistently report challenges with document requirements and verification procedures. As one respondent articulated,

“The BRTA website should introduce a dedicated help section for editing information...Some of their document requirements are unnecessary, making it difficult to gather the needed paperwork.” - P179

This feedback suggests the need for streamlined documentation requirements and more straightforward verification processes. Furthermore, the inability to make corrections to submitted information emerges as a significant pain point, indicating the need for a more flexible system that allows users to edit their submissions without requiring complex administrative procedures.

The E-Passport service demonstrates the need for more efficient processing systems. Users express particular frustration with the current requirement to resubmit documents physically after online submission. As one respondent clearly stated,

“I should be able to submit all my documents online, I do not want to resubmit the documents offline after submitting it online...” - P117

Another critical process improvement needed relates to error correction capabilities. As highlighted by one user:

“Ekbar apply korar pore data edit kora jay na eta thik kora dorkar” (After applying once, data cannot be edited - this needs to be fixed.)” - P200

The NID portal requires significant policy adjustments regarding data management and correction procedures. The current system's rigidity in handling information updates creates unnecessary complications, particularly when citizens need to synchronize their NID information with other government services. The survey reveals a strong desire for more straightforward procedures for information updates and corrections. As one respondent noted about the data synchronization issues:

“The service should incorporate proper guidelines. Alongside, they have to make sure that their data is up-to-date with other government databases.”
- P105

The Railway E-Ticketing platform needs process improvements, particularly in its payment and refund systems. Users advocate for more streamlined payment procedures, with one respondent specifically suggesting:

“20-tk service should be added to a single purchase. The charging system for ‘Every Single Ticket’ should be omitted. Prompt refund system should exist.” - P226

The booking process during peak periods also requires policy attention, with users suggesting the implementation of fair queuing systems and more transparent ticket allocation procedures.

Across all platforms, several universal process improvements emerge as essential:

- Standardization of interfaces and procedures across different e-government services would help users transfer their learning from one platform to another. Currently, each service operates with different interfaces and requirements, creating unnecessary learning curves for users.
- The implementation of clear security protocols and privacy policies needs to be more transparent to users. This would help address the prevalent trust deficit identified in our survey, where significant portions of users express low confidence in platform security.
- The development of comprehensive user feedback systems would allow for continuous improvement based on user experiences. Current systems often lack clear channels for users to report issues or suggest improvements.
- The need for more flexible correction mechanisms is universal across all platforms. Users should be able to correct minor errors in their submissions without requiring complex administrative procedures or in-person visits to government offices.

These process and policy improvements should be implemented with a focus on reducing bureaucratic complexity while maintaining necessary security and accuracy standards. The goal is to create more user-friendly systems that encourage independent use of e-government services while reducing dependence on mediators or in-person assistance.

Chapter 5

Discussions

At first glance, Bangladesh’s e-government landscape looks vibrant. The public can, in principle, renew a driver’s licence through the BRTA portal, correct a national ID on the NID Online site, order a biometric e-passport, or buy train tickets on the Rail Sheba app. These initiatives exemplify Digital Bangladesh, the policy banner first unfolded in 2009 to signal a break with slow, paper-heavy bureaucracy. Yet fieldwork for this thesis, 293 user survey responses, 28 semi-structured interviews with administrators and mediators, and a Nielsen-based heuristic assessment of four portals, reveals a contrary gap between official rhetoric and lived reality.

This comprehensive research dives into the usability challenges of Bangladesh’s e-government platforms reveals a complex landscape where technological advancement intersects with persistent digital literacy barriers, creating what we might call a ‘digital democracy paradox.’ To understand this paradox, imagine a beautifully designed bridge that can only be crossed by those who already know how to navigate its complex entry points. This is precisely what we observe in Bangladesh’s digital government ecosystem. Our findings illuminate critical gaps between the government’s digital transformation aspirations and the lived realities of citizens attempting to access essential services online.

5.1 Connecting Findings to Existing Literature and Research Questions

Let us begin by examining how our research questions guided us toward understanding these challenges. Our first research question sought to identify the specific usability challenges faced by users with limited digital literacy when interacting with Bangladesh’s e-government websites.

5.1.1 Usability Challenges for Limited Digital Literacy Users

The evidence overwhelmingly demonstrates that these challenges are multifaceted and deeply interconnected, extending far beyond simple interface design issues. Our findings align with and expand upon the observations made by Islam and Inan (2021), who identified digital inequality as a persistent issue in Bangladesh, particularly affecting rural and underdeveloped areas [66]. However, our research reveals

something more nuanced and concerning. These challenges are not limited to geographic or socioeconomic divisions but permeate all levels of society, affecting even urban, educated users who struggle with poorly designed interfaces and unreliable technical infrastructure.

Consider this statistical reality: 88% of our respondents reported connectivity challenges across all platforms. This number represents more than a mere technical inconvenience; it reveals a fundamental barrier to digital participation that undermines the very foundation of e-government initiatives. When citizens cannot reliably access services due to server downtime, slow loading times, or payment processing failures, the promise of digital convenience transforms into a source of frustration and exclusion. This is like having a telephone system where only one in eight calls connects properly; the entire purpose of the technology becomes questionable.

5.1.2 Infrastructure and Technical Barriers

The technical and infrastructure barriers identified in our study echo the concerns raised by Jeba et al. (2020), who found a concerning 37% usability error rate in Bangladeshi government websites due to coding issues [57]. Our survey data supports and extends these findings dramatically. The infrastructure limitations not only affect basic accessibility but also contribute to broader issues of trust and reliability in e-government services.

The interface and navigation complexities we documented provide empirical support for the theoretical frameworks discussed by Twizeyimana (2017), who emphasized the critical importance of user-centered design in e-government implementation [36]. Our heuristic evaluation revealed systematic violations of basic usability principles across all examined platforms, from inconsistent terminology between language versions to cryptic error messages that do not guide resolution. These findings suggest that the gap between system functionality and user needs, identified by Twizeyimana as a key challenge in Rwanda’s e-government implementation, is equally pronounced in Bangladesh’s context.

5.1.3 Mediator Dependency as a Systemic Response

Perhaps most significantly, our research unveils the phenomenon of mediator dependency as both a symptom of usability failures and a coping mechanism that inadvertently perpetuates digital exclusion. While previous studies have acknowledged the role of intermediaries in digital service delivery, our investigation provides the first comprehensive analysis of mediator ecosystems in Bangladesh’s e-government landscape. The persistence of mediator dependency reveals a far more substantial challenge than a mere 7-11% assistance rate might suggest. Our statistical analysis demonstrates that assistance needs are dramatically higher across all platforms, with 80% of beginners requiring frequent help on the BRTA portal and 75% needing assistance with E-Passport services. Even the most accessible platform, Railway E-Ticketing, sees two-thirds of beginners unable to navigate independently. This widespread dependency represents not occasional assistance needs affecting a small minority, but systematic usability barriers that create endemic reliance on external help, a fundamental contradiction to the inclusive aspirations of the Digital

Bangladesh initiative that envisions independent citizen access to government services.

5.1.4 Security and Trust Issues

The security and trust issues identified in our study resonate with the findings of Shareef et al. (2009), who identified security and reliability as critical factors in Bangladesh’s e-government adoption [10]. Our data reveals that only 10-20% of users across platforms express confidence in security measures, indicating that trust deficits remain a persistent barrier more than a decade after Shareef’s initial observations. This continuity suggests that addressing security concerns requires more than technical improvements; it demands a fundamental reconsideration of how the government communicates about data protection and builds citizen confidence in digital systems.

5.2 Proposed Solutions: Building an Inclusive Digital Government Ecosystem

Our second research question focused on how e-government website usability can be improved while considering varying digital literacy levels. The solutions we propose are grounded in both our empirical findings and international best practices, designed to address the root causes of usability challenges rather than merely treating their symptoms.

5.2.1 Addressing Informal Mediator Systems

Having identified these systemic challenges in Bangladesh’s e-government landscape, we now turn to practical solutions that can address the root causes of usability barriers while building upon the existing digital service ecosystem. Our proposed solutions are designed to work with, rather than against, current user behaviors and system dependencies.

5.2.1.1 Current Challenges and Risks

The current reliance on informal mediators for accessing e-government services, while addressing immediate user needs, creates several significant risks and challenges that undermine the security, equity, and effectiveness of digital government initiatives. The most critical concern with the current mediator ecosystem is the substantial security risk it poses to citizen data. When individuals seek assistance from informal mediators, they must share highly sensitive personal information, including National ID details, financial information, and other confidential documents, with unauthorized third parties who operate without government oversight or formal data protection protocols.

Our research revealed numerous instances where citizens expressed concerns about data misuse, with some respondents noting that they had experienced deception or exploitation by mediators. These informal service providers often lack proper data handling procedures, secure storage systems, or accountability mechanisms, leaving citizens vulnerable to identity theft, financial fraud, and privacy breaches.

The current system creates an additional financial burden on citizens who are often least able to afford it. Citizens with limited digital literacy, frequently those from lower socioeconomic backgrounds, must pay mediator fees on top of official government service charges. This creates a regressive system where those who most need support bear additional costs for accessing basic government services.

Furthermore, the lack of standardized pricing allows some mediators to exploit citizens' desperation or limited knowledge by charging excessive fees for services that should be accessible at official rates. This financial barrier contradicts the fundamental principle that government services should be equally accessible to all citizens regardless of their economic status.

Without government oversight or standardized training requirements, the quality of mediator services varies dramatically. Some mediators may lack adequate technical knowledge, leading to errors in applications or incomplete service delivery. Others may not understand the full range of available services, potentially limiting citizens' access to benefits or services they are entitled to receive.

This inconsistency creates an unreliable service environment where citizens cannot be assured of receiving accurate, complete, or timely assistance. The lack of accountability mechanisms also means that citizens have little recourse when mediator services fail to meet their needs or when errors occur.

5.2.1.2 Model 1: One-Stop Digital Solution Centers

To address these significant challenges while maintaining the human-centered support that many citizens require, we propose two complementary models that professionalize and secure mediator services:

Building upon the existing need for assisted digital services, we envision the creation of comprehensive one-stop digital solution centers located strategically in community hubs and near major government offices. This was initially inspired by the Union Information and Service Center (UISC) as discussed by Hoque & Sorwar (2015) [25]. These centers would replace the current fragmented network of informal mediators with professionally managed facilities that maintain consistent service standards while ensuring data security and eliminating exploitative practices.

These centers would be designed using universal design principles, ensuring accessibility for users with varying abilities and digital literacy levels. Each center would feature multiple service stations equipped with assistive technologies and multilingual support systems. Most importantly, these centers would operate under strict government oversight with formal data protection protocols, ensuring that citizens' sensitive information remains secure throughout the service process.

The one-stop model tackles the fragmentation that presently defines Bangladesh's e-government landscape, where citizens must navigate multiple platforms with different interfaces and requirements. By providing a unified service environment with consistent support standards, these centers would reduce the cognitive load on users while ensuring equitable access to government services at official rates without additional mediator fees.

All support staff would receive formal government certification through comprehensive training programs covering technical skills, digital literacy support methods, data privacy protocols, and customer service standards. This certification process would require staff to pass regular assessments and maintain continuing education

requirements, ensuring service quality remains consistently high and addressing the current issues of inconsistent service delivery.

Additionally, recognizing the gender disparity among mediators, who are predominantly male, the government could facilitate the recruitment and certification of women as service providers at these centers. This step would significantly benefit women users who may feel uncomfortable or face societal restrictions in seeking assistance from male mediators. By creating an inclusive environment staffed by both men and women, the one-stop digital solution centers would be more accessible to women, particularly in the conservative social context of Bangladesh. This approach would encourage greater gender equality in digital services and enhance overall service uptake among women.

5.2.1.3 Model 2: Enhanced In-House Digital Support Systems

For government offices that continue to require physical presence for certain services, we propose significantly expanding and professionalizing the existing internal support systems. Rather than citizens relying on external mediators who charge additional fees and may compromise data security, each government office would be equipped with an adequate number of trained digital support specialists.

This model recognizes that many government offices already have some form of internal support, but these systems are often understaffed and inadequately trained. Our proposal involves dramatically increasing the number of in-house digital support specialists and providing them with comprehensive training in both technical skills and customer service methodologies.

These in-house specialists would assist citizens with online processes during their visits, ensuring that even traditionally offline interactions incorporate digital efficiency benefits. By providing expert digital assistance within government offices, citizens can experience the benefits of digital systems while maintaining complete data security under direct government supervision.

This approach directly addresses the two most critical issues with the current external mediator system: security risks and additional financial burden on citizens. When citizens receive assistance from government-employed specialists, their sensitive personal information remains within official channels with proper security protocols, and they incur no additional service fees beyond official government charges. Citizens visiting government offices would be guided through streamlined digital processes by knowledgeable government employees who can address both technical and procedural questions. This approach transforms the traditional bureaucratic experience into a supported digital journey while maintaining complete security and eliminating additional costs.

5.2.1.4 Economic and Employment Benefits

Both models work together to create a comprehensive support ecosystem that eliminates the risks and exploitation associated with informal mediators while maintaining necessary human assistance. The one-stop centers serve communities by providing accessible, professional digital assistance for routine services, while enhanced in-house support ensures that citizens visiting government offices receive the help they need without compromising their security or paying additional fees. This

dual approach gradually reduces dependency on informal mediators while building systematic capacity for inclusive digital government service delivery.

Our research findings highlighted critical needs for online support systems, with users across platforms expressing strong preferences for live chat support and real-time assistance. The certified support specialists could seamlessly provide both in-person and online support services, staffing live chat systems, video calls, and telephone helplines during lower in-person demand periods. This hybrid approach maximizes human resource utilization while serving citizens both physically and digitally, creating meaningful employment opportunities that contribute to economic development and improved government service delivery.

Other than that, these structured support models offer significant economic benefits by transforming thousands of existing informal mediators into certified government support specialists with stable employment and professional recognition. This transition would create substantial job opportunities, directly contributing to unemployment reduction while formalizing the informal mediator economy.

5.2.2 Creating Comprehensive Developer Guidelines

While formalizing mediator systems addresses immediate user support needs, achieving long-term digital inclusion requires addressing the fundamental design inconsistencies that create usability barriers in the first place. This necessitates a systematic approach to how e-government platforms are conceived, developed, and maintained.

5.2.2.1 Understanding the Core Problems

Our extensive research across Bangladesh’s e-government platforms has revealed several critical issues that fundamentally undermine the citizen experience and hinder digital inclusion. These problems create barriers not just for users with limited digital literacy, but for all stakeholders in the e-government ecosystem.

One of the most significant challenges we identified is the disconnect between government security measures and citizen perception. While administrators consistently emphasized robust security protocols, with one BRTA official stating, “We use VPN while accessing sensitive information, so it is very secure”, our survey data reveals a stark reality: only 10.3% of BRTA users, 16.8% of e-Passport users, and 17.4% of NID users expressed confidence in platform security.

This trust deficit stems not from inadequate security measures but from poor communication design. Current government websites present privacy policies and security information as dense, plain-text documents that fail to instill confidence. Citizens cannot easily understand what security measures are in place or how their data is protected. As one passport administrator noted, “To build trust, we need more advertising and letting people know their data is safe”, highlighting the critical need for better security communication through design.

Each e-government platform operates as an isolated digital island, with its own interface conventions, terminology, and user flow patterns. Citizens must relearn basic interaction patterns for every service they access. Consider this: a citizen applying for a driving license through BRTA encounters one type of form validation and error messaging, but when the same citizen applies for a passport, they face entirely

different interface patterns and feedback mechanisms. This fragmentation creates compounding difficulties for users with limited digital literacy. Every new platform requires starting the learning process from zero, making it nearly impossible for these users to develop transferable digital skills.

Our heuristic evaluation revealed critical flaws in how these platforms handle user errors. For example, the BRTA system accepts invalid NID information during registration, only to present cryptic error messages after users complete subsequent steps. The NID portal requires rural users to provide holding numbers that may not exist in their areas, with no guidance for alternatives. These design failures force users to either provide incorrect information or abandon their applications entirely. The current system’s usability problems create cascading effects throughout the entire e-government ecosystem. Citizens who cannot navigate platforms independently turn to mediators, creating privacy risks as they must share sensitive personal information with third parties. Government offices receive increased calls for technical support, straining resources. Most critically, these barriers exclude citizens from accessing essential services, undermining the fundamental goals of digital governance.

5.2.2.2 The Bangladesh E-Government Development Framework

To address these systemic issues, we propose the creation of a standardized development framework specifically tailored for Bangladesh’s e-government ecosystem. This approach draws inspiration from civil engineering, where construction projects, regardless of their architectural uniqueness, must comply with government-established building codes and safety standards.

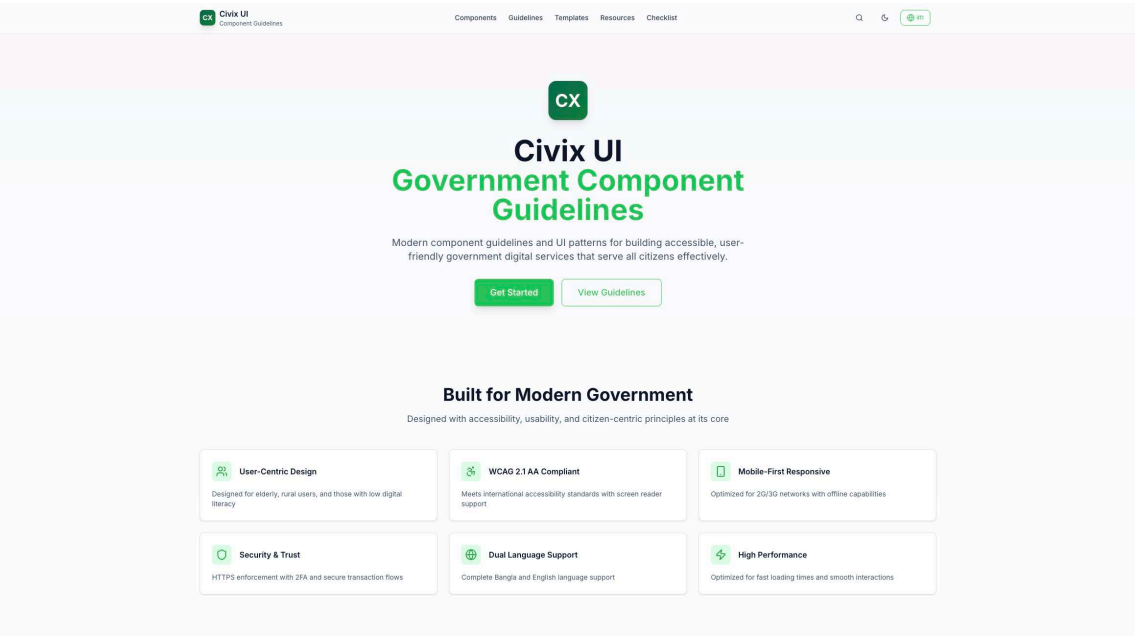


Figure 5.1: Civix UI: a government component guideline - Homepage

The Component Library Approach

Our proposed framework, prototyped at Civix UI (Figure 5.1 showing the homepage of the component library), how standardized components can maintain design consistency while addressing the specific challenges identified in our research. The framework centers around three core elements:

1. Comprehensive Component Library

The framework provides pre-built, tested, and accessible interface components designed specifically for government services. These include form elements optimized for different literacy levels, navigation systems that remain consistent across platforms, and error-handling mechanisms that provide clear, actionable guidance. Each component incorporates features such as progressive disclosure, contextual help, and clear visual hierarchies. Individual components, such as this government-optimized password field as demonstrated in Figure 5.2, include real-time strength indicators and security requirements. This eliminates the need for each contractor to reinvent basic functionality while ensuring a consistent user experience across all platforms.

The screenshot displays the 'Password Field' component within the Civix UI Component Library. On the left, a sidebar lists various components under categories like 'Components', 'Complex Components', and 'Examples'. The 'Password Field' component is highlighted. The main content area shows the 'Password Field' component with a description: 'Secure password input component with visibility toggle, strength indicator, and validation features for government applications and sensitive data collection.' Below this, the 'Password Strength Indicator' is shown with a visual feedback bar indicating 'Strength: Weak'. The 'Government Password Requirements' section lists specific rules for password creation, such as 'At least 8 characters' and 'One uppercase letter'. The 'Use Cases' section provides examples of where this component is used, including 'Account Security' and 'Government Systems'.

Figure 5.2: Component library - Password requirements

For example, instead of each platform creating its form validation system, all government services would use standardized form components that provide consistent feedback patterns. Users who learn to fill out a form on the BRTA platform would immediately understand how to complete forms on the passport or NID platforms.

2. Built-in Compliance and Quality Assurance Features

Our framework includes an integrated checklist system that ensures developers meet usability and accessibility standards. This progress tracking interface shows real-time compliance monitoring across six core domains: Security &

Privacy, Accessibility, Localization, Performance, User Experience, and Content & Documentation. The system transforms abstract usability principles into concrete, measurable requirements.

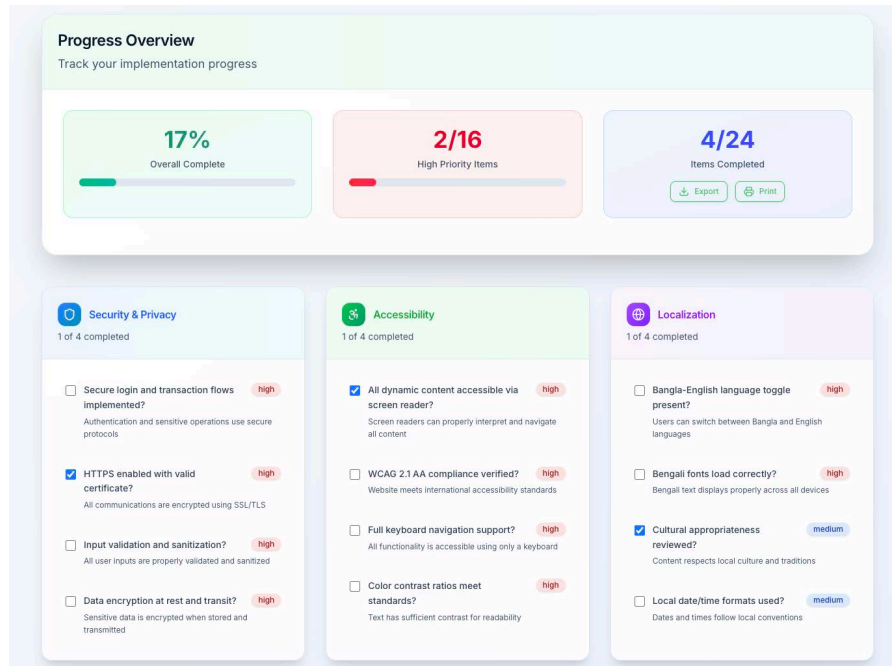


Figure 5.3: Civix UI - Checklist page

As illustrated in Figure 5.3, the checklist transforms abstract usability principles into concrete, actionable requirements. For instance, rather than simply requiring “accessible design,” the checklist specifies contrast ratios, keyboard navigation patterns, and screen reader compatibility standards. This systematic approach ensures that accessibility and usability become integral parts of the development process rather than afterthoughts.

3. Communication Templates for Trust Building

The framework includes a professionally designed template library as demonstrated in Figure 5.4, for essential trust-building pages such as privacy policies, security explanations, and help documentation. These templates transform dense legal text into visually engaging, easy-to-understand presentations that effectively communicate security measures to users.

For example, current government websites typically present privacy policies as overwhelming walls of text that few users read or understand. Our framework’s privacy policy template uses progressive disclosure, visual icons, and plain language to help users understand exactly how their data is collected, used, and protected. An example of this approach can be seen in our redesigned E-Passport interface Figure 5.5, which transforms dense legal text into user-friendly visual presentations. This design-first approach to security communication directly addresses the trust deficit revealed in our research.

For citizens, particularly those with limited digital literacy, the standardized framework would create transferable skills that work across all government platforms.

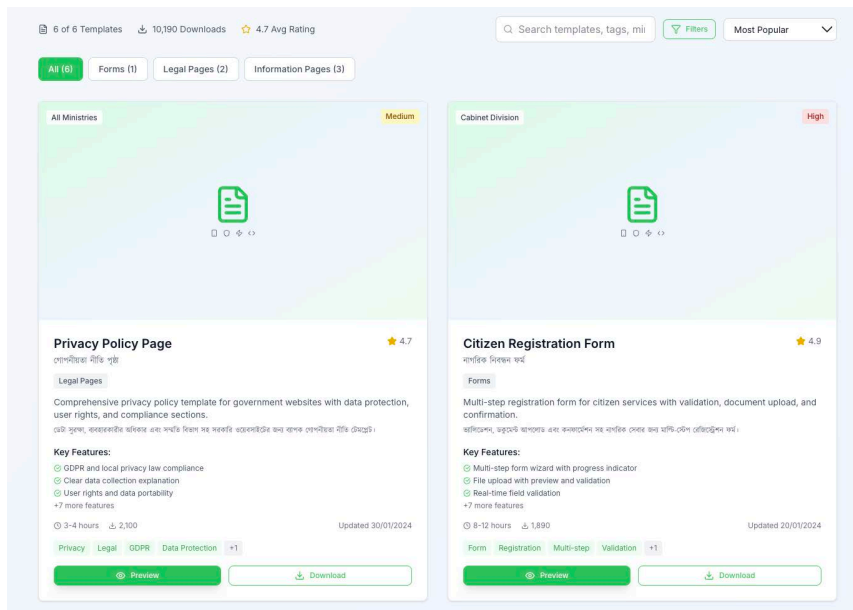


Figure 5.4: Civix UI - Templates page

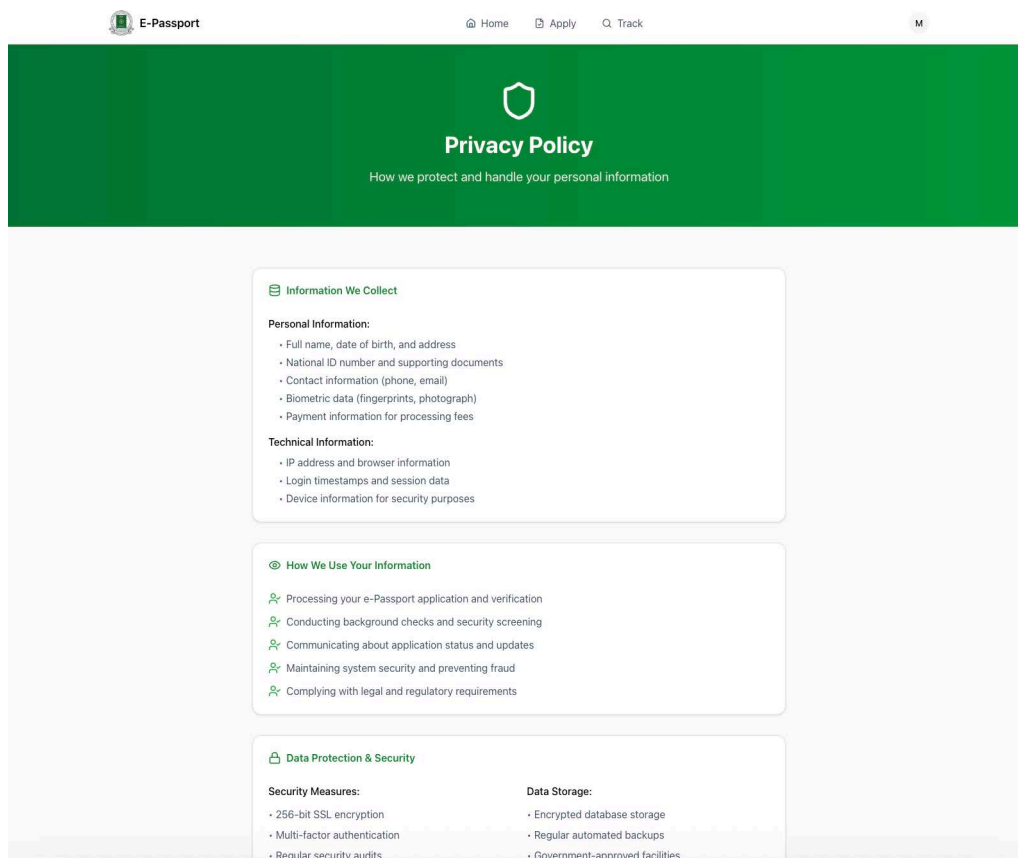


Figure 5.5: E-Passport Re-imagined: privacy policy page

Once a user learns to navigate one government service, they can apply that knowledge to any other service. This dramatically reduces the learning curve and builds confidence in digital government interactions.

The framework's emphasis on clear error prevention and recovery means fewer failed transactions and less frustration. Users would receive consistent, helpful feedback when problems occur, along with clear guidance on how to resolve issues. The improved security communication would build trust, encouraging more citizens to use digital services independently.

For government agencies, the framework would address the fundamental inefficiencies of the current multi-vendor approach. Instead of each contractor reinventing basic interface patterns, developers could focus on implementing the unique functionality required for each service.

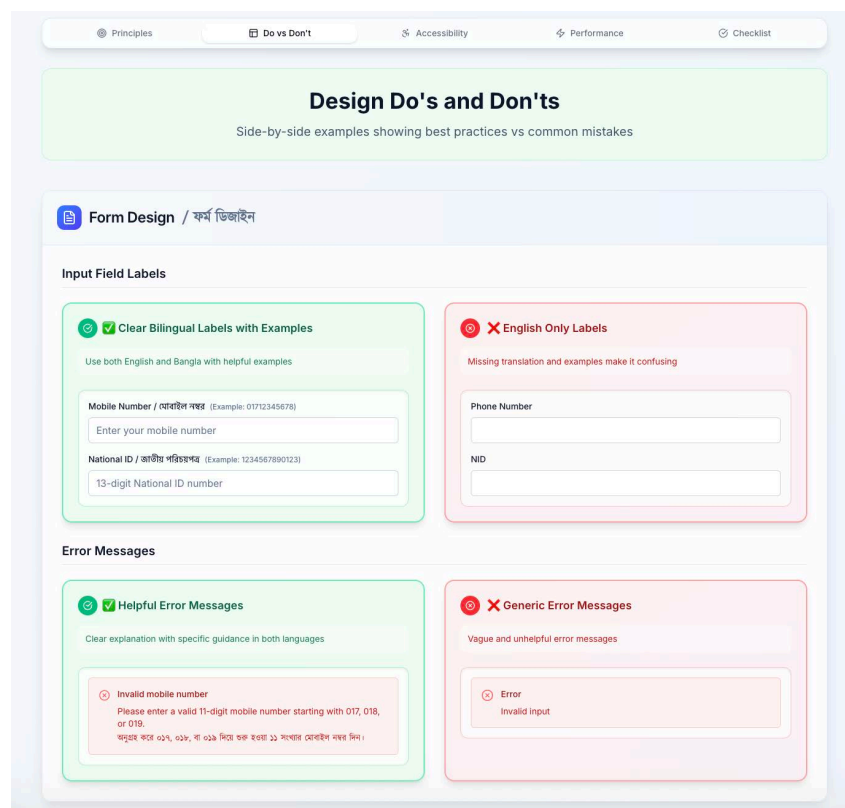


Figure 5.6: Civix UI: Guidelines page

The framework provides concrete guidance through side-by-side comparisons of best practices versus common mistakes. As shown in Figure 5.6, showing the Dos and Don'ts with clear examples, rather than just handing over the written guidelines on what a component should look like, is a better option. The standardized approach would significantly reduce development costs and timelines. Government technical staff would need to learn only one system, rather than managing multiple, incompatible platforms. Quality assurance would become more straightforward, as all platforms would share common architectural patterns and component libraries.

5.2.2.3 Implementation Strategy and Compliance Mechanisms

The framework would be implemented through a phased approach that ensures a smooth transition while maintaining service continuity:

- **Phase 1: Framework Development and Testing**
 - Complete development of the core component library
 - Conduct extensive user testing with citizens across different literacy levels
 - Refine components based on feedback and usability data
 - Develop comprehensive documentation and training materials
- **Phase 2: Pilot Implementation**
 - Select 2–3 high-traffic government services for initial implementation
 - Train government technical staff and selected contractors
 - Monitor performance metrics and user feedback
 - Refine the framework based on real-world usage
- **Phase 3: Full Deployment**
 - Integrate framework requirements into all government technology procurement processes
 - Establish compliance monitoring and auditing procedures
 - Implement training programs for all government contractors
 - Begin systematic migration of existing platforms to framework standards
- **Compliance and Quality Assurance:** Government procurement processes would require contractors to demonstrate proficiency with the standardized framework and commit to using approved components. Regular auditing processes would verify compliance, similar to how building inspections ensure construction code adherence. Non-compliant implementations would require remediation before project acceptance, creating strong incentives for proper standard adoption.

5.2.2.4 Expert Validation and Practical Validity

To validate the practical feasibility of our proposed framework, we developed a comprehensive prototype of the e-Passport portal that demonstrates how the standardized components and design principles could be implemented in practice. This working prototype as shown in the Figure 5.7, served as a concrete example during expert consultations, allowing industry professionals to evaluate the framework’s real-world applicability rather than abstract theoretical concepts.

The prototype encompasses multiple key pages that address the specific usability challenges identified in our research. Each page is designed to tackle pain points observed from surveys, interviews, and heuristic evaluations.

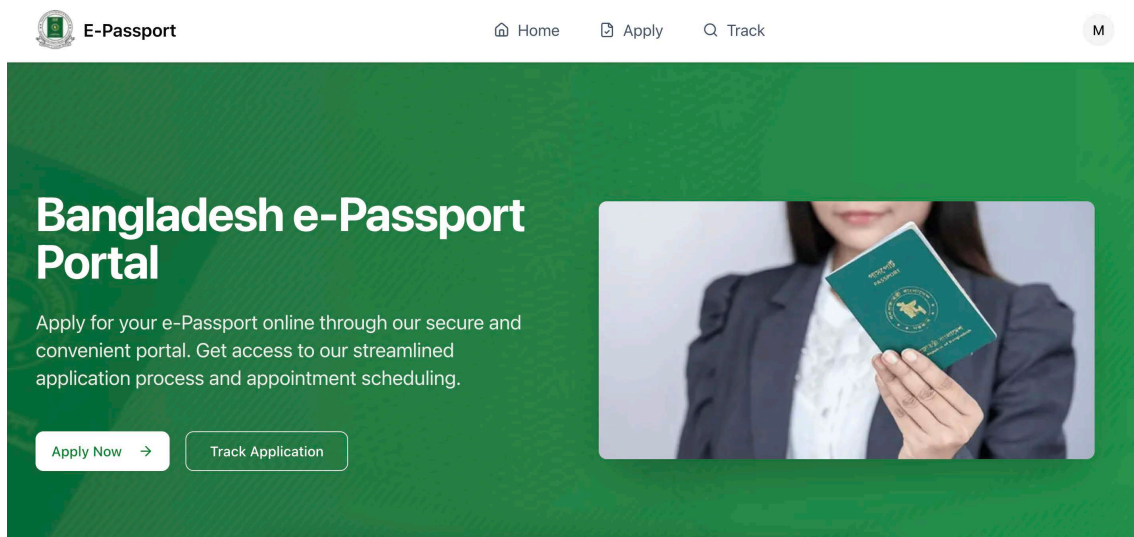


Figure 5.7: E-Passport re-imagined portal homepage - Prototype

1. **Streamlined application form with automatic NID data fetching and clear progress indicators.**

Figure 5.8 demonstrates how users can quickly fill out applications by automatically retrieving their National ID (NID) information, thus reducing manual entry and the risk of mistakes. Clear progress indicators guide users through each step, improving transparency and reducing anxiety, especially for users with limited digital literacy.

2. **Intuitive application tracking system with real-time status updates and clear next steps.**

After submission as illustrated in the Figure 5.9, users can easily track their application status in real-time. This system reduces uncertainty and helps users, especially those unfamiliar with digital processes, understand what to expect next and if any action is needed on their part.

3. **Transparent fee structures with multiple payment options.**

The payment page demonstrated in Figure 5.10 clearly outlines all applicable fees, due dates, and provides several payment options (e.g., bKash, Nagad, card). This transparency addresses user concerns about hidden or confusing costs and builds trust, especially for financially sensitive users.

4. **Comprehensive documentation requirements presented visually and by category.**

Required documents are organized by category and illustrated with icons or images represented in Figure 5.11, helping users quickly identify what they need to submit. This reduces cognitive load, especially for users with limited reading skills or digital experience.

Expert validation of our prototype framework has been overwhelmingly positive. Digital development specialists noted that such standardization would significantly improve both development efficiency and user experience consistency. Professionals

e-Passport Application

Complete all steps to submit your e-Passport application. Your registered data will be automatically fetched from NID records.

1

2

3

4

5

6

7

Personal Information

Contact Details

Passport Options

Documents

Payment

Appointment

Review & Submit

Personal Information

Enter your NID number to automatically fetch your registered details, or fill in manually

Quick Start - Fetch from NID

Fetch Details

✔

✔ Successfully fetched details for Abdul Karim

📄

Found 1 existing passport(s) - Eligible for renewal

📄

Birth certificate verified

Full Name

Enter your name exactly as it appears on your NID

National ID (NID) Number

Date of Birth

📅

Place of Birth

Gender

Select gender

▼

Marital Status

Select marital status

▼

Profession

Continue

Figure 5.8: Streamlined application form with automatic NID data fetching and progress indicators

81

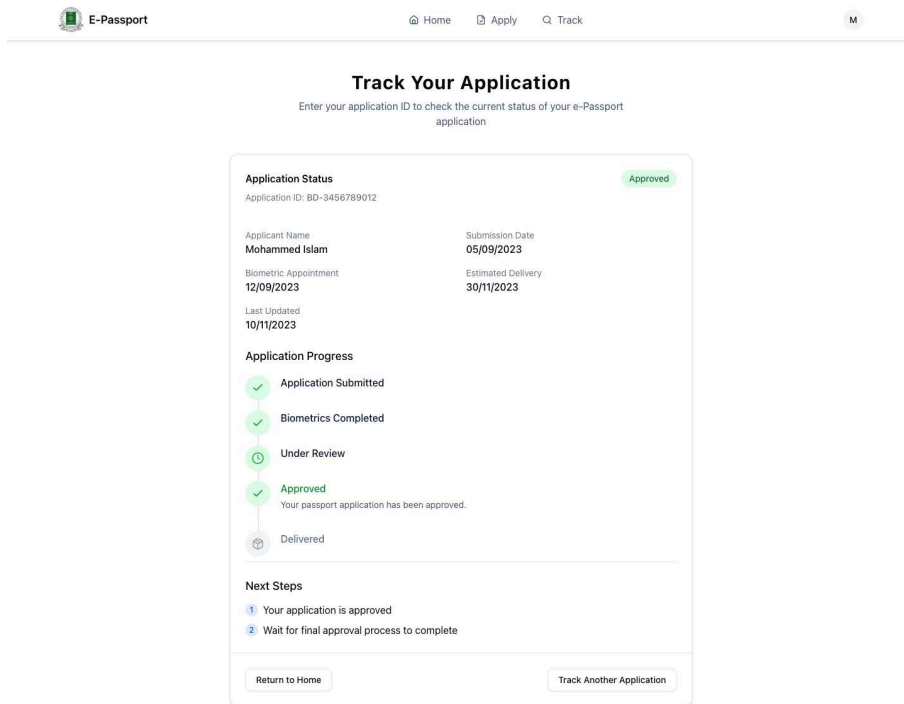


Figure 5.9: Real-time application tracking with clear status updates and guidance on next steps.

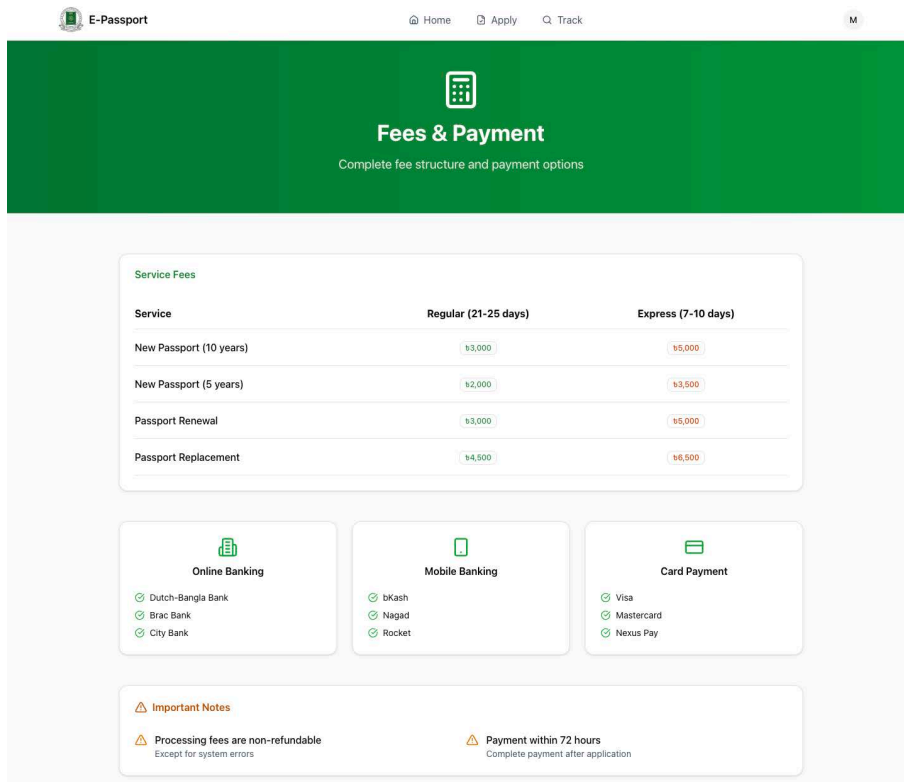


Figure 5.10: Transparent fee structures and multiple payment options

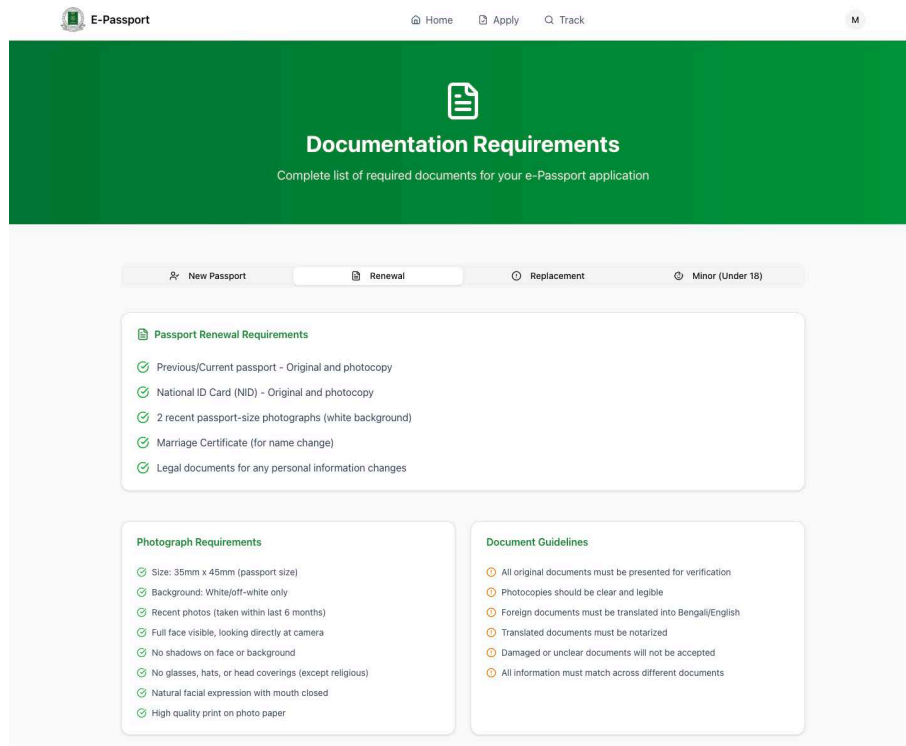


Figure 5.11: Documentation requirements displayed visually and by organized categories

with prior experience in creating digital services emphasized that the framework could reduce project timelines and operational costs while simultaneously enhancing the quality and reliability of service delivery.

The senior UI/UX designer who evaluated the system highlighted a critical gap in existing government design practices, namely, the absence of centralized, reusable UI components or documented design conventions. From their perspective, the framework's consistent structure, modular design elements, and prioritized checklist system offered a practical solution to this issue. The checklist, in particular, was praised for helping project teams navigate delivery timelines while maintaining adherence to accessibility and usability standards.

The accompanying feedback from the software engineering expert further reinforced the framework's technical viability. They affirmed that the system's token-based design and structured component naming conventions would streamline the development process and minimize confusion across vendor teams. Moreover, the expert emphasized that maintaining a centralized design system would significantly simplify future updates. For instance, if the government were to adopt a new phone number format, a single update to the central token or component could propagate across all integrated platforms, ensuring consistency while reducing redundant effort. Although individual vendor systems would still require updates on their end, the process will be much simpler. Both experts emphasized that successful adoption would depend heavily on institutional support, policy-level endorsement, and cross-departmental alignment.

The prototype-based validation approach proved particularly valuable, as experts could interact with functional examples of bilingual form components, transparent

fee structures, and user-friendly progress tracking systems. This hands-on evaluation method provided more actionable feedback than traditional paper-based reviews.

The standardized framework represents more than just a technical solution; it's a capacity-building initiative that would transform how Bangladesh approaches digital government development. By establishing clear standards and providing proven tools, the framework would enable the country to build truly world-class digital services that serve all citizens effectively. Over time, this approach would create a virtuous cycle: better user experiences would increase citizen engagement with digital services, providing valuable usage data to further refine and improve the platforms. As citizens develop stronger digital skills through consistent, well-designed interfaces, the overall digital literacy of the population would improve, creating conditions for even more advanced digital government initiatives. The framework's emphasis on accessibility and inclusion would ensure that Bangladesh's digital government transformation truly serves all citizens, regardless of their current digital literacy levels. This inclusive approach to digital governance could serve as a model for other developing nations facing similar challenges in bridging the digital divide while modernizing government services.

5.2.3 Critical Infrastructure Resilience

Beyond interface design and user support systems, Bangladesh's e-government ecosystem faces fundamental infrastructure vulnerabilities that undermine service reliability and citizen trust, requiring systematic technical interventions to ensure dependable digital service delivery.

5.2.3.1 Systemic Server Dependencies and Single Points of Failure

Our research revealed a critical vulnerability. Bangladesh's e-government ecosystem suffers from cascading failures when the NID server experiences downtime. When citizens attempt BRTA vehicle registration, e-Passport applications, or banking services, all depend on real-time NID verification. Server failure doesn't just affect NID services; it paralyzes the entire digital government ecosystem. This creates a 'single point of failure' scenario. Our interviews revealed mediators scheduling work around anticipated NID server availability, while government offices experience significant productivity losses during outages. Multiple administrators and mediators consistently identified NID server downtime as their primary technical challenge.

Importantly, our research uncovered a communication gap between agencies. The NID administrator denied frequent downtime, stating "Our server is never down," while BRTA administrators, passport mediators, and users across platforms regularly reported NID verification failures. This disconnect suggests inadequate monitoring of service inter-dependencies. So we have added our own automated uptime monitoring to the three main platforms (NID, BRTA, e-Passport) from February to April 2025 found extremely high service availability (NID: 98.68%, BRTA: 99.69%, e-Passport: 100%). The exception was the Railway E-Ticketing portal, which we could not test due to technical blocking of automated tools.

This evidence suggests that many “server down” complaints from users or mediators may actually be due to local internet connectivity issues or misunderstandings, rather than true server outages. This points to a communication gap: users frequently attribute any access failure to the government platform, when in fact the root cause may be on their side. Addressing this requires better user education and clearer communication from service providers, so that users can distinguish between their own connectivity issues and genuine platform outages.

However, it is also important to recognize that when BRTA administrators refer to ‘server issues,’ they may be highlighting problems not with the public website, but with internal API servers or back-end systems that ordinary users cannot see. These technical challenges often arise from multi-departmental coordination problems or outdated infrastructure within the government’s own digital ecosystem. As a result, miscommunication between different departments can lead to a cycle of blame-shifting, where neither users nor officials have a clear understanding of the root cause.

To overcome these challenges, process and policy improvements should focus on establishing clear lines of communication, regular cross-departmental technical reviews, and transparent reporting of both public-facing and internal system outages. Only then can the government reduce confusion, improve trust, and create a more user-friendly digital service environment. Besides policy reforms, technical solutions are also crucial to ensure the reliability and resilience of e-government platforms.

5.2.3.2 Proposed Technical Solutions

- 1. Distributed Architecture with Intelligent Caching:** Transition from centralized, tightly-coupled architecture to distributed systems that handle component failures gracefully. Implement API gateway layers that cache frequently requested NID verification data, reducing real-time dependency on the central server. For routine verification tasks, systems would rely on cached, recently verified data rather than requiring live database queries for every interaction.
- 2. Multi-Level Redundancy Systems:** Establish geographically distributed backup servers with both hot standby (immediately available) and warm standby (activatable within minutes) capabilities. Implement database replication across multiple data centers, ensuring that failures at one location don’t cause complete service interruption.
- 3. Service Level Agreements with Accountability:** Create binding SLAs guaranteeing minimum uptime percentages with automatic failover requirements and financial penalties for vendors failing to meet reliability standards. This creates strong incentives for maintaining robust infrastructure.
- 4. Proactive Monitoring and Coordination:** Deploy comprehensive monitoring systems to identify potential issues before service disruptions. Establish inter-agency coordination protocols for maintenance scheduling and emergency communication during outages.

Without addressing these fundamental infrastructure challenges, even the most user-friendly interfaces and comprehensive support systems cannot deliver consistent, dependable service that citizens need and deserve.

Chapter 6

Limitation and Future Works

6.1 Methodological Limitations

While our research provides comprehensive insights into the usability challenges of Bangladesh’s e-government platforms, several limitations should be acknowledged to provide context for our findings and recommendations. Understanding these limitations is essential for properly interpreting our results and identifying areas where additional research could strengthen our understanding of digital government usability.

Our survey methodology, while comprehensive in scope, relied heavily on self-reported data, which may introduce response bias. Participants’ assessments of their digital literacy levels and service satisfaction may not perfectly align with objective measures of these constructs. Additionally, our sampling approach, utilizing convenience and snowball sampling methods, may have inadvertently skewed our participant pool toward more digitally engaged users, potentially under representing the most digitally excluded populations.

Bangladesh currently lacks a standardized task-based digital literacy or competency scoring system tailored to its socio-technical context. While this study adapted international frameworks (e.g., DigComp, SPDLF), these may not fully capture the nuances of local user behaviors, educational disparities, and infrastructural constraints. As a result, the digital literacy scoring, though systematic, may not perfectly reflect the real-world capabilities of Bangladeshi users.

6.2 Geographic and Demographic Constraints

The geographic concentration of our data collection primarily in Cities may limit the generalizability of our findings to rural areas, where internet infrastructure, digital literacy levels, and government service access patterns may differ significantly. Rural citizens often face additional challenges, including limited internet connectivity, fewer technology support options, and different cultural attitudes toward digital services. Our focus on four specific e-government platforms, while providing depth of analysis, may not represent the full spectrum of digital government services available in Bangladesh. Other platforms may face different usability challenges or have

implemented innovative solutions that could inform broader improvement strategies. The selection of platforms was based on their popularity and importance, but this approach may have overlooked valuable insights from less commonly used but equally important services.

6.3 Future Research Opportunities

Building upon our foundational research, several critical areas warrant additional investigation to develop a more complete understanding of e-government usability in Bangladesh and similar developing contexts. These future research directions would strengthen the evidence base for policy recommendations and solution design.

In-depth ethnographic studies focusing specifically on rural and marginalized communities would address the geographic limitations of our current research. These studies should examine not only technical usability challenges but also cultural, social, and economic factors that influence e-government adoption in different communities. Understanding these broader contextual factors is essential for designing truly inclusive digital government services. Future research can contribute to the development of a comprehensive, task-based digital literacy framework tailored specifically for Bangladesh. While initiatives like DLit-BIGD have made valuable progress, they remain limited in scope and do not offer a fully operationalized skill assessment system for e-service contexts. There is a significant opportunity to build a more inclusive and granular model that reflects the cognitive, technical, and contextual realities of Bangladeshi users, especially those with low education or rural backgrounds. Such a framework could inform both policy design and system development for inclusive digital transformation.

Studies examining the effectiveness of different developer training and standardization approaches would inform the implementation of our proposed development framework. This research could identify the most effective methods for ensuring consistent implementation of usability standards across different vendors and project types.

6.4 Comparative and Longitudinal Study Needs

Longitudinal studies tracking user experiences over extended periods would provide valuable insights into how digital literacy develops over time and how sustained exposure to e-government platforms affects user confidence and independence. Such research could identify the optimal timing and methods for digital literacy interventions, helping to design more effective support programs.

Comparative studies examining e-government usability across different developing countries would help identify universal challenges versus those specific to Bangladesh's context. This research could reveal successful intervention models from other countries that might be adapted for Bangladesh's unique circumstances. Countries with similar developmental profiles but different e-government approaches could provide particularly valuable comparison cases.

Chapter 7

Conclusion

Our research findings have significant implications for how Bangladesh approaches digital government development and implementation. The evidence strongly suggests that current approaches, while technically sophisticated, have not adequately addressed the human factors that determine success in digital service delivery. Moving forward, policymakers and implementers must recognize that technical functionality alone is insufficient; systems must be designed and supported with a deep understanding of user capabilities, limitations, and needs.

The persistent mediator dependency we documented should prompt a fundamental reconsideration of what constitutes successful e-government implementation. Rather than viewing mediator usage as a failure of digital systems, policymakers should recognize it as evidence of user agency and adaptability. Citizens are actively finding ways to access digital services despite system limitations, demonstrating their desire to engage with government services efficiently. Policy responses should build upon this demonstrated demand while addressing the underlying barriers that make mediator assistance necessary.

Our findings also highlight the critical importance of involving actual users throughout the design and development process, not merely as final testers of completed systems. The gap between administrator perceptions of system usability and actual user experiences revealed in our research demonstrates the dangers of assuming that technical functionality equates to user-friendly design. Future development processes must incorporate regular user feedback, iterative testing, and ongoing usability monitoring to ensure that systems truly serve citizen needs.

The security and trust issues we identified require sustained attention that extends beyond technical security measures. Building citizen confidence in digital government services requires transparent communication about data protection practices, clear explanations of how personal information is used and protected, and visible accountability mechanisms for addressing security concerns. Government agencies must recognize that security is not merely a technical issue but a communication and trust-building challenge that requires ongoing effort.

Through addressing these limitations and actively pursuing these research directions, Bangladesh can continue developing its understanding of effective e-government im-

plementation while building increasingly inclusive and user-friendly digital services. The foundation established by our research provides a starting point for this ongoing journey toward truly accessible digital government, but sustained effort and continued learning will be essential for achieving the full potential of e-government to serve all citizens effectively.

Our investigation represents a critical step toward understanding and addressing the complex challenges that arise when digital government aspirations meet the realities of diverse user capabilities and needs. By maintaining focus on user-centered design principles, evidence-based policy making, and inclusive service delivery models, Bangladesh can continue progressing toward its vision of accessible, efficient, and effective digital government services for all citizens.

Bibliography

- [1] Bangladesh Road Transport Authority. *BRTA Services*. Accessed: 2024-10-17. Bangladesh Road Transport Authority. 1987. URL: <https://brta.gov.bd/site/page/e9eae2b1-6587-4d1a-ba24-aac3d61e719e>.
- [2] Jakob Nielsen. *10 Usability Heuristics for User Interface Design*. Accessed: 2025-01-30. 1994. URL: <https://www.nngroup.com/articles/ten-usability-heuristics/>.
- [3] Hugh Beyer and Karen Holtzblatt. *Contextual Design: Defining Customer-Centered Systems*. San Francisco, CA, USA: Morgan Kaufmann Publishers Inc., 1997. ISBN: 9780080503042.
- [4] Shirley Ann Becker. “E-government usability for older adults”. In: *Communications of the ACM* 48.2 (2005), pp. 102–104.
- [5] bKash Limited. *About bKash*. Accessed: 2024-10-17. bKash Limited. 2007. URL: <https://www.bkash.com/en/about>.
- [6] Imane Taoufik, Hind Kabaili, and Driss Kettani. “Designing an e-government portal accessible to illiterate citizens”. In: *Proceedings of the 1st international conference on Theory and practice of electronic governance*. New York, NY, USA: Association for Computing Machinery, 2007, pp. 327–336. ISBN: 9781595938220. DOI: 10.1145/1328057.1328125. URL: <https://doi.org/10.1145/1328057.1328125>.
- [7] Government of Bangladesh. *Sitemap of Bangladesh Government*. Accessed: 2024-10-17. Government of Bangladesh. 2008. URL: <https://bangladesh.gov.bd/site/view/sitemap/Sitemap?lang=en>.
- [8] Ministry of Land, Bangladesh. *Sitemap of Ministry of Land*. Accessed: 2024-10-17. Ministry of Land, Bangladesh. 2008. URL: <https://minland.gov.bd/site/view/sitemap?lang=en>.
- [9] France Bélanger and Lemuria Carter. “The impact of the digital divide on e-government use”. In: *Communications of the ACM* 52.4 (2009), pp. 132–135.
- [10] Mahmud Akhter Shareef et al. “Identifying critical factors for adoption of e-government”. In: *Electronic Government, an International Journal* 6.1 (2009), pp. 70–96.
- [11] Vishanth Weerakkody, Yogesh K Dwivedi, and Asoka Kurunananda. “Implementing e-government in Sri Lanka: Lessons from the UK”. In: *Information Technology for Development* 15.3 (2009), pp. 171–192.

- [12] Bangladesh Digital Registration Information Service. *BDRIS - Bangladesh Digital Registration Information Service*. Accessed: 2024-10-17. Government of Bangladesh. 2010. URL: <https://bdris.gov.bd/>.
- [13] M Shakhawat Hossain Bhuiyan. “E-government applications in Bangladesh: status and challenges”. In: *Proceedings of the 4th International Conference on Theory and Practice of Electronic Governance*. New York, NY, USA: Association for Computing Machinery, 2010, pp. 255–260. ISBN: 9781450300582. DOI: 10.1145/1930321.1930374. URL: <https://doi.org/10.1145/1930321.1930374>.
- [14] Zhao Huang and Laurence Brooks. “Evaluating usability of web-based electronic government: users’ perspective”. In: *Human-Computer Interaction. Users and Applications: 14th International Conference, HCI International 2011, Orlando, FL, USA, July 9-14, 2011, Proceedings, Part IV 14*. Springer. Cham, Switzerland: Springer, 2011, pp. 456–465.
- [15] Taewoo Nam and Djoko Sigit Sayogo. “Who uses e-government? Examining the digital divide in e-government use”. In: *Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance*. New York, NY, USA: ACM, 2011, pp. 27–36. DOI: 10.1145/2072069.2072076. URL: <https://dl.acm.org/doi/10.1145/2072069.2072076>.
- [16] National Board of Revenue. *About the National Board of Revenue*. Accessed: 2024-10-17. National Board of Revenue. 2011. URL: <https://nbr.gov.bd/about-us/about-us/eng>.
- [17] Ashok Sivaji, Azween Abdullah, and Alan Giffin Downe. “Usability testing methodology: Effectiveness of heuristic evaluation in E-government website development”. In: *2011 fifth Asia modelling symposium*. IEEE. New York City, NY, USA: IEEE, 2011, pp. 68–72.
- [18] Mrinal Kanti Baowaly and Moniruzzaman Bhuiyan. “Accessibility analysis and evaluation of Bangladesh government websites”. In: *2012 International Conference on Informatics, Electronics & Vision (ICIEV)*. IEEE. New York, NY, USA: IEEE, 2012, pp. 46–51.
- [19] Dutch Bangla Bank. *About Rocket by Dutch Bangla Bank*. Accessed: 2024-10-17. Dutch Bangla Bank. 2012. URL: <https://www.dutchbanglabank.com/rocket/about.html>.
- [20] Hasan Shahid Ferdous et al. “Usability analysis of e-Governance services in Bangladesh—A survey and future directions”. In: *2012 15th International Conference on Computer and Information Technology (ICCIT)*. IEEE. New York, NY, USA: IEEE, 2012, pp. 417–422.
- [21] Monique M Hennink. *Focus group discussions*. Oxford University Press, 2013.
- [22] Anil Rajput and K. Nair. “Significance of digital literacy in e-governance”. In: *The SIJ Transactions on Industrial, Financial & Business Management* 1.4 (2013), pp. 136–139.
- [23] Janice C Sipior, Burke T Ward, and Regina Connolly. “E-government awareness and visitation among the digitally disadvantaged”. In: *Journal of Internet Commerce* 12.1 (2013), pp. 26–47.

- [24] Viswanath Venkatesh, Hartmut Hoehle, and Ruba Aljafari. “A usability evaluation of the Obamacare website”. In: *Government information quarterly* 31.4 (2014), pp. 669–680.
- [25] Md Rakibul Hoque and Golam Sorwar. “ICT based e-government services for rural development: a study of Union Information and Service Center (UISC) in Bangladesh”. In: *The Electronic Journal of Information Systems in Developing Countries* 71.1 (2015), pp. 1–19.
- [26] Ankur Joshi et al. “Likert scale: Explored and explained”. In: *British journal of applied science & technology* 7.4 (2015), pp. 396–403.
- [27] Agnieszka Agata Tomaszewicz. “The impact of digital literacy on e-government development”. In: *Online Journal of Applied Knowledge Management* 3.2 (2015), pp. 45–53. URL: https://www.iiakm.org/ojakm/articles/2015/volume3.2/OJAKM_Volume3.2pp45-53.pdf.
- [28] Matias Dodel. “e-Government’s hidden inequality: why spending on online services can be regressive and how to avoid it”. In: *Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance*. New York, NY, USA: Association for Computing Machinery, 2016, pp. 68–74. ISBN: 9781450336406. DOI: 10.1145/2910019.2910052. URL: <https://doi.org/10.1145/2910019.2910052>.
- [29] Wolfgang E Ebbers, Marloes GM Jansen, and Alexander JAM van Deursen. “Impact of the digital divide on e-government: Expanding from channel choice to channel usage”. In: *Government information quarterly* 33.4 (2016), pp. 685–692.
- [30] Zahiruddin Md Babar. “Digital divide: Concepts and reality in Bangladesh”. In: *Journal of Business* 2.2 (2017), pp. 24–33.
- [31] Rita Ismailova and Yavuz Inal. “Web site accessibility and quality in use: a comparative study of government Web sites in Kyrgyzstan, Azerbaijan, Kazakhstan and Turkey”. In: *Universal Access in the Information Society* 16 (2017), pp. 987–996.
- [32] Aron Kondoro and Joel S. Mtebe. “Accessibility and Usability of Government Websites in Tanzania”. In: *The African Journal of Information Systems* 9.4 (2017), Article 3. URL: <https://digitalcommons.kennesaw.edu/ajis/vol9/iss4/3>.
- [33] Rajiv Kumar, Amit Sachan, and Arindam Mukherjee. “Qualitative approach to determine user experience of e-government services”. In: *Computers in Human Behavior* 71 (2017), pp. 299–306.
- [34] Mahin Naderifar, Hamideh Goli, Fereshteh Ghaljaie, et al. “Snowball sampling: A purposeful method of sampling in qualitative research”. In: *Strides in development of medical education* 14.3 (2017), pp. 1–6.
- [35] Nripendra P Rana et al. “Citizens’ adoption of an electronic government system: towards a unified view”. In: *Information systems frontiers* 19 (2017), pp. 549–568.

- [36] Jean Damascene Twizeyimana. “User-centeredness and usability in e-government: A reflection on a case study in Rwanda”. In: *Proceedings of the International Conference on Electronic Governance and Open Society: Challenges in Eurasia*. New York, NY, USA: Association for Computing Machinery, 2017, pp. 172–178. ISBN: 9781450354127. DOI: 10.1145/3129757.3129786. URL: <https://doi.org/10.1145/3129757.3129786>.
- [37] Matias Dodel and Florencia Aguirre. “Digital inequalities’ impact on progressive stages of e-government development”. In: *Proceedings of the 11th international conference on theory and practice of electronic governance*. New York, NY, USA: Association for Computing Machinery, 2018, pp. 459–463. ISBN: 9781450354219. DOI: 10.1145/3209415.3209475. URL: <https://doi.org/10.1145/3209415.3209475>.
- [38] Pusp Raj Joshi and Shareeful Islam. “E-government maturity model for sustainable E-government services from the perspective of developing countries”. In: *Sustainability* 10.6 (2018), p. 1882.
- [39] Rajiv Kumar et al. “Factors influencing e-government adoption in India: a qualitative approach”. In: *Digital Policy, Regulation and Governance* 20.5 (2018), pp. 413–433.
- [40] Silas Formunyuy Verkijika and Lizette De Wet. “A usability assessment of e-government websites in Sub-Saharan Africa”. In: *International Journal of Information Management* 39 (2018), pp. 20–29.
- [41] Yakup Akg  l. “The accessibility, usability, quality and readability of Turkish state and local government websites an exploratory study”. In: *International Journal of Electronic Government Research (IJEGR)* 15.1 (2019), pp. 62–81.
- [42] Nuha Awlad Karaim and Yavuz Inal. “Usability and accessibility evaluation of Libyan government websites”. In: *Universal Access in the Information Society* 18 (2019), pp. 207–216.
- [43] Ria Lyzara et al. “E-government usability evaluation: Insights from a systematic literature review”. In: *Proceedings of the 2nd International Conference on Software Engineering and Information Management*. New York, NY, USA: Association for Computing Machinery, 2019, pp. 249–253. ISBN: 9781450366427. DOI: 10.1145/3305160.3305178. URL: <https://doi.org/10.1145/3305160.3305178>.
- [44] Liang Ma and Yueping Zheng. “National e-government performance and citizen satisfaction: a multilevel analysis across European countries”. In: *International Review of Administrative Sciences* 85.3 (2019), pp. 506–526.
- [45] Nagad. *About Nagad Service*. Accessed: 2024-10-17. Nagad. 2019. URL: <https://nagad.com.bd/pg/?n=about-nagad>.
- [46] OECD. *The Survey of Adult Skills: Reader’s Companion, Third Edition*. Paris, 2019. DOI: 10.1787/f70238c7-en. URL: <https://doi.org/10.1787/f70238c7-en>.
- [47] Abdur Rahman. “E-Governance in Bangladesh”. In: *Global Encyclopedia of Public Administration, Public Policy, and Governance*. Ed. by Ali Farazmand. Cham: Springer International Publishing, 2019, pp. 1–8. ISBN: 978-3-319-31816-5. DOI: 10.1007/978-3-319-31816-5_3227-1.

- [48] John Sweller, Jeroen J. G. Van Merriënboer, and Fred Paas. “Cognitive Architecture and Instructional Design: 20 Years Later”. In: *Educational Psychology Review* 31.2 (2019), pp. 261–292. DOI: 10.1007/s10648-019-09465-5. URL: <https://doi.org/10.1007/s10648-019-09465-5>.
- [49] Md Shamim Talukder et al. “Determinants of user acceptance and use of open government data (OGD): An empirical investigation in Bangladesh”. In: *Technology in Society* 56 (2019), pp. 147–156.
- [50] Nourah Aloboud, Raghad Alotaibi, and Amani Alqahtani. “Evaluating the usability and the accessibility of Saudi e-government websites”. In: *Human-Computer Interaction. Design and User Experience: Thematic Area, HCI 2020, Held as Part of the 22nd International Conference, HCII 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings, Part I* 22. Springer. Cham, Switzerland: Springer, Cham, 2020, pp. 363–372.
- [51] Abdul Aziz. “Digital inclusion challenges in Bangladesh: The case of the National ICT Policy”. In: *Contemporary South Asia* 28.3 (2020), pp. 304–319.
- [52] S Begum. “Citizens’ Perspective on Land E-Mutation at Upazila Land Offices in Mymensingh”. In: *Semantic Scholar* (2020), pp. 1–20. URL: <https://pdfs.semanticscholar.org/9cb6/99c7d54baccffdc27a01e323563e173d207f.pdf>.
- [53] Borka Jerman Blažič and Andrej Jerman Blažič. “Overcoming the digital divide with a modern approach to learning digital skills for the elderly adults”. In: *Education and Information Technologies* 25 (2020), pp. 259–279.
- [54] C Chang and Husam Almaghalsah. “Usability evaluation of e-government websites: A case study from Taiwan”. In: *International Journal of Data and Network Science* 4.2 (2020), pp. 127–138.
- [55] Government of Bangladesh. *About ePassport Service in Bangladesh*. Accessed: 2024-10-17. Government of Bangladesh. 2020. URL: <https://www.epassport.gov.bd/instructions/about-us>.
- [56] SM Taiabul Haque et al. “Privacy vulnerabilities in public digital service centers in Dhaka, Bangladesh”. In: *Proceedings of the 2020 International Conference on Information and Communication Technologies and Development*. New York, NY, USA: Association for Computing Machinery, 2020, pp. 1–12. ISBN: 9781450387620. DOI: 10.1145/3392561.3394642. URL: <https://doi.org/10.1145/3392561.3394642>.
- [57] Madina Tul Jeba et al. “Usability and accessibility testing: a study on public sector and government websites of Bangladesh”. In: *Proceedings of ICETIT 2019: Emerging Trends in Information Technology*. Springer. Cham, Switzerland: Springer, 2020, pp. 666–674.
- [58] Taejun Lee, Byung-Kwan Lee, and Seulki Lee-Geiller. “The effects of information literacy on trust in government websites: Evidence from an online experiment”. In: *International Journal of Information Management* 52 (2020), p. 102098.
- [59] Yan Li and Huping Shang. “Service quality, perceived value, and citizens’ continuous-use intention regarding e-government: Empirical evidence from China”. In: *Information & Management* 57.3 (2020), p. 103197.

- [60] Isaac Kofi Mensah. “Impact of government capacity and E-government performance on the adoption of E-Government services”. In: *International Journal of Public Administration* 43.4 (2020), pp. 303–311. DOI: 10.1080/01900692.2019.1628059. URL: <https://www.tandfonline.com/doi/full/10.1080/01900692.2019.1628059>.
- [61] Anas Mustaf, Othman Ibrahim, and Fathey Mohammed. “E-government adoption: A systematic review in the context of developing nations”. In: *International Journal of Innovation: IJI Journal* 8.1 (2020), pp. 59–76.
- [62] Surjit Paul and Saini Das. “Accessibility and usability analysis of Indian e-government websites”. In: *Universal Access in the Information Society* 19.4 (2020), pp. 949–957.
- [63] Mercy Samuel et al. “Drivers and barriers to e-government adoption in Indian cities”. In: *Journal of Urban Management* 9.4 (2020), pp. 408–417.
- [64] Md Wasel Bin Shadat et al. *Digital Literacy of Rural Households in Bangladesh*. Working Paper. BRAC Institute of Governance and Development (BIGD), 2020. URL: https://bigd.bracu.ac.bd/wp-content/uploads/2020/10/Working-Paper_Digital-Literacy-of-Rural-Households-in-Bangladesh.pdf.
- [65] Yoseph Zeleke. “Usability and accessibility model for e-government websites in Ethiopia”. In: *International Journal of Public Administration* 43.6 (2020), pp. 516–526. DOI: 10.1080/01900692.2019.1664883.
- [66] Muhammad Nazrul Islam and Toki Tahmid Inan. “Exploring the fundamental factors of digital inequality in Bangladesh”. In: *Sage Open* 11.2 (2021), p. 21582440211021407.
- [67] Chad R Lochmiller. “Conducting thematic analysis with qualitative data”. In: *The Qualitative Report* 26.6 (2021), pp. 2029–2044.
- [68] Suresh Malodia et al. “Future of e-Government: An integrated conceptual framework”. In: *Technological Forecasting and Social Change* 173 (2021), p. 121102.
- [69] Sohail Raza Chohan and Guangwei Hu. “Strengthening digital inclusion through e-government: cohesive ICT training programs to intensify digital competency”. In: *Information technology for development* 28.1 (2022), pp. 16–38.
- [70] Jawad Golzar, Shagofah Noor, and Omid Tajik. “Convenience sampling”. In: *International Journal of Education & Language Studies* 1.2 (2022), pp. 72–77.
- [71] Amna Ilyas, Syed Hamza Wajid, and AbdulHafeez Muhammad. “Usability evaluation of e-government website: A use of system usability scale”. In: *Pakistan Journal of Engineering and Technology* 5.1 (2022), pp. 11–15.
- [72] Shagofah Noor, Omid Tajik, and Jawad Golzar. “Simple random sampling”. In: *International Journal of Education & Language Studies* 1.2 (2022), pp. 78–82.
- [73] Riina Vuorikari, Stefano Kluzer, and Yves Punie. *DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes*. EUR 31006 EN. JRC128415. Luxembourg: Publications Office of the European Union, Mar. 2022. DOI: 10.2760/115376. URL: <https://publications.jrc.ec.europa.eu/repository/handle/JRC128415>.

- [74] A. R. Tahseen Jahan. *Union Digital Centers: Digitizing Bangladesh's Grassroots*. Accessed: 2025-01-29. Aspire to Innovate (a2i) Programme. Dec. 2023. URL: <https://a2i.gov.bd/union-digital-centers-digitizing-bangladeshs-grassroots/>.
- [75] Leonardo Filipe da Silva, Emilene Zitkus, and André Pimenta Freire. “An exploratory study of the use of the internet and e-government by older adults in the countryside of Brazil”. In: *Information* 14.4 (2023), p. 225.
- [76] Bangladesh Railway. *Railway Services and Information*. Accessed: 2025-01-30. Bangladesh Railway. 2024. URL: <https://railapp.railway.gov.bd/>.
- [77] Jonathan Jacob Paul Latupeirissa et al. “Transforming public service delivery: A comprehensive review of digitization initiatives”. In: *Sustainability* 16.7 (2024), p. 2818.
- [78] National Identity Wing, Bangladesh. *NID Services Portal*. Accessed: 2025-01-21. National Identity Wing, Bangladesh. 2025. URL: <https://services.nidw.gov.bd/nid-pub/>.