ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

SCHOOL OF INFORMATION SCIENCE

USABILITY OF E-GOVERNMENT SERVICE FOR TAX PAYERS IN ETHIOPIA: THE CASE OF E-TAX SYSTEM

By

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Science and Systems (Information Systems Specialization)

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Declaration

This thesis has not previously been accepted for any degree and is not being concurrently submitted in candidature for any degree in any university.

I declare that this thesis entitled “Usability of E-Government Service for Tax Payers in Ethiopia: The Case of E-Tax” is a result of my own investigation, except where otherwise stated. I have undertaken the study independently with the guidance and support of my research advisor. Other sources are acknowledged by citations giving explicit references. A list of references is appended.

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This thesis has been submitted for examination with my approval as university advisor.

Advisor’s Signature: ________________________

Lemma Lessa (PhD)

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Abstract

The e-tax portal/system is a web-based tax filling and payment system designed to reduce cumbersome manual processes, cut evasion and help boost domestic revenue collection. The system is also used for payment of public services and other remittances. Usability of the e-tax portals, is key for members especially the public to find them easy to use, effective, efficient as well as satisfying to use. The heuristic evaluation (HE) method is one of the most common in the suite of tools for usability evaluations because it is a fast, inexpensive, and resource-efficient process in relation to the many usability issues it generates. The data collected in the evaluations performed with usability experts were analyzed from the 10 Nielsen usability heuristics. The results showed that this method of assessment is effective in pointing out various usability issues in e-government services assessed specifically e-tax portal interface.This research presents results of an evaluation of an e-tax portal for Ethiopia using the popularly used Jakob Nielsen's 10 Usability Heuristics for User Interface Design. Based on the results, the paper further presents compliance. Furthermore, a usable e-tax portal will decrease training, support and maintenance costs. The paper also provides general recommendations on how to develop and manage more usable websites.

Keywords: Usability, Usability Evaluation, Heuristic evaluation, Usability Heuristic evaluation, e-tax, e-tax portal, e-government

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List of Acronyms

API	Application Program Interface
MOR	Ministry of Revenue

ERCA	Ethiopian Revenue and Customs Authority
UCD	User-Cantered Design
HE	Heuristic Evaluation
ICT	Information Communication Technology
EDI	Electronic Data Interchange
IT	Information Technology
G2C	Government-to-Citizen
G2G	Government-to-government
G2B	Government-to-Business
G2E.	Government-to-Employee
B2B	Business-to-Business
B2C	Business-to-Consumer
P2P	person-to person
A2C	Administration-to-Consumer
IA	Information Architecture
UX	User experience
UI	User Interface
AUDA	African Union Development Agency
UCD	User Centre Design
DE	Dialogue Element
HCI	Human Computer Interaction
CSV	Comma Separated Values
VAT	Value Added Tax
SUS	System Usability Scale

CHAPTER ONE

INTRODUCTION

This chapter provides an overview of the study, including the motivation, statement of the problem, and the fundamental research questions, followed by both general and specific objectives. Additionally, it discusses the significance of the study and the scope of the research. Throughout the discussion, relevant justifications are presented, each supported by related literature from the field. The chapter concludes with a summary outlining the structure of the remaining sections of the paper.

1.1. Background of the Study

The integration of technology has transformed numerous facets of our daily lives, impacting government services, the economy, and social interactions (Vlachogianni & Tselios, 2023). Information technologies promote ecological innovations that support sustainable development by minimizing environmental impacts and optimizing resource use (eLAC, 2020). Globally, various government sectors are adopting information technology to enhance service delivery and engage more effectively with citizens (Ruta, 2017).

Revenue generation is vital for sustainability and presents a significant challenge for both advanced and developing economies, playing a crucial role in the growth and development of countries worldwide. In Ethiopia, the government has been enacting tax reforms aimed at increasing tax revenue to meet the growing demand for public services from its citizens. A key recent initiative to enhance tax revenue has been the introduction of e-taxation systems for taxpayers, a project supported by the Investment Climate Facilitation for Africa (Nazrawit, 2022)

The Ministry of Revenue's e-tax system is a web-based platform designed to streamline tax filing and payment processes, thereby reducing manual operations across regional and branch offices. Since its development in February 2013 by the Ethiopian Revenue and Customs Authority (now the Ministry of Revenue), the e-tax system has provided significant benefits to both the business community and the broader economy (Ruta, 2017).

E-taxation involves the electronic transfer of data between the IT systems of tax professionals and tax authorities (Baguma, 2018). While taxation can greatly contribute to economic development in developing nations, electronic tax systems are generally more effective in advanced economies (Barati & Bakhshayesh, 2015). To meet the government's goals of enhancing speed and accuracy in tax administration, reducing collection costs, improving information accuracy and completeness, and ultimately fostering taxpayer satisfaction and trust, it is essential to implement efficient e-tax systems.

Taxpayers have access to a variety of services offered by tax authorities, including registration, e-filing, e-tax payments, and tax return submissions, all facilitated through applications for compliance certificates (Nazrawit, 2022). The adoption of e-tax systems brings numerous advantages for both tax authorities and taxpayers, such as cost-free preparation and submission of tax returns, enhanced security, 24/7 accessibility, time savings, and the convenience of filing from any personal computer or mobile device (Barati & Bakhshayesh, 2015). Furthermore, a computerized and integrated tax system can enhance national wealth by effectively curbing tax evasion and addressing issues of injustice and inefficiency within the income tax framework.

According to Baguma (2018), usability is defined as "the extent to which a product, such as software or a website, can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use." He notes that effectiveness pertains to "the accuracy and completeness with which specified users can achieve specified goals in particular environments," while efficiency refers to "the resources expended in relation to the accuracy and completeness of goals achieved." Satisfaction encompasses "the comfort and acceptability of the system's performance to its users and others affected by its use." E-tax systems must exhibit both effectiveness and efficiency to ensure user satisfaction, as usability plays a crucial role in the overall success and quality of software. Usability inspections of e-tax systems aim to identify and resolve issues within the current user interface design, providing recommendations for improvement (Silvis, Bothma, & Beer).

This study offers a comprehensive set of heuristics and information architecture (IA) framework for evaluating the usability of the Ministry of Revenue's head office websites, along with a practical workflow for conducting assessments. Based on the findings, the paper outlines recommendations for addressing identified usability gaps within the Ministry of Revenue's e-Tax portal. Given the public-facing nature of these portals, their usability is essential for ensuring that taxpayers find them easy to navigate, effective, efficient, and satisfying to use.

In summary, the integration of technology has significantly transformed various aspects of daily life, including government services, the economy, and social interactions (Vlachogianni & Tselios, 2023). Information technologies also support sustainable development by minimizing environmental impact and optimizing resource use (eLAC, 2020). Across the globe, government sectors are increasingly adopting information technology to enhance service delivery and engage with citizens (Ruta, 2017). Revenue generation remains crucial for both advanced and developing economies, and the Ethiopian government has been implementing tax reforms to boost revenue and meet the rising demand for public services. One key initiative is the introduction of e-tax systems, aimed at streamlining tax processes and improving revenue collection, with significant benefits to both the business community and the broader economy (Nazrawit, 2022; Ruta, 2017).

1.2. Motivation

In spite of the crucial advantages of E-tax services, there are lots of challenges that studies have devoted usability evaluation of e-tax website design in several dimensions shows that further investigation on e-tax system interface design is expect. As stated by Eilu, et al, (2021), usability challenges are not given more attention with government's websites, due to this challenges citizen face problems and utilization of these e-government websites fail to meet their expectations. Baguma, (2018) argue that broad goal of usability to be to present the information to the users in a clear and concise way; give the correct choices to the users in a very obvious way; remove any ambiguity regarding the consequences of an action such as clicking on delete/remove/purchase; and putting the most important elements in the right place on a Web page or a Web application. As Eilu, et al (2021), e-tax portal, which are available, may not be fully usable, due to the facts that: the introduction of online tax return services was meant to foster tax compliance and improve tax revenues, but the evidence shows that these online tax services may not have improved tax returns as expected . The current lack of access to assistant technology reflects not only an economic gap but a severe malfunction as in assistant technology design and development Escobar, (2023).

Although there are some statistics on the effects of usability challenges on general government online services, few or no studies have been carried out on the extent to which online tax service achieve the usability goals in developing countries, and its effects on the overall tax revenue Eilu, et al, (2021). Therefore, regular e-services websites assessment is required solution for this weaknesses and motivation for strengths of websites Joshi and Islam, (2018). According to Nazrawit, (2022) agreement in her study that e-tax system must initiate to solve the challenge of revenue generation, which includes personal income tax, value added tax, company income tax, have been the major sources of government revenue in the economies of the world. To fill such gaps Tamru, (2021) presents as the literature review is demonstrates the concept's and practices historical evolution from traditional public administration to the modern digital era. Still, several studies assessed usability mainly by considering parameters such as ease of use, accessibility, or satisfaction Escobar, (2023). Usability is important, from the user's perspective, since it can make the difference between performing a task accurately or not, and to enjoy the process or being frustrated Nielsen, (2014). Usability is the extent to which a product [a portal] can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use Eilu, et al (2021). The Heuristic Principles of Usability to review the user interface portal utilizing heuristic principles of usability concept was developed after reviewing the literature on usability, interaction, and design Dannala and Chunduri, (2022).

As the researcher identified from different literature and observed the issue on the ground, it is a critical and understanding the challenges and the impact of evaluation of the system using principles is an important tool to have usability evaluation of the e-tax service. To address these issues, a range of studies have shown the value of involving target users in the design by considering and evaluating their needs and wishes through a systematic, iterative user centred design (UCD) process (Meyer et al). Tax revenues are used for state building, infrastructural development, reduce long-term independence on foreign assistance, increase the fiscal effects of trade liberalisation, and to generally provide the much needed public goods and services in developing countries Eilu, et al, (2021). Due to various challenges and problems and no more studies have been carried out on the extent to which usability of online tax service motivated me to do a research on the area. Furthermore, it can provide quick and relatively inexpensive feedback to designers, provide feedback early in the design process, and suggest the best corrective measures to designers what motivate me to do.

1.3. Statement of the problem

Despite being in operation for over a decade, e-tax systems in many developing countries have proven to be inefficient and less usable than anticipated. Factors contributing to taxpayer dissatisfaction include inadequate technological readiness, slow network speeds during the filing process, and insufficient system security for protecting tax-related data (Mustapha, 2015). Additionally, the lack of significant increases in tax revenue following the introduction of online tax return services in many African nations can be attributed to serious usability challenges within these systems (Eilu et al., 2021). Usability issues are often reported through usability assessments, which provide feedback from evaluations to the system designers (Nielsen, 2014). Usability experts typically use standard user tasks to engage with the product's interface, identify existing usability problems, and assign specific heuristic violations to each issue encountered (Georgsson et al., 2014). The mere availability of e-tax system technology does not guarantee taxpayer satisfaction with its implementation and use (Mustapha, 2015). A usability problem is defined as any element of an interface that is confusing, misleading, or suboptimal (Lazar et al., 2019). Consequently, many e-tax portals are not effectively usable.

Research suggests that online tax services have not improved tax return submissions as anticipated (Eilu et al., 2021). Their study found that, out of four online tax return services assessed, only 50% of these services and 33% of various electronic payment options were utilized by taxpayers, resulting in an average usability score of just 16%. This indicates serious usability issues with these services. Furthermore, research by Omar Mohamed and Yusoff (2012) revealed critical problems in heuristic evaluations, with 57.14% of issues categorized as critical for each heuristic. To address these gaps, Meyer (2022) proposed the design and validation of a novel online platform intended to attract more taxpayers, as reliance on existing e-tax systems is costly and decreases compliance levels (Baguma, 2018). A user-friendly and efficient e-tax portal could also reduce training, support, and maintenance costs.

According to (Alsanous et al.,) usability evaluations in e-tax systems should focus on key factors such as user satisfaction, efficiency, and effectiveness. Conducting heuristic evaluations is essential for enhancing the usability of applications and software (Ramadhanti, Budiyanto, and Yuana, 2023). Currently, the Ten Usability Heuristic Evaluation (HE) framework, developed by Nielsen and Molich, is one of the most widely referenced usability techniques (Yodihartomo, 2020). The term 'usability' is commonly understood as the capability of being used, focusing on the ease with which users can accomplish their intended tasks using a designated tool (Yodihartomo, 2020). Therefore, a comprehensive set of integrated heuristics, frameworks, and evaluation workflows for utilizing these heuristics is necessary (Silvis, Bothma, and Beer).

Literature reviews on usability provide valuable context and summarize key concepts from related studies (Silvis et al.). However, research on web usability in Africa, particularly in East Africa, remains limited (Yodihartomo, 2020). Most existing studies have focused on other aspects of e-government services rather than on the usability of online government services, specifically e-tax services. This paper presents recommendations for addressing current usability gaps to enhance the effectiveness, efficiency, and user satisfaction of the e-tax portal (Baguma, 2018). To date, there has been no comprehensive study evaluating web usability in this context.

The Ethiopian e-tax portal may face several usability challenges, including the use of technical jargon that non-expert users might find difficult to understand, hindering accessibility for less tech-savvy individuals. Additionally, a lack of real-time feedback can leave users uncertain about whether their actions are being processed correctly. Inconsistent design elements and changes in layout between pages can confuse users, disrupting their experience, while inadequate error prevention and unclear error messages make it difficult to resolve mistakes. Poor navigation can further frustrate users, especially if the system isn't intuitive, and the absence of easily accessible help documentation or support leaves users struggling when they encounter difficulties. Addressing these problems will require a systematic redesign or improvement of the portal based on user feedback and usability testing. Understanding these challenges through Nielsen's heuristics can help prioritize enhancements to create a more efficient, intuitive, and user-friendly Ethiopian e-tax portal.

1.4. Research question

The study aims to address the following research questions:

What specific usability issues in the system services limit task performance (e.g., filing taxes, making payments) pose difficulties for both users and tax authorities?

What specific usability challenges of the system are associated with the e-tax system based on the application of Nielsen's heuristics in Ethiopia?

What strategies can be implemented to enhance the usability of the e-tax system?

1.5. Objective

1.5.1. General Objective

The main objective of the usability evaluation of the e-tax system is to identify usability challenges that impact task efficiency and effectiveness, and to propose solutions based on Jakob Nielsen's 10 usability heuristics. The aim is to enhance the system's intuitiveness, accessibility, and overall user experience, while minimizing errors and improving task completion times.

1.5.2. Specific objective

To develop an integrated list of usability and an information architecture framework for e-tax system

To identify existing challenges of e-tax system in Ethiopia.

To suggest usability problems in an existing user interface design and to make recommendations for fixing the problems and improve the usability of the design.

1.6. Scope of the study

E-Tax which is a broad subject covers both technical and non-technical aspects. The study will addressed:

- ✓ E-tax system for users, and customer's application development.
- ✓ E-tax system as package and organizational, ethical and user perspective.

It focus on for Ethiopia e-government service using e-tax system primary expected continued effort in enhancing usability of e-tax service for tax payers. The target population for this study are those experts based on heuristic usability evaluation system.

1.7. Significance of the study

This study presents a framework and workflow guidelines designed for various evaluators of e-tax websites, including web developers and usability experts, to offer recommendations for enhancing usability. The significance of this study lies in its ability to provide targeted insights, enabling policymakers—particularly tax authorities or the Ministry of Revenue (MOR)—to better understand the existing challenges related to the e-tax portal and identify potential solutions. The researchers have established that heuristic evaluation principles and guidelines are a crucial method for identifying usability issues in user interface design (Iqbal, 2015). Nelson's heuristic evaluation offers several advantages, such as ease of use, low cost, effectiveness, and reliability (Baguma, 2018).

A key contribution of this paper is the identification of best practices within this application domain, which can be implemented to evaluate and enhance the e-tax system. The findings of the study could assist the government in achieving its objectives and promoting socio-economic development through improved revenue collection performance. Ultimately, this aims to attract and retain more taxpayers by encouraging them to adopt the e-tax system, as opposed to relying on traditional manual processes, which can be costly and contribute to lower compliance levels. Address the gaps identified in previous research, providing a valuable reference for other researchers to conduct further investigations in this specific area.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter provides a comprehensive analysis and discussion of relevant literature and models pertaining to the research problem outlined in the previous chapter. It encompasses theories related to e-taxation, user-centered design, and usability. To establish a context for the study and introduce fundamental concepts, the chapter begins with an overview of e-government, including electronic government and electronic tax systems. This is followed by a discussion on usability, usability heuristics, and the evaluation of e-tax services through heuristic principles.

2.2. Overview of e-Government

Scholars have various perspectives on e-government. According to Chohan and Hu (2022), the success of e-government programs hinges on cultivating citizens' ICT skills, as public investments in these services become cost-effective when citizens are actively engaged. Takeoka (2009) defines e-government as the application of information and communication technologies, especially the Internet, for delivering government information and services. Adefris (2018) further describes e-government as the use of the Internet and the World Wide Web to provide government information and services to citizens. Avdic (2012) characterizes e-government as the provision of online public services to citizens and businesses, encompassing various services such as registration for healthcare, education, employment benefits, and taxation.

E-government integrates key elements to enhance the services provided to both the public and private sectors within countries. It supports essential government functions, including Electronic Data Interchange (EDI), interactive voice response, voicemail, email, web service delivery, virtual reality, and critical public infrastructure (Anjoga et al., 2017).

In his research, Andersson (2019) emphasizes that e-government aims to achieve public value by enhancing government efficiency, improving services for citizens, and promoting social values such as inclusion, democracy, transparency, and participation. E-government is fundamentally about leveraging information and communication technologies, particularly the Internet and World Wide Web, to deliver government products, information, and services. The European Parliamentary Research Service (EPRS) (2015) defines e-government or digital government as the application of ICT to enhance public services and increase citizen participation in democratic governance. Another definition describes e-government as "the use of information technology to enable and improve the efficiency of government-provided services to citizens, employees, businesses, and agencies" (Benaida, 2023).

The World Bank (2015) states that "e-government is the use by government agencies of IT (such as Wide Area Networks, the Internet, and mobile computing) that can transform relationships with citizens, businesses, and other governmental entities" (World Bank, 2022). Ahmad et al.

(2017) define e-government as the utilization of ICTs in public administration to enhance managerial efficiency and effectiveness, uphold democratic principles, and establish a framework for legal and supervisory oversight, all aimed at reducing administrative and financial burdens while transitioning to a knowledge-based society.

Dian (2020) reiterates that e-government involves the use of IT by government agencies, which can transform interactions with citizens, businesses, and other government branches. The continued benefits include enhanced accountability and performance in government activities, improved service delivery, access to government information for citizens, and increased participation in governance (Faizan, 2017). Despite the array of definitions present in the literature, the most frequently cited definition is: the government's use of ICT to facilitate interactions and business transactions with citizens, businesses, employees, other agencies, and government entities through electronic media such as telephone touchpads, faxes, smart cards, self-service kiosks, emails/internet, and EDI (Hiwot, 2022).

2.3. Overview of e-Government Services

The mere availability of electronic public services does not guarantee their utilization across all segments of society (Raza & Hu, 2022). Over the past decade, e-government services have become increasingly vital; given their importance, at least one or more systems now provide citizens with essential information and adequate services (Benaida, 2023). According to (Davies, 2015), the primary goal of e-government is to enhance the efficiency of government services by reducing the costs associated with electronic information management and communications, reorganizing government agencies, and minimizing administrative silos of information. E-government services aim to alleviate the administrative burdens faced by citizens and businesses by streamlining interactions with public authorities, making them faster, more convenient, and less costly, thereby fostering competitiveness and economic growth. Raza and Hu (2022) discuss various aspects of public service delivery, including the transformational relationships among participants, open access to information, increased operational efficiency through cost reduction, and improved acceptance by citizens.

The diverse range of e-government services can be categorized into four main types: government-to-citizen (G2C), government-to-business (G2B), government-to-government (G2G), and government-to-employee (G2E). Numerous benefits are associated with e-government services, primarily the provision of direct services to users, eliminating the traditional paperwork flow between the government and its citizens (Anjoga et al., 2017). Information and communication technology (ICT) equips public administrations with tools for faster and more efficient data processing; efficient public services can lead to significant cost savings and even the development of new services at existing costs (EPRS, 2015).

The significance of these government services lies in their ability to reduce costs, lessen administrative burdens, eliminate the need for mailed paper forms and in-person interactions, and enhance the speed and efficiency of online information provision, integrating ICT tools provided by citizens and businesses. These e-service technologies aim to achieve several objectives, including improved service delivery, strengthened relationships with businesses and industries, increased citizen empowerment through access to information, and more efficient and effective government administration. In the context of this research, e-government service quality can be defined as the efficient delivery of online public services to citizens in a timely and cost-effective manner that enhances citizens' trust and the effectiveness of e-government services (Faizan, 2017). Night and (Bananuka, 2018) argue that the government should be viewed as providing services to citizens and taxpayers in a manner that reflects a balance between the taxes paid and the cost of the services rendered.

2.4. E-Taxation: Definition and its Essence

According to the the research conducted by (Rotimi et al, 2020), and (Baguma, 2018) define the electronic tax system is the trans-organizational processes as the system of collecting taxes and data transfer between IT systems professionals of the authorities and taxpayers electronically with the aid of internet service. Tax authorities must be focus on enhancing electronic tax system usage and ensure that there is further training of taxpayers on the importance of tax compliance as well Night and (Bananuka, 2018). E-taxation is the process by which taxes are calculated, collected and administered as well as managed in an electronic media. According to USAID Information Technology Tax Administration, (2013), (Baguma, 2018) e-tax systems is secure with a comprehensive internet portal provide various benefits to the taxation body and tax payers such as: cost-free preparation and submission of tax returns, more safety and security, 24/7 availability, time saving and the ability to file returns from anywhere on any computer/mobile device Baguma (2018).

The electronic tax system can be defined as the system of collecting taxes by the relevant authorities electronically from the taxpayers with the aid of internet service Rotimi and et al, (2020). According to (Awai & Oboh, 2020) the online tax system has taken in better attention globally through the development of information technology. ICT has changed the way taxpayers and tax authorities pay their taxes and, selection of companies for audit and the way they conduct those audits respectively. In taxes and revenue collection, technological innovation has been played a significant role in tax administration and the birth of electronic tax systems Awai & Oboh, (2020). The research conducted by (Uba et al 2021: Stella & Oboh, 2020) e-tax and its administration is the Integrated Electronic Tax Administration System (ITEAS) is the process of gathering, administering and assessing the revenue through an electronic channel to automate tax offices.

The research conducted by (Night and Bananuka, 2018: Rotimi, 2020) the electronic tax system is one of the mechanism tax authorities allow taxpayers to pay on time. According to Stella & Oboh, (2020) cited to the United Nations (2007), e-taxation is a mechanism where tax returns are filed electronically, without the need to file any paper returns; and the use of internet, the www and software for variety of tax administration purposes. In advanced and developing country, the adopting e-taxation includes: increasing revenue generation, supporting administrative system, replacing manual tax administration, improving faster tax refund procedures, tax assessment processes, and helping the authorities reduce and eliminate tax evasion (Stella & Oboh, 2020). According to (Wasao, 2014), his argument about electronic tax system is an online platform that enables the taxpayer access tax services through the internet, which include registration payment and compliance certificate application, and filing of returns

Awai & Oboh, (2020) States the electronic payment system is the transfer of cash via online transactions for business-to-business (B2B), business-to-consumer (B2C), person-to person (P2P), and, most recently, administration-to-consumer (A2C). (Okifo and Igbunu, 2015) argue that e-payment is the part of e-tax system which makes things an easy, safe and efficient way to pay bills and other transactions by electronic means such as card, telephone and internet. According to (Stella & Oboh, 2020) investigate on their research e-tax achieved as taxpayers pay their taxes electronically quickly from the comfort of their homes, workplaces and other places where internet is available. The electronic tax system is a great achievement effort to improve the system of taxation, beneficial to both tax authorities and taxpayers. According to (Stella & Oboh, 2020) the e-tax system was created basically to enhance an efficient and transparent payment system to optimize voluntary compliance and tax revenue generation.

2.5. E-Taxation Services

Various studies have evaluated e-service websites in government and revenue processes. Electronic tax systems first emerged in the USA, offering online services for filing income and tax returns and making payments for both individuals and corporations (Muturi & Kiarie, 2015; Takeoka, 2009). These e-tax services enable online filing and assessment of tax returns, as well as electronic funds transfers for tax payments and refunds. Baguma (2018) and Maisiba and Atambo (2016) argue that e-tax systems enhance compliance and provide faster access to tax services without requiring physical visits to tax authorities. Night and Bananuka (2018) emphasize that for taxpayers to be motivated and satisfied with the e-tax system, it must be user-friendly and pleasant to interact with. (Stella and Oboh 2020) highlight that e-tax services allow taxpayers to pay, receive receipts, and obtain tax clearance certificates from the comfort of their homes or offices at any time. They also refer to (Deloitte, 2017), which details various e-tax services, including registration of new taxpayers, e-stamp duty, e-tax payment with e-receipts, e-filing, and e-tax clearance certificates for application, receipt, and verification.

The effectiveness of e-tax services can be challenging to measure due to their intangible nature. Night and (Bananuka, 2018) note that visible outcomes, such as infrastructure development and security services, are crucial for ensuring accountability and demonstrating the benefits of tax payments. (Purwanto, 2023) suggests that taxpayers are more likely to comply if they feel satisfied with the services provided by the government, reflecting the perceived value of their tax contributions. (Stella and Oboh, 2020) state that electronic tax administration systems are used to improve communication, efficiency, and effectiveness in tax collection and enforcement. According to the (National Tax Agency Report, 2022), enhancing e-tax services involves providing necessary information for accurate tax filing, ensuring an excellent filing and payment experience, and addressing transfer pricing taxation. (Bananuka and Night and, 2018) argue that the government should visibly provide services that reflect the value of the taxes paid by its citizens.

2.6. E-Tax System Usability

As (Yodihartomo, 2020) notes, usability is defined in two primary ways. The ISO standard describes it as "the extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO, 2010). Meanwhile, (Nielsen, 2012) defines usability as a critical quality index in the interaction of digital products, which includes factors such as memorability, learnability, efficiency, user satisfaction, and error frequency.Nielsen identifies five key aspects of usability (Nielsen, 2012):

- ✓ Learnability: How easily a user can operate a product for the first time.
- ✓ Efficiency: The speed at which users can perform tasks once they have learned the design.
- ✓ Memorability: How quickly users can regain their proficiency with the design after not using it for a period.
- ✓ Errors: The frequency and severity of errors, as well as the ease of recovering from them.
- ✓ Satisfaction: The overall contentment of users after completing tasks.

According to Novak (2014), usability is a vital aspect of human-computer interaction (HCI), frequently referred to as "user friendliness" or the "capability of use" within information systems. Baguma (2018) characterizes web usability as encompassing the clarity, simplicity, consistency, and ease of use of websites. Titania et al. (2023) emphasize that usability encompasses the user's comprehension of the application. Furthermore, Stella and Oboh (2020) argue that a well-implemented and fully automated electronic tax payment system enhances transparency and simplifies the tax payment process. The EU Internet Handbook underscores that web usability should ensure websites are user-friendly without necessitating specialized knowledge. On a global scale, the adoption of e-taxation aims to boost revenue generation, streamline administration across all levels of government, minimize bureaucracy, accelerate tax refund processes, refine tax assessment procedures, and reduce or eliminate tax evasion.

In essence, usability refers to how effectively, efficiently, and satisfactorily a software or website enables specified users to achieve their goals in a given context (Baguma, 2018). It is considered a measure of "work effectiveness" (ISO 2010; Hertzum, 2010). While Nielsen's and Shneiderman's definitions focus on applications, the ISO standard emphasizes the context of use, accounting for various attributes and variables related to users (Novak, 2014). The EU handbook underscores that usability aims to present information clearly and unambiguously, placing elements appropriately on web pages to avoid confusion (Baguma, 2020).

2.7. E-Tax System Usability Evaluation

The usability evaluation process encompasses a variety of methods, including heuristic evaluation, cognitive walkthroughs, interviews, log analysis, task analysis, eye tracking, perspective-based inspections, think-aloud usability testing, guideline reviews, focus groups, questionnaires, and remote testing (Islam et al., 2020; Wahyuningrum et al., 2020). This evaluation aims to assess system quality through two main steps: identifying usability problems and determining their severity. Usability evaluation methods are broadly categorized into usability testing and usability inspections, with heuristic evaluations being a key component of the inspection methods (Dix et al., 2003).Heuristic evaluation involves applying usability criteria, where evaluators use "rules of thumb" rather than specific guidelines to assess usability, aiming to improve the ease of use of an interface (Lazar et al., 2010). According to (Titania et al. 2023), expert reviews are particularly useful for uncovering usability issues early in the development of websites or software. These methods can be divided into two categories: "inspection methods" (which do not involve end users) and "test methods" (which involve end users) (FATTA et al., 2018).

Usability standards provide a framework for measuring user performance and satisfaction, helping to assess how well a system integrates into the overall workflow (Novak, 2014). In developed countries, concerns about risk, privacy breaches, and information disclosure are critical factors influencing the adoption of electronic tax systems (Night & Bananuka, 2018). Usability evaluation methods like cognitive walkthroughs, expert evaluations, user tests, and perspective-based inspections often require user involvement or multiple experts (Baguma, 2018). These methods involve well-defined processes for gathering information about user interactions with software and assessing how specific features contribute to usability.

If taxpayers find an electronic filing system difficult to use, they are less likely to adopt it, impacting tax compliance (Maisiba & Atambo, 2016). (Debei et al., 2015) suggest that trust in the security of online tax systems positively influences consumer attitudes and adoption. (Novak, 2014) emphasizes that usability can be systematically improved and evaluated. Since websites are central to e-services, continuous assessment is essential to ensure high-quality service delivery (Shayganmehr & Ali, 2021). Regular evaluation of e-service websites helps identify both strengths and weaknesses, crucial for developing effective online services (Joshi & Islam, 2018). Usability evaluation can be categorized into three broad approaches: expert-based evaluations, automated testing with tools, and user-based testing (Mariann et al., 2010). Expert-based evaluations are particularly effective for assessing information architecture, as users may excel at using interfaces but lack the expertise to evaluate their design effectively (Lazar et al., 2010).

2.8. E-Tax System Usability Heuristics

Heuristic evaluation is a method that allows for the automatic classification of usability issues, streamlining the evaluation process by eliminating the need for post-evaluation meetings among evaluators (Granollers, 2018). Usability heuristics are general guidelines or "rules of thumb" designed to improve usability (Bagman, 2018). According to (Yodihartomo, 2020: Nielsen and Molich, 1990) proposed four methods for evaluating usability, one of which is heuristic evaluation. Among various heuristics developed by researchers, Nielsen’s set of 10 heuristics, introduced in 1994, is the most widely used and refined from the original list created by Nielson and Rolf Mulch in 1990. These ten heuristics are: visibility of system status; match between system and the real world; user control and freedom; consistency and standards; error prevention; recognition rather than recall; flexibility and efficiency of use; aesthetic and minimalist design; help users recognize, diagnose, and recover from errors; and help and documentation (Bagman, 2018).

(Granollers, 2018: cited MAsip et al., 2012) describes a comprehensive framework that facilitates a semi-automatic approach to selecting the most appropriate set of heuristics for each specific situation. While using web usability heuristics by a single expert can efficiently uncover most usability issues at a low cost and in a short time, automatic web evaluation tools are often not employed because they primarily focus on reporting the number of errors rather than providing detailed analysis. Nielsen initially proposed a set of nine heuristics for early usability inspections, which were later expanded to the ten heuristics used today (Nielsen, 1994a). Heuristic evaluations are quick and cost-effective, requiring only a few days to inspect a site and produce a report. This method involves usability experts reviewing a site's interface based on accepted usability principles, identifying major design rule breaches, and offering prompt feedback to designers. Assigning the correct heuristics helps suggest the most effective corrective measures (Baguma, 2018).

Nielsen and Molich's Ten Usability Heuristics have been shown to effectively identify a significant number of usability issues, with the number of problems detected increasing as the number of evaluators grows from one to five (Nielsen & Molich, 1990). This suggests that having three to five participants is optimal for heuristic evaluation. However, various studies have highlighted that some issues may arise from incomplete procedures and the subjective nature of usability assessments.

2.9. E-Tax System Usability Heuristics Evaluation

Heuristic evaluation is one of the most common methods to identify usability problems. These methods find usability problems with a minimum amount of time, cost and resources [9].The evaluations were conducted in a professional, ethical and socially-responsible manner. Heuristic evaluation's primary goal is to identify usability problems when some expert users operate the system interface at a relatively low cost and time, resulting in multiple enhancements to the e-tax applications (Kumar et al., 2020). According to (Mariann, et al.,) heuristic evaluations are usually conducted by using a small set of general usability principles; therefore, evaluators are allowed to decide how they want to perform the evaluation of the e-tax interface and they are not required to perform tasks. If more than one evaluator is involved in the process, they should perform the evaluations independently and briefed after performing the evaluations so that they can share their experiences and suggest solutions (Mariann, et al; Baguma, 2018; Nielsen, 1995).

(Titania and et al., 2023) stated that by considering UI design principles based on the users' needs the major heuristic usability problems in a design or e-tax system without using the large set of resources related to various user groups could be solved. The outcome of the heuristic evaluation the e-tax system is a list of an interface's usability problems with references to the heuristics that were violated by the design according the evaluator (Nielsen, 1995a). During a heuristic evaluation, the evaluator(s) needs to go through the interface several times to inspect various dialogue elements (Pickard, 2013). The vast literature on web-apps UI/UX design and analysis using HE, there seems lack of explanation on how's the usability and quality of web-apps based on the HE(Titania and et al, 2023).

The results of a heuristic evaluation typically include a list of features that cause usability problems that should be improved, features that do not cause problems and do not need to be changed, and features that should be tested with actual users (TecEd, 2016). Evaluation is used to improve the usability of the web app by applying the Heuristic Evaluation method, which is an informal method of usability analysis (Titania and et al., 2023). The table below shows usability HE principles in who inspection experts use in order to tackle the problem found in e-tax system. HE conducted by evaluators who are acknowledged domain experts, experienced and those who are in the content of the system being studied. The heuristics or rules of thumb' guide their critique of the design under evaluation. The result of HE is a list of usability problems in the system, more experts are involved with an evaluation, and more problems are discovered.

No.	Heuristic	Description
H1	Visibility of System Status	The system should always keep users informed about the ongoing events through appropriate messages in a period of time.
H2	Match between system and the real world	The system should speak the familiar users' language which follows the real-world convention, making information appear naturally and logical.
H3	User control and freedom	Users have the ability to leave, undo, or redo the unwanted action that made by mistake.
H4	Consistency and Standards	Users do not have to wonder different situations or the action where lead to the same meaning.
H5	Error Prevention	The system notify user which require confirmation before they commit an action which lead to the permanent change or error.
H6	Recognition rather than Recall	Reduce the users' memory load to accomplish action by providing objects, actions, and options visible and easily retrieved.
H7	Flexibility and Efficiency of use	The system allows novice users to accelerate the interaction and makes the expert can tailor the action easily.
H8	Aesthetic and minimalist	Dialogues should not contain irrelevant information which

	design	diminishes the relevant information visibility.
H9	Help users recognize, diagnose and recover from errors	Error message explained in a plain language, precise, and suggest a solution to the users.
H10	Help and documentation	The system provides help and documentation for the users to make them easier to retrieve information and list of concrete steps to achieve goals.

Table 1. List of Nielson's 10 Heuristic Usability Evaluation Description

2.10. Determinants of E-Tax Evaluation Principles

Various sets of principles are available for conducting heuristic evaluations (Mariann et al.). (Nielsen, 1994) describes heuristics as general rules that capture common properties of usable interfaces, with the flexibility to incorporate additional principles as needed during the evaluation process. Conversely, (Shayganmehr and Ali, 2021) emphasize that effective assessment indices and indicators include website design, responsiveness, quality, security, content, citizen participation, trust, support, and maintenance. Nielsen's 10 usability heuristics are: visibility of system status; match between system and the real world; user control and freedom; consistency and standards; error prevention; recognition rather than recall; flexibility and efficiency of use; aesthetic and minimalist design; help users recognize, diagnose, and recover from errors; and help and documentation. The following section outlines each heuristic according to (Nielsen, 1995) and its application in web usability research:

Visibility of System Status: The design should keep users informed about what is happening through appropriate feedback within a reasonable timeframe. Users should always know the current system status, which helps them understand the outcomes of their actions and determine the next steps. Clear communication about system states fosters trust and ensures predictable interactions (Jakob Nielson, 1995). Match between System and the Real World: The design should use familiar language, concepts, and conventions that align with users' real-world experiences. Information should be presented in a logical order that users can easily understand without additional clarification. This approach ensures that users can interpret the system without needing to consult definitions (Jakob, 1995).

User Control and Freedom: Users should have the ability to easily undo or exit unwanted actions. Providing a clear "emergency exit" helps users feel in control, reduce frustration, and navigate back from mistakes without complex procedures (Jakob, 1995). Consistency and Standards: Users should not be confused by different meanings of similar words or actions. Adhering to platform and industry conventions reduces cognitive load and prevents the need for users to learn new terminologies or processes (Jakob, 1995). Error Prevention: Good design aims to prevent errors before they occur by eliminating error-prone conditions or providing confirmation options. Distinguishing between slips (unconscious errors) and mistakes (conscious errors) helps in crafting better error prevention strategies (Jakob, 1995).

Recognition Rather Than Recall: Design should minimize the user's memory load by making elements, actions, and options visible. Users should not need to remember information from one part of the interface to another; instead, critical information should be readily accessible (Jakob, 1995). Flexibility and Efficiency of Use: The design should accommodate both novice and expert users by providing shortcuts for frequent actions and allowing customization. Flexible processes enable users to perform tasks in various ways, catering to their preferences and expertise (Jakob, 1995).Aesthetic and Minimalist Design: Interfaces should focus on essential information and avoid irrelevant or rarely needed content. Reducing clutter ensures that relevant information remains prominent and supports the user's primary goals (Jakob, 1995).

Help Users Recognize, Diagnose, and Recover from Errors: Error messages should be clear, use plain language, and provide precise problem identification and constructive solutions. Effective visual treatment of error messages aids in their recognition and resolution (Jakob, 1995). Help and Documentation: While the design should ideally be self-explanatory, providing documentation may be necessary. Help content should be easily searchable, task-focused, concise, and include clear, actionable steps (Jakob, 1995).

Heuristic evaluations are a cost-effective and rapid method for identifying usability issues, requiring only a few days for site inspection and reporting. This approach provides valuable early feedback to designers and helps suggest appropriate corrective actions (Baguma, 2018). The Ten Usability Heuristics by Nielsen and Molich have been widely adopted, with research indicating that increasing the number of evaluators from one to five significantly enhances the detection of usability problems (Nielsen & Molich, 1990). However, some challenges, such as incomplete procedures and the subjective nature of usability, may still affect the evaluation process.

2.11. Challenges of e-Tax System in Developing Countries

The evolution of e-government initiatives reflects a significant shift in how governments interact with citizens, particularly in developed countries where the push for access, transparency, and improved service delivery is robust. However, the scenario in developing countries is markedly different, influenced by a myriad of factors including economic conditions, infrastructure limitations, and the availability of human capital (African Union Development Agency, 2022). In many developing nations, the implementation of e-government services is fraught with challenges. As highlighted by (Benaida,2022), while there is an urgent need for government services to align with technological advancements, the reality is that many governments grapple with inadequate IT infrastructure and financial constraints. These shortcomings stymie efforts to deliver advanced electronic services, which are essential for fostering trust between citizens and their governments.

Additionally, (Twizeyimana et al., 2019) highlight that many e-government initiatives struggle due to a fundamental misunderstanding of the e-government concept, including its processes and functions. This lack of clarity restricts the potential advantages that e-government can offer, resulting in a persistent gap between the demand for and the availability of e-services. (Zeleke, 2018) points out that this gap often arises from an inability to address users' actual needs and expectations. (Adfires, 2018) identifies a range of challenges associated with the implementation of e-government, including limited access to e-services, security concerns, trust issues, service quality, lack of awareness, and individual differences among users. These challenges can significantly hinder participation and impede the effective utilization of e-government services.

The transition from centralized government operations to the adoption of electronic services is not straightforward. (Benaida, 2023) notes that various factors, including design considerations, logistical infrastructure, internet speed, and the adoption of new services, present considerable obstacles for governments embarking on the journey toward e-government. Addressing these challenges is crucial for realizing the potential of e-government initiatives, ensuring that they effectively serve the needs of citizens, and fostering a more transparent and accountable governance framework. In summary, while e-government initiatives hold promise for enhancing service delivery and governance, the unique challenges faced by developing countries necessitate tailored strategies that consider the local context, resources, and user needs.

2.12. E-Tax Interface design and implementation Approaches

(Sesha and Santosh, 2022) emphasize that web portals serve as a crucial interface for organizations, reflecting their value and significantly influencing usability and performance. Research indicates that one effective design approach, User-Cantered Design (UCD), should prioritize flexibility, scalability, and sustainability (Titania et al., 2023). Previous studies have shown that design principles are pivotal in crafting an effective UI/UX that aligns with user needs, ultimately ensuring good usability. User involvement is essential in this process, as it allows for the design of UI/UX that accurately reflects users' requirements. During the design phase, these principles are key to enhancing the usability of interactive systems (Sesha et al., 2022).

When developing interfaces for expert user groups—especially those with financial and technical backgrounds—it's crucial to consider their daily work processes. This understanding ensures that the system interfaces effectively support their tasks and enhance their overall work experience. Skilled users in these fields must have their unique needs addressed (Novaka, 2014). To create an effective UI/UX, it is vital to apply design principles that meet users' needs, thereby ensuring that the application's usability is appropriate for the target market (Titania et al., 2023).

The foundation of effective design can be traced back to established guidelines, such as Schneiderman's Eight Golden Rules of Interface Design and Nielsen's Ten Usability Heuristics for Interaction Design. Since their inception, various authors have expanded upon these frameworks, modifying Nielsen's list and introducing new principles to address specific aspects not previously covered (Granollers, 2018). Additionally, usability evaluation tools and guidelines—such as Jacob Nielsen's usability heuristics and research-based web design and usability guidelines—are available to assist in both the design and evaluation of web interfaces. These resources include website optimization tools, link validators, HTML validators, and accessibility testing software (Baguma, 2018).

In summary, the integration of user-centred design principles, a thorough understanding of user needs, and the application of established usability guidelines are essential for creating effective web portals that enhance user experience and satisfaction. By prioritizing these elements, organizations can develop interfaces that not only meet user demands but also contribute to improved overall performance and value.

2.13 Models and Frameworks to Evaluate Usability of e-Services

2.13.1 IA framework

This study introduces an Information Architecture (IA) framework aimed at efficiently segmenting websites into clear and simple dialogue elements, as proposed by Mariann et al. It presents a structured evaluation workflow for heuristic evaluators assessing the usability of an E-tax website's IA. Step 1: Identify project participants: Determine all participants in the evaluation, including the project manager, researchers, and evaluators like librarians and web developers. Evaluators do not need to be usability or IA experts. Step 2: Identify dialogue elements: Define the dialogue elements for evaluation, ensuring all evaluators assess the same components using a consistent numbering system for easier report comparison. Step 3: Begin the first pass through the system: After briefings, evaluators conduct an independent evaluation in two passes. The first pass helps them become familiar with the dialogue elements, while the second pass identifies any missing elements that could affect usability. Both findings should be documented. Step 4: Evaluate each dialogue element independently: Evaluators perform a detailed heuristic evaluation for each dialogue element using predefined heuristics, starting with elements like headers and footers. They document issues, observations, and recommendations, noting when a heuristic is inapplicable. Step 5: Writing the report: The researcher decides the format of evaluators' reports, providing a consistent template. Reports should be structured with headings indicating dialogue element and heuristic numbers, aiding comparison. Evaluators must address all heuristics, even for elements without identified problems, and note any uncategorized issues. Step 6: Consolidation of the reports: After evaluations, the researcher consolidates the reports into a single document reflecting all evaluators' findings. Using the provided template facilitates comparison and synthesis of findings through qualitative content analysis, resulting in a comprehensive usability overview

2.14 Theoretical/Conceptual Framework

According to the international standard ISO, usability refers to how effectively, efficiently, and satisfactorily a product can be used by specified users to achieve their intended goals within a particular context. Nielsen (1994) highlights that web usability, which is marked by simplicity and organization, helps users find the information they need. He describes usability as a blend of factors that affect the interaction between the user and the product or system. Moreover, the quality of a website is primarily gauged by its capacity to help users accomplish their objectives, often reflected in their willingness to return and interact with the site repeatedly (Ali et al., 2021).

2.14.1 Theoretical Framework

This topic explains, from literature, the theoretical foundation of the issues relevant to meet the objective of the research, usability evaluation e-tax system based on a heuristic evaluation.

E-tax system

The electronic tax system is a method for collecting taxes electronically from taxpayers through internet services by the relevant authorities. This online approach enables taxpayers to access various services offered by tax authority, such as registration for a personal identification number, filing returns, and applying for a compliance certificate. In Ethiopia, the electronic tax system was introduced in 2013 and includes several e-services: e-Registration, e-Payment, and e-Filing. E filing allows taxpayers to submit their tax returns via the Federal Ministry of Revenue Service's Integrated Tax Administration System (ITAS). E-payment facilitates the payment of all federal taxes and levies through platforms like the Ethiopian National bank, commercial bank of Ethiopia and private banks Settlement System. E-registration enables new taxpayers to register with the ministry of revenue service for various taxes. E-taxation refers to the collection and administration of tax procedures through electronic means (Wasao, 2014) describes the electronic tax system as an online channel that enables taxpayers to access tax authority services from the comfort of their homes, including registration for a Tax Identification Number and electronic filing of tax returns.

The paper examines the usability of an online e-tax system in Ethiopia, which also facilitates filing and payments for public services, given the public nature of e-tax portals, their usability is crucial for ensuring that taxpayers find them easy, effective, and satisfying to use. The study evaluates Ethiopians' e-tax portal using Jakob Nielsen's 10 Usability Heuristics for User Interface Design and identifies current usability issues. It offers recommendations for the Ethiopia ministry of revenue (MoR) to address these gaps, aiming to enhance the portal's effectiveness and efficiency. A more user-friendly e-tax portal would also reduce training, support, and maintenance costs. Additionally, the paper provides general suggestions for developing and managing more usable websites.

Usability

In the early research on human-computer interaction (HCI), the term "usability" was defined within a situational context by ISO 9241. According to (ISO, 2010), usability is described as the "extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use." Generally, the term "usability" refers to the "capability of being used," encompassing the ease of use and how effectively users can accomplish their intended tasks using a given tool (Quiñones and Rusu, 2019; Baguma, 2018).

In the context of websites, the process of users accessing and retrieving information is facilitated by the web interface, which enables them to perform these tasks effectively. Various theoretical frameworks and models have been developed and tested to assess different aspects of online quality. Additionally, some researchers have examined quality-related issues specific to e-governance on government websites (Ali et al., 2021). Nielsen (1994) discusses the concept of web usability, asserting that well-organized and straightforward web pages assist users in locating the information they seek. He defines usability as a combination of factors that influence the interaction between the user and the product or system.

There are three primary methods for evaluating usability: inquiry-based methods, investigative methods (such as heuristic evaluation), and user testing. Inquiry-based methods involve data collection techniques, including questionnaires, interviews, and focus groups. Investigative methods, particularly heuristic evaluation, involve experts assessing the system against usability criteria; usability testing is a form of user research where test participants use their product to complete tasks especially during the design and production phases. One of the most recognized frameworks for these evaluations is Nielsen's Ten Usability Heuristics.

Usability remains a fundamental concept in HCI, with various definitions emerging over the years; however, the core principles have remained consistent despite significant advancements in systems, products, and services due to rapid technological innovations (Chen et al., 2015). ISO also provides a detailed definition of usability, stating it is the "extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO, 2010).

According to Nielsen, usability is a crucial aspect of the software development process and encompasses several key factors: Learnability: The system should be easy to learn, enabling users to quickly begin accomplishing tasks; Efficiency: Once users have learned the system, it should facilitate efficient use, allowing for a high level of productivity; Memorability: The system should be easy to remember, so that infrequent users can return without needing to relearn everything; Errors: The system should minimize errors, enabling users to make few mistakes during operation, and when errors do occur, recovery should be straightforward. Critical errors should be avoided entirely; and Satisfaction: The system should be enjoyable to use, ensuring that users feel satisfied and positive about their experience.

Usability Heuristic Evaluation

Extensive systematic reviews of usability inspection in both research and practice have demonstrated the significant benefits of heuristic evaluation (HE) (Hollingsed and Novick, 2007; Quiñones and Rusu, 2017). These benefits include requiring fewer resources, being intuitive and easy for people to implement, not necessitating complex planning, being applicable early in the development process, and offering better predictions of potential interface issues. HE is particularly effective at identifying more critical problems compared to usability testing, guidelines, and cognitive walkthroughs because it utilizes widely accepted heuristics, specifically Nielsen's heuristics, to inspect an interface and pinpoint usability problems that are both theoretically grounded and domain-specific (Jaferian et al., 2011).

Heuristic evaluation of user interfaces is defined as a series of activities aimed at examining an interface and forming opinions about its strengths and weaknesses (Nielsen and Molich, 1990). The objectives of the evaluation include the following points (ISO, 2010): collecting new information about user needs; providing feedback on the strengths and weaknesses of the design from the user's perspective; assessing whether user requirements have been met; and establishing baselines or making comparisons between different designs. There are 86 methods available for evaluating usability, among which heuristic evaluation is one of the simplest and quickest to implement (ISO, 2010; Quiñones and Rusu, 2019; Baguma, 2018). According to (ISO 9241:210, 2010), as illustrated in the accompanying figure, two major categories of user-cantered evaluation are identified: User-Based Testing and Inspection-Based Evaluation (ISO, 2010). HE falls under inspection-based evaluation and is ideally conducted in the field by usability experts who possess experience with end-user issues and knowledge of standardized ergonomic design (Yodihartomo, 2020). For evaluators to effectively assess usability, it is crucial that they have a comprehensive understanding of the system, including its features, navigation, and the specific context of use. This knowledge allows them to apply an appropriate set of existing or customized heuristics, or to identify the particular aspects of User Experience that need evaluation based on the system's scope (Yodihartomo, 2020)

Usability Evaluation of Interfaces

The assessment process focuses on evaluating the usability and acceptability of an artifact (Nielsen, 1994), with criteria such as user error frequency influencing these qualities. Cybis , (2007) describes usability evaluation techniques as diagnostic methods that involve inspecting interfaces to identify user-system interaction issues. (Preece, et al., 2005) highlight that understanding the importance of evaluation and determining the appropriate timing for it are crucial aspects of interaction design, aiming to create systems that are easy to learn, efficient, safe, and satisfying for users. One recommended technique for assessing system interface usability is heuristic evaluation (Preece, et al., 2005)

2.14.2. Conceptual Framework

A conceptual framework serves to clearly illustrate the research concepts and propose relationships between them, providing a context for interpreting study findings and explaining observations to address the research question (Luo et al., 2015). Miles and (Huberman, 1994) define a conceptual framework as either a visual or written representation that explains, through graphical or narrative means, the key factors, concepts, or variables and their presumed relationships.

The objective of evaluating the usability of the Ethiopian e-tax portal using Nielsen's 10 Usability heuristic principles is to assess how well the portal performs in terms of user-friendliness and identify any challenges or areas of improvement. Nielsen's heuristics are widely used guidelines for evaluating the usability of websites and digital systems. Below is an outline of the objectives based on these principles: which establishes a foundational understanding for assessing the usability of the existing system. Characteristics of e-tax portals are derived from a literature review, and the case study enhances comprehension of the features and functions of the

Ethiopian e-tax portal in ministry of revenue, thereby facilitating the selection of an appropriate inspection or expert usability evaluation method. According to (Luo, 2015), the focus is on three commonly used usability evaluation methods: user-cantered evaluations, expert-based evaluations, and model-based evaluations. From each method the expert based heuristic evaluation is chosen as the evaluation method for the Ethiopian e-tax portal's usability.

The next concept outlines the heuristic principles utilized to assess the usability of the e-tax portal, with the concept presents the usability evaluation results along with recommendations for improvement (Luo, 2015). Drawing from these concepts, the research framework aims to answer the question: what types of usability issues exist in the e-tax portal? The conceptual framework for applying Nielsen's 10 Usability Heuristics to evaluate an e-tax system focuses on systematically assessing the usability of the system's interface and its effectiveness in supporting key user tasks. This framework offers a structured approach to identifying usability issues, recommending design improvements, and enhancing overall user satisfaction, all while adhering to well-established usability principles.

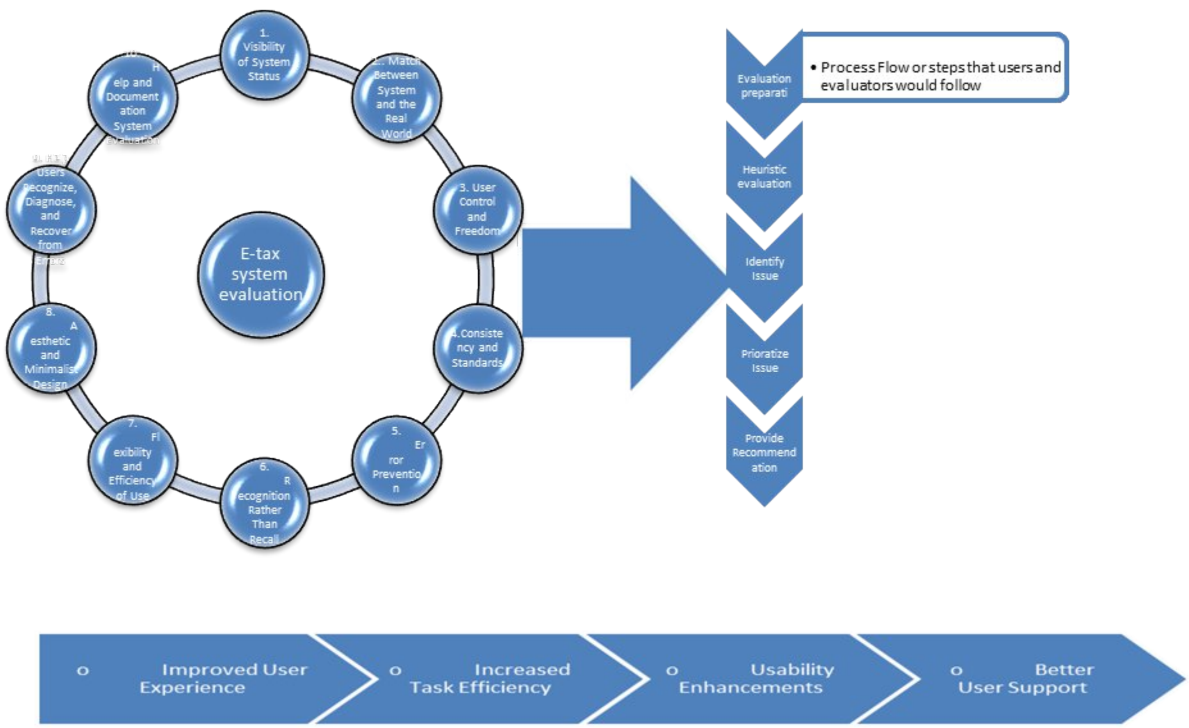

Figure 1. Framework Structure for Nielsen's Heuristic Usability Evaluation of E-Tax System

1. Core Components of the Conceptual Framework

The conceptual framework for evaluating the e-tax system using Nielsen's 10 Usability Heuristics is built around several core components that interact throughout the evaluation process. First, Users include the system's end-users: such as tax filers both novice and experienced, tax consultants, and administrators whose needs, goals, expectations, and challenges must be understood, particularly when filing taxes online, making payments, or seeking assistance. Second tasks refer to the key actions users need to perform, such as registering, filing returns, submitting payments, tracking status, managing tax details, and troubleshooting errors, with task complexity ranging from simple tasks like checking tax status to more complex ones like completing returns with multiple deductions. The third is heuristic evaluation, based on Nielsen's 10 usability heuristics, provides the principles for assessing the system's design and its effectiveness in meeting user needs. Finally, Usability issues and solutions involve identifying design flaws that may hinder user performance or satisfaction using the heuristics, followed by actionable design solutions to address these issues and improve the overall user experience.

2. Application of Nielsen's 10 Usability Heuristics to the E-Tax System

Nielsen's 10 usability heuristics provide the guiding principles for evaluating the e-tax system, identifying usability challenges, and recommending improvements. These heuristics include ensuring Visibility of System Status, where the system provides clear feedback (e.g., confirmation messages, progress indicators) and keeps users informed about their actions, such as data submission or payment processing. The system must also ensure a match between system and the real world, using familiar language and terminology (e.g., "Income," "Tax Deduction," "Payment Confirmation") and aligning interface elements with users' mental models of tax processes. User control and freedom is essential, allowing users to easily undo or redo actions, such as editing tax forms or correcting payment details, with clear options to backtrack or cancel actions during critical steps. The system should follow consistency and standards, ensuring a uniform interface (e.g., button styles, control placement) and adhering to established design conventions.

Error prevention is another key principle, with the system incorporating features like data validation, pre-filled fields, and error-checking to avoid common mistakes, such as submitting incomplete forms or entering invalid tax IDs. In line with recognition rather than recall, the system should reduce cognitive load by displaying relevant options and information without requiring users to remember details from previous actions, ensuring critical actions are easily accessible and clearly labeled. The system should also offer flexibility and efficiency of use, catering to both novice and expert users by providing features like shortcuts, auto-fill, and saved preferences to streamline tasks. An aesthetic and minimalist design is crucial, ensuring that the interface is visually appealing, free of unnecessary clutter, and prioritizes essential elements to make tasks straightforward. Additionally, the system must help users recognize, diagnose, and recover from errors by providing clear, constructive error messages and troubleshooting options, such as links to help sections or live chat. Finally, the help and documentation should be easily accessible, context-sensitive, and relevant to users' current tasks, providing support when issues arise, such as through FAQs, user guides, or tooltips. Process of Heuristic Evaluation in the Framework

3. Process of Heuristic Evaluation in the Framework

Preparation： Define evaluation scope which identify which tasks will be evaluated (e.g., tax registration, filing a return, making payments) and which user groups will be involved. Select Evaluators: A group of usability experts familiar with Nielsen's heuristics (typically 3-5 evaluators) will independently assess the system. Evaluation: a) Systematic review which evaluators use the 10 heuristics to assess the e-tax system's interface. Each evaluator will focus on the critical tasks to spot violations of the usability heuristics. B) Usability issue identification where Evaluators record usability problems they encounter based on the heuristics. Each identified issue will be linked to the specific heuristic it violates. Prioritization: a) Severity rating when Issues are rated based on their severity (e.g., critical issues, moderate issues, minor issues) and impact on task completion (e.g., errors, confusion, delay). B) Task impact while evaluators assess which usability flaws most hinder users' ability to efficiently and effectively complete key tasks.

4. Recommendation for Improvement:

Based on the identified issues, evaluators recommend design solutions such as simplifying the interface, adding error prevention features, improving system feedback, or enhancing help documentation. These solutions provide actionable insights that address user pain points and enhance overall system usability, ensuring users can complete tasks more efficiently and with fewer errors.

2.15. E-Government in Ethiopia

According to Zeleke, the e-Government Strategy and Implementation Plan of Ethiopia encompasses four key objectives: bringing the government closer to the people, implementing effective governance, enhancing service delivery, and fostering private sector participation through resource deployment, entrepreneurship, and competence. The introduction of e-tax in 2011 positioned Ethiopia among the nations adopting e-government for taxation purposes. While the government's efforts to facilitate tax payment and filing are commendable, the reluctance of some taxpayers to engage with the e-government platform is not a challenge unique to Ethiopia; similar issues have been observed in other countries. (Azmi et al. 2012) noted that taxpayer willingness to use the e-filing system largely depends on their perception of its usefulness.

E-Government involves leveraging information technology such as computers, networking, and communications to enhance the efficiency and quality of government organizational structures and processes. Its goals include delivering high-quality, standardized, and transparent services to the public while facilitating streamlined operations that are not hindered by constraints of time, space, or departmental silos.

2.16. E-Tax System Initiatives in Ethiopia

Taxation plays a vital role in the development of any country by enabling the mobilization, allocation, distribution, and stabilization of resources. According to (Tamiru, 2021), the development of the e-tax system in Ethiopia has been accompanied by a series of tariff and tax reform initiatives implemented by the government and the Ministry of Revenue. These reforms were necessitated by outdated tariff and tax laws, inadequate customs and tax administration, and a tax regime that failed to attract investment, facilitate trade, and generate sufficient revenue to cover both current and capital expenditures, thereby financing development and poverty reduction projects that primarily benefit the government.

The increase in both direct and indirect taxes, particularly those related to foreign trade, has contributed significantly to revenue growth. For instance, revenue as a percentage of GDP rose from -5.2 percent in 1996/97 to -14.5 percent in 2002/03. This underscores Ethiopia's challenges in revenue collection, especially when compared to the over 23% of GDP collected by other countries in Sub-Saharan Africa (Mesfin & Bogale, 2013).

The primary types of taxes in Ethiopia, established by the Ministry of Revenue in accordance with the Income Tax Proclamation No. 286/2002, include: Value Added Tax (VAT): A tax of 15% applied to the final price of every taxable transaction. Excise Tax: Applicable to selected goods, including luxury items and basic goods that are demand inelastic. Turnover Tax: Imposed on individuals not registered for VAT, applicable when annual transactions exceed 500,000 Birr, with a rate of 2% on goods sold locally and 10% on other transactions. Income Tax: Taxed on income derived from employment, business activities, entertainment, music, sports, etc. Business Profit Tax: Taxed at a rate of 30% on taxable income, calculated as business income minus deductions and exemptions.

2.16.1. E-Tax Portal in Ministry of Revenue

The e-tax system integrates electronic tax declaration and payment processes (e-filing and e-payment), allowing taxpayers to declare and pay their taxes anytime and from anywhere via the Internet. Taxpayers can also receive payment receipts directly to their email addresses. The e-declaration system, a component of this e-tax application, was initially launched in 2004 on a pilot basis with 50 top taxpayers who voluntarily completed an e-notification registration form and registered for the e-notification system. These selected taxpayers were supported in using the system through information clearance, training, and user account creation. The primary goals of the e-declaration system are to enhance tax compliance, reduce taxpayer costs, and improve the tax information collection process.

The e-tax application system connects to the SIGTAS database and aims to be comprehensive by incorporating the e-notification feature. The e-payment system was implemented by selecting 11 government enterprises, all of which have accounts at the Commercial Bank of Ethiopia. In February 2010, the e-payment system began on a pilot basis through a memorandum of understanding between the Ministry of Revenue and Insana, as well as the National Bank. Initially, the Commercial Bank of Ethiopia facilitated the e-payment system, as other private banks were not yet prepared, although many private banks have since adopted the system.

According to documents from the Ministry of Revenue, full implementation of the e-tax system commenced in December 2011, expanding to include all high taxpayers and all Ministry of Revenue offices. Consequently, commercial banks trained their customers on using the e-payment system and established user accounts for them. The office e-announcement system operates as a secure communication channel between taxpayers and the institution's system, utilizing unique usernames and passwords provided by the taxpayers. The e-payment system relies on e-notifications of payments and generated document numbers, facilitated by an API established with commercial banks and the National Bank. Taxpayers using the e-tax system complete their required payments, which are then recorded in the core SIGTAS system, thereby opening their tax accounts. A payment receipt is automatically generated and sent to their registered email address.

2.16.1.1. Ministry of Revenue E-tax System Performance

step 1: e-Tax users log into their assigned accounts and enter their tax payment information into the system, step 2: The SIGTAS system verifies the entered information and, using the API (Application Programming Interfaces) established with the recipient, sends the generated document number and payment amount to the recipient system every five minutes, step 3: The access system makes the document information available to the banks, step 4: Taxpayers are required to make payments to the bank using the provided document number(s) as a reference, Step 5: The bank notifies the access system once the payment has been completed, step 6: Based on the payment details, banks transfer the federal tax to the National Bank, while regional and city government taxes are sent to the Commercial Bank of Ethiopia, step 7: The National Bank forwards the payment information to the Ministry of Revenue's SIGTAS system, step 8: The SIGTAS server processes the received file, verifies the documents, and updates the taxpayer's tax account accordingly, step 9: Once the required information is recorded in the tax account, an electronic receipt is automatically generated and sent to the taxpayer's registered email address, with a copy also sent to the tax center, and the last step 10: The SIGTAS system retrieves the information from the billed document for account reconciliation.

Step 11: As part of the process, the payment information system of the National Bank, which is integrated with the Commercial Bank of Ethiopia, receives data from the bank, debits the taxpayer's tax account, and emails an electronic receipt to the taxpayer.

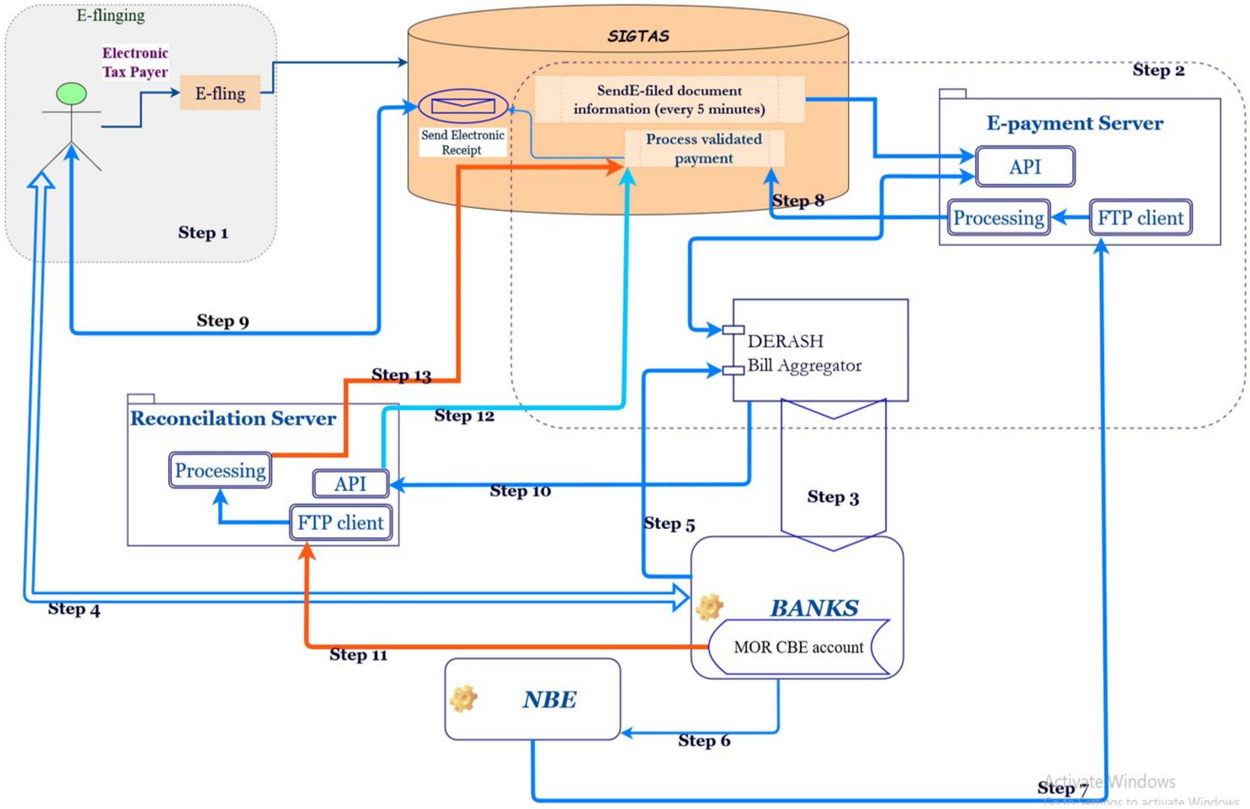

Figure 2. Graphical description of e-tax system in Ethiopian

2.17. Review of Related Works

2.17.1. Heuristic Evaluation:

This section provides an in-depth exploration of Heuristic Evaluation, complementing leading surveys in the field (Mendoza, 2009). It emphasizes the Heuristic Evaluation process and the **available tool support.**

Heuristic: Heuristic Evaluation is an inspection method developed by Nielsen and (Molich, 1990) designed to identify usability issues in user interfaces. In this straightforward approach, a small group of evaluators independently examines the interface for compliance with established usability principles, known as "heuristics." The usability problems identified are compiled into a comprehensive report, which the development team reviews to reach a consensus on how to address and prioritize these issues.

Evaluators carefully analyze the interface, noting any features that violate the heuristics. The output of a Heuristic Evaluation consists of a list of potential usability problems. After combining the lists from all evaluators, they convene to identify duplicates, merge similar descriptions, suggest solutions, and assign severity ratings for prioritization. Nielsen recommends using a 0-4 severity rating scale for this process (Nielsen, 1995b (see Table 2).

List of Label	Definition
0	I don't agree that this is a usability problem at all
1	Cosmetic problem only: need not be fixed unless extra time is available on project
2	Minor usability problem: fixing this should be given low priority
4	Major usability problem: important to fix, so should be given high priority
4	Usability catastrophe: imperative to fix this before product can be release

Table 2. Nielson's severity rating scale borrowed from (Nielson 1995 b)

Several Heuristic Evaluation dimensions can be identified from the description above: the heuristics that are used to guide the inspection, evaluators performing the inspection, the user interface that is being evaluated, and the process that is followed. Heuristics are general principles of usability that "appear to capture common characteristics of usable interfaces" (Nielsen, 2005 a). Initially, Nielsen and Molich [1990] proposed nine heuristics based on their observations of typical problem areas in interfaces and existing guidelines. A subsequent factor analysis of 249 usability problems [Nielsen 1994b] resulted in the formulation of ten heuristics (see Table 2.2). These heuristics are widely used for evaluating interfaces in general. For instance, (Instone,1997) elaborated on Nielsen's ten heuristics specifically for the Web, placing a greater emphasis on navigational aspects.

1	Visibility of system status
2	Match between system and the real world
3	User control and freedom
4	Consistency and standards
5	Error prevention
6	Recognition rather than recall
7	Flexibility and efficiency of use
8	Aesthetic and minimalist design
9	Help users recognize, diagnose, and recover from errors
10	Help and documentation

Table 3. Nielson's ten usability heuristics (Nielson 1994, 2005 b)

For example, Dykstra [1993] created calendar-specific heuristics derived from user testing of various commercial calendar systems. The results indicated that evaluators using these tailored heuristics identified more usability issues, and the problems they found were often more severe compared to those assessed through standard Heuristic Evaluation. It's important to note that Dykstra's proposed heuristics included sub-headings; on average, each of the nine heuristics had 6.6 sub-headings detailing aspects of the broader heuristic, with one heuristic featuring as many as 19 sub-headings. This structure may resemble a Guideline Review with 60 guidelines rather than a Heuristic Evaluation based on nine high-level heuristic.

For instance, Cockton and Woolrych's extended usability problem format (originally introduced in [Woolrych 2001]) requires evaluators to "hypothesize likely difficulties in context" instead of merely concentrating on specific problem features. This extended format encourages a more reflective approach, making evaluators less prone to suggesting problems without adequate justification (Cockton and Woolrych, 2001). Furthermore, an updated version of the form (Cockton et al. 2003) includes a section for providing evidence of heuristic non-conformance, prompting evaluators to consider their rationale for identifying violated heuristics.

Evaluators: Typically, Heuristic Evaluations involve between 3 and 5 (Bevan et al. 2003) and 8 ([Nielsen and Landauer, 1993) evaluators, though this number remains a topic of debate (Bevan et al. 2003). Novice evaluators often struggle in Heuristic Evaluations (Nielsen 1992; Jeffries et al. 199; Desurvire et al. 1992. Their performance is partly due to a lack of experience in both usability and the relevant application domain. (Nielsen, 1992) categorizes evaluators into three groups: "novice," "regular specialists" (those with usability expertise), and "double specialists" (those with both usability and application domain expertise). In his research, regular specialists identified 75% of the issues when combining individual problem lists, while achieving the same success rate required fourteen novice evaluators.

User Interfaces: Nielsen [1990] discovered that the evaluation of paper versus computer mockups can affect the types of usability issues identified. The author of this dissertation contends that the "physical" characteristics of user interfaces influence both their usability and evaluability. For instance, when assessing interactive interfaces, evaluators engage directly with the interface, inputting information, navigating between screens, and testing various functionalities. This hands-on experience allows evaluators to encounter issues firsthand, facilitating the identification of potential problems.

Usability Problem Formats

Evaluator performance can be influenced by the formats used to capture usability problems during evaluation sessions. Cockton and colleagues [Cockton et al. 2003] developed an extended form that demonstrated significant improvements in evaluator performance compared to an earlier study (Cockton and Woolrych 2001). Heuristic Evaluation is known to yield a high volume of identified problems (Jeffries et al. 1991; Tan et al. 2009), but it also produces many false alarms issues that are not actual problems with the interface (Bailey et al. 1992). A high rate of false alarms poses a risk of making design changes based on incorrect assessments, so minimizing them is crucial.

2.18. Chapter Summary

This chapter primarily concentrates on reviewing the literature related to Nielsen's heuristic usability evaluation of e-tax systems in developing countries. It begins with an introduction to key concepts associated with e-tax systems, followed by an in-depth discussion of e-tax system usability evaluation, the principles of heuristic evaluation, and their determinants. A conceptual framework has been developed based on the identified determinants of the heuristic evaluation principles applicable to e-tax systems. Additionally, a review of relevant studies is provided. The subsequent chapter will address the research design and methodology.

CHAPTER THREE

RESEARCH DESIGN AND METHODS

3.1. Introduction

This chapter outlines the research design and methods employed in the study. It begins with a concise overview of the research design and methodology, followed by a discussion on the selection of the approach, including various types of research methodologies and their contexts. The chapter briefly presents the data collection methods and analysis techniques used in the study. Additionally, it addresses the validity and reliability of the data-gathering instruments, as well as the techniques utilized to answer the research questions and achieve the study objectives.

3.2. Research Design and Methods

Research methodology refers to the systematic, step-by-step process that researchers follow to conduct their studies, formulate problems, and present results based on the data collected during the investigation (Sileyew, 2019). According to (Eksioglu et al., 2011), heuristic evaluation was employed to identify significant usability issues by utilizing both usability guidelines and Nielsen's heuristic evaluation principles. Each individual window of the Ministry of Revenue's e-tax system was assessed, and design problems along with their corresponding severity rankings were identified. Based on the findings from this evaluation, usability test scenarios were developed. The subsequent research phases undertaken in the evaluation of the Ethiopian e-tax system using the Nielson's HE method are outlined in the steps that the researcher will follow to complete the study. Research methodology refers to the systematic approach and specific techniques that researchers use to gather, analyze, and interpret data in a study. It encompasses the principles, processes, and methods employed to ensure the research is conducted rigorously and ethically

3.2.1. Research Design

A research design serves as a structured plan or framework that guides the process of collecting, evaluating, and interpreting data (Pandey, 2015). It outlines how the research will be organized and executed, detailing the overall strategy for data collection, analysis, and evaluation. It also serves as a framework for addressing the research questions. This framework outlines how the research will be structured and executed, detailing the overall strategy for data collection, analysis, and evaluation. In this study, heuristic evaluation and usability testing methods were employed to assess or evaluate the usability of e-tax portal applications, identify interface design issues, and provide recommendations for enhancement (Ali et al., 2022).

3.2.1.1 Research Approach

The research approach helps the researcher interpret the findings (Sileyew, 2019). Rather than simply referring to a theoretical framework, qualitative and quantitative methods pertain to different modes of data collection, analysis, and reporting (Mackenzie & Knipe, 2006). Quantitative analysis emphasizes gathering information and interpreting data from a larger participant pool, enabling the summarization of characteristics across groups or relationships (Sinaga, 2014). In a qualitative method for evaluating the Ethiopian e-tax system using Nielsen's usability heuristics, the focus would typically be on gathering non-numerical data to understand user experiences, behaviors, and perceptions in-depth. Qualitative methods allow evaluators to explore the usability of the system from the perspective of real users, uncovering issues related to ease of use, user satisfaction, and specific usability challenges. Below is an outline of the qualitative methods that could be employed in this context:

1. Heuristic Evaluation by Experts: A group of usability experts (or evaluators familiar with Nielsen's heuristics) would systematically evaluate the Ethiopian e-tax portal against Nielsen's 10 usability heuristics. The evaluators would individually review the system, identifying usability issues by examining the portal's interface, interactions, and design. They would then compile their findings, categorizing issues according to the 10 heuristics. Finally they would generate qualitative insights into specific usability flaws, such as confusing design, technical jargon, or inconsistent navigation.

2. User Interviews: Semi-structured interviews with actual users of the Ethiopian e-tax system (e.g., individual taxpayers, business owners, tax professionals) would provide rich, qualitative data on their experiences using the portal. Participants would be asked about their experiences using the portal, focusing on issues like ease of navigation, understanding of instructions, error handling, and overall satisfaction. Interviews would be open-ended; allowing users to express their thoughts freely. This would provide a deeper understanding of user difficulties, misconceptions, or frustrations that might not be apparent through expert evaluation alone.

3. User Observation: Observing users while they interact with the Ethiopian e-tax portal in real-time, with users verbalizing their thoughts and decision-making processes as they use the system (a method known as "think-aloud"). Then Participants would be asked to complete tasks (such as filing a tax return or making a payment), and their actions and thoughts would be recorded. Observers would note where users encounter difficulties, make errors, or express confusion.This approach provides qualitative insights into the user behavior, helping to identify pinpoints that might be invisible in other evaluation methods, such as navigation confusion or problems with form completion.

4. Usability Testing with Task Scenarios: Usability testing involves users completing predefined tasks on the e-tax portal while being observed and interviewed. The tasks might be related to common activities such as creating an account, filing a tax return, or making a payment. Participants would be given tasks to complete and observed for issues related to system usability. After each task, they would be asked to discuss their experience, providing qualitative feedback about what worked well and what didn't. The outcome generated insights about the usability issues users face while interacting with the portal, particularly in terms of task efficiency, error recovery, and system satisfaction.

5. Focus Groups: Focus group discussions with a group of users (e.g., experts, Participants) could be organized to gather collective feedback about the Ethiopian e-tax portal. A moderator would guide a discussion among users to explore common challenges, their overall impressions of the portal, and the usability issues they encountered. Participants can discuss the portal's design, navigation, and functionality, providing insights into common themes. Focus groups can reveal shared user experiences, identify recurring usability problems, and highlight features that are perceived as helpful or frustrating.

6. Content Analysis of Feedback/Support Requests: Reviewing user feedback, complaints, or support requests submitted by Ethiopian e-tax portal experts and participants could also provide qualitative data. These might include emails, help desk tickets, or comments left on the portal. Analyzing this content allows researchers to identify recurring issues users face when interacting with the system. For example, common questions, frustrations, or requests for clarification could highlight usability problems. This approach provides real-world data about the pain points and problems experienced by users that may not be captured through direct observation or interviews. In the evaluation of the Ethiopian e-tax system using Nielsen's heuristics, qualitative methods like heuristic evaluation by experts, user interviews, think-aloud observation, usability testing, focus groups, and content analysis would provide in-depth insights into usability issues. These methods allow for a comprehensive understanding of the system's usability from the perspective of actual users, helping to identify specific challenges related to design, navigation, error handling, and user satisfaction.

Qualitative research aims to grasp the meanings behind people's lives, convey their views and perspectives, address the contextual conditions they inhabit, provide insights, and synthesize various sources of information (Yin, 2011). The research will commence with the collection of qualitative data through heuristic evaluation conducted by selected experts, who will assess the e-tax system based on Nielsen's ten heuristic principles. The heuristic evaluation method can provide valuable insights into the design and functional aspects that require improvement, ultimately offering important information for enhancing the usability of Ethiopian e-tax system. The quantitative approach involves the use of numerical data that is mathematically generated and analyzed, primarily addressing "what" questions and utilizing structured data collection methods (Taherdoost, 2022). This approach emphasizes the importance of numbers and figures in both data collection and analysis. By employing this method, researchers can gain insights into the existing usability issues of the e-tax system. Utilizing usability evaluation and heuristic evaluation principles, experts can assess the interface design of the system from a usability perspective.

3.2.1.2 Research Strategy

A research strategy is a well-organized plan that directs researchers throughout their study, helping to ensure its timely completion. It involves choosing appropriate methods for data collection and analysis, which in turn shape the researcher's approach and thinking (Walia & Chetty, 2020). The usability of the e-tax portal was assessed using the heuristic evaluation method, which employs Jakob Nielsen's ten usability heuristics as a framework for evaluating the user interface design of e-tax applications (Ali et al., 2022), which proposed in 1994, this method focuses on a heuristic-driven inspection to enhance interface usability based on established design principles have been applied across various technologies and computing environments (Francisco et al., 2021).

The researcher check through heuristic evaluation as the research strategy to explore usability issues within the e-tax system interface that are inadequately defined in existing literature and require further clarification. The researcher aims to identify usability problems in the e-tax system that are closely associated with the site's interface by applying established heuristic usability principles and illustrating their interactions through the development of a conceptual framework. The researcher will conduct usability testing and heuristic evaluation to gain a deeper understanding of this underexplored concept, demonstrating its significance and examining related issues. The conceptual framework will be evaluated through the usability of the e-tax portal using both usability tests and heuristic evaluations, incorporating triangulation methods such as questionnaires survey, expert opinions, document analysis and observation.

While there are numerous usability evaluation methods assessing software usability in the field of Human-Computer Interaction (HCI) , such as heuristic evaluations, cognitive walkthroughs, expert evaluations, action analysis, user tests, and perspective-based inspections (Baguma, 2018; Holzinger, 2005). Many of these require user involvement of multiple experts focus on interface inspection, while others evaluate software performance under various conditions. Furthermore, having a single expert apply web usability heuristics can identify most usability issues more quickly and cost-effectively (Baguma, 2018). Automated web evaluation tools were deemed unsuitable as they primarily address accessibility, providing general error reports that lack specific utility for website administrators.

To address the challenges associated with the e-tax portal, the analysis methodology incorporates elements from heuristic evaluation method based on Nielsen’s 10 usability principles and usability test, allowing evaluators to assess the software interface against essential design guidelines. The approach is tailored to create a heuristic evaluation framework specifically for e-government tax portal software tools.

According to (Preece et al., 2002), three manual methods are commonly used to identify usability issues in user interfaces: (a) Usability Testing, which involves observers documenting usability issues as users complete tasks; (b) Questionnaires and Interviews, where users share their system experiences through structured formats, discussing missing features and overall satisfaction; and (c) Expert Inspection Methods, where usability experts review the interface and identify problems based on their expertise. These manual techniques provide deeper insights into user experiences and complement automated evaluations.

Usability testing is crucial for assessing the effectiveness of e-tax applications, serving as a fundamental aspect of software design, implementation, testing, acceptance, and revision. It aims to gauge user perceptions by measuring ease of use, efficiency, and overall satisfaction with the software (Ramayasa and Candrawibawa, 2021). Usability testing can be integrated throughout the development lifecycle of the e-tax application (Weichbroth, 2020). Researchers have identified several key attributes for evaluating the usability of e-tax applications, which include (a) learnability; (b) effectiveness; (c) efficiency; (d) memorability; (e) errors; and (f) user satisfaction (Hussain and Omar, 2020; Lynn et al., 2020). The experts selected for this evaluation were chosen based on Nielsen and Mack's recommendation to involve 3-5 evaluators (J. Nielsen and Mack, 1994). All selected experts have a background in e-tax systems. The researcher will conduct the Heuristic evaluation with four experts who are knowledgeable about the e-tax system and familiar with usability principles.

Usability evaluation can be understood from various perspectives, and the methodology for assessing each dimension will vary accordingly. The interaction dimension of the conceptual framework will be evaluated through an inspection method to determine whether the current interface design aligns with the usability of the e-tax portal as specified in the framework. Ultimately, insights from usability experts will be leveraged to generalize the findings and validate the framework. Nielsen's heuristic evaluation will confirm that the proposed conceptual framework effectively illustrates the usability of the interface design for e-tax services.

3.2.1.3 Study Setting

This study focuses on the e-tax portal of Ethiopia's Ministry of Revenue, which serves all regional and branch services and connects to national e-government services. The researcher chooses this portal due to its comprehensive service offerings. The portal is managed at the federal level by the IT directorate known as the Management Information System (MIS) directorate, which oversees nine regional and six branch service providers. To evaluate the usability of the e-tax system using Nielsen's heuristic evaluation, the study will include several key components: Participant Selection: A team of four usability experts, including UX designers experienced in e-tax systems, will be assembled to provide diverse insights; System Access: Evaluators will have full access to all features of the e-tax system, such as filing returns, checking status, and making payments; Heuristic Criteria: The experts will be introduced to Jakob Nielsen's ten usability heuristics, with a checklist to guide their evaluations; Evaluation Process: Evaluators will assess the system independently to gather a broad range of usability perspectives; Documentation: Evaluators will document their findings, including specific usability problems, severity ratings, and improvement suggestions; Debriefing Session: A group discussion will be conducted post-evaluation to share insights and identify common themes; Reporting Results: A comprehensive report will summarize the evaluation findings, detailing usability issues, severity ratings, and recommendations for improvement; and finally follow-up evaluation: Subsequent evaluations will be planned to assess the effectiveness of implemented changes. By incorporating these components, the study aims to effectively apply Nielsen's heuristic evaluation to assess the usability of the e-tax system, ultimately enhancing user experience and efficiency.

Ministry of Revenue: The Ethiopian Ministry of Revenue is responsible for collecting customs duties and domestic taxes, while also protecting society from the negative impacts of smuggling and contraband. It takes legal action against those involved in smuggling and tax evasion, while facilitating the legitimate movement of goods and people across borders. In the context of an e-tax system, the Ministry's key responsibilities include developing policies and regulations aligned with national tax laws, establishing standards for electronic filing and payments, and overseeing the system's deployment to meet taxpayer needs. Additionally, it ensures integration with existing tax administration systems, conducts outreach programs to educate taxpayers, and provides training for tax officials. The Ministry also maintains and updates the e-tax system, offers technical support to users, monitors compliance, and manages data collection to enhance tax administration. By fulfilling these roles, the Ministry aims to improve the efficiency, transparency, and accessibility of e-tax administration, ultimately fostering better compliance and enhancing the taxpayer experience.

3.2.1.4 Case Selection, Sample Selection

Sampling is a method of selecting individuals from population in order to estimate population characteristics. Purposive sampling is a type of sampling, select members of samples according to the purpose of the study. It is also known as judgment, selective or subjective sampling. Purposive sampling used for identify the data sources of this research technique of the case. Thus, to collect the primary data, appropriate and convenient samples were selected who have direct participation and involvement in the selected e-tax system in an organization. For this purposive sampling method, key respondents experts were selected purposely from different usability inspection groups of IT experts as information resources for the sake of the research questions to be properly answered.

According to Baguma, (2018) with heuristic evaluation, a usability expert (s) reviews the usability of site's interface using accepted heuristic usability principles. Nielsen, (1994) recommends that three to five evaluators be used; hence four is considered to be an appropriate number. This step includes severity rating of the problems. This study experts and participants involved in usability experts of e-tax portal interface had good knowledge and experience. Four key respondent experts include those, who are: included one application server administrator, one business analyst, and two digital tax announcement support and follow-up officers in one group, and ten participants in Nielsen's 10-heuristic usability test evaluation of the e-tax system consist of 4 database administrators, 3 tax officers, 1 data encoder, and 2 non-filer follow-up signor officers from 53 IT experts in the organization. According to Titania et al, (2020) studies of usability inspection methods have discovered that many usability problems are overlooked by expert testing, but that user testing also finds problems that are overlooked by inspection. Considering more than 4 respondents probably makes the data repetitive. So, the researcher collected all the information at this stage.

3.2.1.5 Data Analysis Strategy

Heuristics as the Usability Evaluation: According to Yodihartomo, (2020) Usability Heuristic Evaluation (HE) has emerged as one of the most frequently referenced and utilized practices in usability techniques Hollingsed and Novick, (2007). Heuristic evaluation is an often-used usability inspection method on account of its relative quickness and cheapness compared to other methods Simin, (1915). Moreover, Jakob Nielsen's ten usability heuristics are useful when evaluating the user interface design. As the goal of the evaluation here is to identify the usability issues of the case e-government portal, the researcher conducted a heuristic evaluation, using Nielsen's ten heuristics. The heuristic evaluation method was proposed by Jakob Nielsen in 1994 (Nielsen, 1994). This is a heuristic-driven inspection in which general principles of good interface design aims at maximizing artifact usability. Traditionally, ten (10) heuristics (Nielsen, 1994) have been used to cover new technologies and computing environments Francisco et al., (2021).

The e-tax portal can effectively be evaluated using the expert-based method called heuristic evaluation where it is also classified as a usability inspection method Nielsen and Mack, (1994). It offers a seamless usability expert experience by utilizing usability principles of Nelsons heuristic, provide valuable insights, how users interact with website, allowing, identifying and addressing any usability issues. A heuristic analysis is used to identify a product's common usability issues so that the problems can be resolved, consequently improving the user's satisfaction and experience and raising the chances of a digital product's success. As part of the Nieson's 10 heuristic evaluation plan, a system, a format, and which tools to use should be agreed upon. When a heuristic evaluation is performed with a group of experts, each individual evaluates the UI separately. This approach to the expert review is done in order to ensure the evaluations will be independent and unbiased. When all the evaluations are complete, the findings are then collated and aggregated.

Focusing on usability, Nieson's 10 heuristic analysis is an evaluation method, whose 4 experts compare a digital product's design to a list of predefined design principles (commonly referred to as heuristics) Include: visibility of system status, match between system and the real world, user control and freedom, Consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimal design, help users recognize, diagnose, and recover from errors and help and documentation are identify where the product is not following those principles.

Selection of Evaluators: Heuristic Evaluation (HE) is a method designed to improve existing designs in preparation for user testing, focusing on identifying issues within the system. This process typically involves 3 to 5 evaluators (Rahmadina et al., 2019). For this research, the researcher has selected internal experts affiliated with the Ethiopian tax system. The team consists of two Digital Tax Announcement Support and Follow-up Officers, a System Analyst, and an Application Server Administrator from Ethiopia. These four experts will play a critical role in the heuristic evaluation process.

Preparation of Heuristic Evaluation (HE) Test Documents: HE relies on a set of heuristics to initially assess usability during the design specification phase, but it can also be applied to evaluate the design of the e-tax system. Nielsen and Molich (1990) proposed ten heuristic rules for usability evaluation, which are outlined in the table below.

Heuristic Principles	Definitions
H1-Visibility of System Status	The system should provide real-time information to users about what is happening through timely and appropriate feedback that is logically acceptable (as soon as possible).
H2- Match Between	The system should communicate in the user's language, using words,

System and The Real Word	phrases, and concepts that are familiar to the user rather than system-oriented terms.
H3- User Control and Freedom	User’s often select system functions accidentally, so there should be a "clear emergency exit" that allows them to escape from undesired situations without lengthy dialogs.
H4- Consistency and Standards	Users should not have to wonder whether different words, situations, or actions mean the same thing.
H5- Error Prevention	A well-thought-out design to avoid problems from the beginning is better than well-designed error messages.
H6-Recognition Rather than Recall	Minimize the user's memory load by making objects, actions, and options visible. Users should not have to remember information from one part of the dialog to another. Instructions for system use should be straightforward
H7- Flexibility and Efficiency of Use	Allow users to customize, adjust, and use system instructions for action
H8-Aesthetic and Minimalist Design	Existing dialogs should not contain irrelevant or rarely needed information.
H9-Help User Recognize, Diagnose and Recovers User	Error messages should be expressed in clear and simple language (without programming code), indicating the problem precisely, and suggesting constructive solutions.
H10 - Help and Documentation	Documentation needs to be provided. Information provided through such means should be easy to find, focused on user tasks, contain concrete steps to follow, and not be excessively large.

Table 4. Heuristic principles

Severity rating: HE can identify usability issues and problems assessed according to their level of difficulty (severity rating), in the software. Severity rating can determine the number of resources, and provide an initial estimate of the usability principles that need to be added (Sulistioyono, 2017).

Severity rating	Explanation
0	No usability issues (I don’t consider this to be a problem.)

1	Cosmetic problem category, existing issues do not need to be fixed unless there is extra time in the project
2	Minor usability problem category, fixing existing issues is given low priority.
3	Major usability problem category, fixing existing issues is given high priority.
4	Usability catastrophe category, existing issues are given higher priority and must be fixed immediately before the project is launched.

Table 5. Nielson's severity rating scale (Nielson, 1995 b)

4. Data Analysis and UX Discussion

In this stage, the evaluation results from the four experts are recapitulated, considering severity rating values. Subsequently, an analysis is conducted to obtain a basis for the design improvements in the form of UI e-tax design interface is a critical part of the design process. A visual representation or screenshot of how the final website or product will look for the Ethiopian e-tax portal based on the severity ratings analyzed earlier.

No.	Structured problem report
1	A numeric identifier of the problem
2	A short description of the problem
3	Likely difficulties for the user
4	Specific context (the location of the problem in the interface)
5	Possible causes of the problem (what is wrong in the design)
6	The heuristic(s) used
7	The severity rate, containing 4 levels: cosmetic, minor, major and catastrophe,

Table 6. Structured problem report format adapted from (Cockton andWoolrych, 2001)

Heuristic evaluation and usability testing methods were used to evaluate the usability of the e-tax portal applications, identify usability issues with their interface designs, and suggest recommendations for improvement Ali1 et al., (2022). The usability testing method defines the usability of a system and e-tax application. It has been accepted as an essential activity in software design, implementation, testing, acceptance, and revision because it aims to determine user perception about the application by measuring convenience and efficiency and ensuring user satisfaction with the software product (Ramayasa and Candrawibawa, 2021). Usability testing can be conducted throughout the development life cycle of the e-tax application (Weichbroth, 2020).

Researchers have identified many attributes for testing the usability of e-tax applications, which include (a) learnability; (b) effectiveness; (c) efficiency; (d) memorability; (e) errors; (f) user satisfaction; (Kous et al., 2020; Lynn et al., 2020).The selected experts were notified based on the recommendation by Nielsen and Mack that requires 3-5 evaluators (J. Nielsen and Mack, 1994). Both of them of the selected experts have expertise in e-tax system.

The e-tax system user experience is most commonly measured using one of three methods: observing participants attempt (called a usability test), collecting users' prior experience in a survey, or having interface experts evaluate a website using guidelines and heuristics often called inspection methods or expert reviews (Lewis, 2012). Some are employing extensive usability evaluation techniques with a carefully chosen, representative user base (for example, Hix et al. (1999)), whereas others undertake efforts that do not involve users, such as review and inspection by a usability expert. From the literature, the researcher has compiled a list of usability evaluation methods that have been applied by experts to e-tax system. In today's digital age, having a user-friendly website is crucial for businesses. Well-designed product has great usability which is significant contributor to product quality and a seam less user experience. There are a few ways product usability can be tested: which the researcher utilizes is an inspection method called heuristic analysis method. Usability testing tools are software programs or platforms that enable the researcher to observe and analyze how users navigate through the website but no applied in this research.

The researcher was analyzed the data collected through survey to statistical population concerning the practice of E-taxing system. The data which was being collected via questionnaires were analyzed with descriptive statistics using Statistical Package for Social Science (SPSS) version 20, and excel. The results of the analysis were systematically organized and presented through various methods, including tabulation, which involved arranging the data in a table format to facilitate the understanding of trends in the adoption and development of electronic tax systems in Ethiopia. The analysis also included the calculation of measures of central tendency, such as mean and mode, along with the creation of frequency tables and percentage distributions. Additionally, qualitative data gathered from interviews were integrated into the analysis to provide deeper insights into user experiences and perspectives regarding the e-Tax system. According to Night and Bananuka, (2018) cited Barati et al. (2014) suggest that positive evaluations such as convenience in terms of time and place and limited movements to the tax authority premises lead to the adoption of the e-tax system which improves tax compliance among taxpayers.

Nielsen's 10 usability heuristics provide a set of guiding principles to identify potential usability issues within a system. When applied to an e-tax system, these heuristics help evaluate and improve both user experience and system efficiency. For example, visibility of system status ensures that users are always informed about what's happening through timely feedback. In an e-tax system, this could involve displaying progress indicators during tax filing or document submission, so users are aware of the status of their actions. The system should also match the real world by using terminology and concepts that are familiar to users. For an e-tax system, this means presenting tax-related language in a clear and intuitive way closely aligned with what users typically encounter in tax forms or instructions. Additionally, user control and freedom allows users to easily undo or redo actions. In the context of an e-tax system, this could involve providing a clear option to navigate back to previous steps or edit entries, particularly when users need to correct errors made during form completion.

The Consistency and Standards heuristic emphasizes that a system should adhere to established conventions. In an e-tax system, this means maintaining consistency in how forms are presented, how terminology is used, and how processes are structured across various pages. This reduces confusion, especially for users who may have experience with similar systems. Additionally, error prevention is more effective than relying on error messages. For an e-tax system, this can be achieved through real-time validation—such as checking that tax numbers or amounts are entered correctly—and by providing clear instructions to guide users before they make mistakes. The system should also minimize memory load by making options, actions, and information easily visible. In the case of an e-tax system, this could involve providing pre-filled fields, access to tax history, or helpful icons, so users don't have to remember all the necessary details.

Furthermore, the system should cater to both novice and expert users, offering flexibility and efficiency. For an e-tax system, this might involve providing shortcuts for experienced users who need to navigate quickly, while also offering step-by-step guidance for beginners. The aesthetic and minimalist design principle calls for an interface that avoids irrelevant or rarely needed information. In an e-tax system, this means keeping the design clean, focused, and free of distractions, while prioritizing key tasks like filing, submitting, or viewing tax details. In the event of an error, error messages should be clear, concise, and offer actionable solutions. For example, if there is missing tax information or incorrect data entry, the system should clearly explain the issue and provide instructions on how to correct it. Lastly, while it's ideal for users to navigate the system without needing external documentation, it's still essential to offer support. In an e-tax system, this could include accessible FAQs, on-demand help, customer support contact details, and guides to assist with tax-related queries

Nielsen's 10 Heuristic Evaluations Applied to E-Tax System Analysis: In the context of an e-tax system, applying these heuristics involves reviewing the system's usability by checking if the system is intuitive, efficient, and minimizes errors. For example, testers might evaluate whether the user interface provides enough visual cues for tax submission progress (Visibility of System Status), or if it uses clear tax-related terminology and concepts (Match Between System and the Real World). Evaluators would also check if there are any barriers to correcting mistakes (User Control and Freedom), and whether the system adheres to common standards for tax filing (Consistency and Standards). By using Nielsen's heuristics, the evaluation can uncover areas where the e-tax system may cause user frustration, confusion, or errors, and help guide improvements to make the system more user-friendly.

3.2.2. Research Techniques

The research techniques used in Nielsen's 10 Heuristic usability evaluation for evaluating an e-tax system primarily involved participants and expert-based usability testing, where evaluators assessed the system against Nielsen's 10 established heuristics. This process can be adapted to test specific features of the e-tax system, identify potential usability issues, and improve user experience. Below are the key research techniques that identify the issue of the system including expert reviews, usability testing, heuristic evaluation, task-based testing, and surveys and questionnaires could be used to applied Nielsen's 10 heuristics to evaluate an existing e-tax system. By applying these research techniques alongside Nielsen's 10 heuristics, usability experts can identify key areas for improvement and enhance the overall user experience. These techniques ranging from expert reviews to experienced Participants testing provided a comprehensive approach to evaluating the usability of the system ensured it is user friendly, efficient, and error-resistant.

For evaluating the usability of an e-tax system in Ethiopia using Nielsen's 10 Usability Heuristics, a combination these techniques would be employed. These methods would help identify usability issues, assess user satisfaction, and ensure the system is efficient, user-friendly, and aligned with real-world tax filing processes within the ministry of revenue. The research techniques would include data collection focused on user behavior, such as task completion, error frequency, and time on task, all of which would be carefully observed and recorded. Additionally, the analysis would involve qualitative evaluation of user behavior and encountered issues, as well as quantitative analysis of task completion rates and time taken to complete tasks, provided a comprehensive view of the system's usability.

3.2.2.1. Data Collection

For usability evaluation of an e-tax system in Ethiopia using Nielsen's 10 Usability Heuristics, the researcher would typically employed a combination of heuristic evaluation techniques and usability testing methods. Below are the key research data collection techniques would be used in such an evaluation, specifically tailored to Nielsen's 10 Usability Heuristics:

Expert Reviews

Experts (e.g., UX designers, usability specialists, or tax professionals) use Nielsen's heuristics to assess the e-tax system without involving end-users directly. They systematically review the interface and identify any usability problems based on their experience and knowledge of the heuristics. They would evaluate the clarity of tax-related terminology, the visibility of system status during form submission, consistency in the design, and ease of navigation throughout the tax filing process.

Heuristic Evaluation: Heuristic evaluation is a technique where expert evaluators assessed the usability of the e-tax system based on Nielsen's 10 usability heuristics, making it an efficient method for identifying usability issues early in the development process. A group of 4 usability experts, familiar with Nielsen's principles, individually reviewed the system's interface to identify violations or areas where the system fails to meet the heuristics. The experts applied the heuristics to pinpoint usability problems, and their findings are documented, categorized by heuristic principle, and prioritized based on severity, ranging from critical to minor issues. Data is collected through observations and expert feedback, providing valuable insights for improving the system's usability.

Usability testing: Usability testing involved real users interacting with the e-tax system to assess how well it supports their tasks, uncover usability issues, and evaluate overall system performance. Data is collected through the observation of user behavior, such as task completion, error frequency, and time on task. The process began with recruiting users who are representative of the target population, including individuals with varying levels of digital literacy, from novice to expert. Participants are then given real-world task scenarios, such as registering for an account, filing taxes, and making payments. Researchers observed users as they performed these tasks, noting any difficulties, errors, or frustration experienced. Additionally, participants may be asked to use a think-aloud protocol, verbalizing their thoughts during task completion, which provided valuable insights into their mental models and the challenges they encounter while interacting with the system.

Surveys and questionnaires: These are effective tools for gathering user feedback on their overall satisfaction, ease of use, and perceptions of the e-tax system. The questions are designed to align with Nielsen's 10 usability heuristics, focusing on aspects such as system communication, error prevention, and alignment with real-world expectations. Data is collected through survey responses, which include both quantitative ratings (e.g., Likert scale) and qualitative feedback (open-ended responses). The process involves designing questionnaires based on Nielsen's principles, incorporating both closed and open-ended questions to capture a range of user experiences. These surveys are then distributed to a large sample of e-tax users, either via email, through the e-tax website, or in-person at various offices, to ensure a broad representation of feedback.

Interviews; Interviews offered valuable qualitative insights into users' experiences, challenges, and satisfaction with the e-tax system. Typically conducted in a semi-structured format, these interviews allow users to provide detailed feedback while enabling the interviewer to explore responses further. Data is collected through audio recordings or notes taken during the interview. The process involves selecting a diverse group of users, including both novices and experienced experts of the e-tax system. A set of open-ended questions is developed, focusing on Nielsen's 10 usability heuristics, such as user experiences with error prevention, system navigation, and how well the system aligns with real-world processes. Interviews can be conducted in person or remotely via phone or video, depending on the participant's convenience.

Heuristic rating scales: Heuristic rating scales provide a quantitative approach to evaluating the e-tax system by having evaluators rate its performance according to Nielsen’s 10 usability heuristics. This method results in numerical scores that assess the system's overall usability. Data is collected through evaluation scores for each heuristic, along with severity ratings for identified issues. Evaluators rate the system on a scale (e.g., 0 to 4) for each heuristic, and each usability issue is assigned a severity rating (e.g., critical, major, minor, cosmetic and no problem), which helps prioritize areas for improvement based on their impact. By employing these methods, you can uncover both usability issues and user satisfaction while ensuring the e-tax system is efficient, user-friendly, and aligned with real-world tax filing processes in Ethiopia.

This section focuses on data collection for analysis. Primary data was gathered from experts of the selected e-tax services through the identification of key individuals who have engaged with the e-tax portal, based on appropriate sample selection. The following outlines the stages of problem formulation, focusing on issues identified through user experience with in Ethiopia e-tax system portal, as gathered from pre-research observations. The primary goal of the heuristic evaluation is to identify usability issues faced by expert users interacting with a system or application interface, all while keeping costs low. This method can lead to significant enhancements in e-tax applications (Ali et al., 2022). When a heuristic principle is violated, an expert assesses the severity of the issue and suggests potential solutions. Heuristic evaluations can be conducted at any stage of the software development process and typically yield actionable insights.

Jakob Nielsen's ten principles for evaluating usability issues in interface design include: visibility of system status, match between the system and the real world, user control and freedom, consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimalist design, help users recognize, diagnose, and recover from errors, and help and documentation (J. Nielsen, 1994a). Data collection involved a validated checklist based on Nielsen’s principles, comprising 98 questionnaires and utilizing a severity rating scale. All evaluators received training in heuristic evaluation from the researcher. To enhance the quality of usability assessments, multiple sessions were conducted to standardize interpretations of the checklist items. Evaluators evaluated the e-tax interface system (portal) divided into two phases. In the first phase, evaluators assessed the e-tax system’s user interface using Nielsen’s method and rated the severity of identified usability issues. The second phase involved calculating the mean severity of each usability problem. For this assessment, the researcher implemented the Nelsons heuristic severity scale questionnaire featuring with 5-points rating scale includes: 0 - no usability issues (I don't consider this to be a problem.), 1- cosmetic problem category, existing issues do not need to be fixed unless there is extra time in the project, 2 minor usability problem category, fixing existing issues is given low priority, 3 major usability problem category, fixing existing issues is given high priority, and 4 usability catastrophe category, existing issues are given higher priority and must be fixed immediately before the project is launched.

The Second questionnaires were usability testing by system usability scale (SUS) questionnaire is utilized to evaluate the application's usability. For this assessment, the researcher implemented 10 SUS questionnaire featuring a 5-point Likert scale. Ten participants rate their agreement with statements concerning the tasks assigned by the facilitator (Researcher) during the earlier usability test, choosing from options that range from 1- strongly disagree to 5 - strongly agree. Ten usability Participants includes: Four Database Administrator more than 10 years' experience in database and had two digital tax filing support and follow-up officers with 10 years of experience in e-tax systems, one application server administrator with 12 years of experience in e-tax systems and database management, and one master's student specializing in e-tax applications with a computer science background and seven years of experience in system analysis and training for the e-tax system.

The literature review entails investigating theories related to analysis and evaluation activities utilizing heuristic evaluation (HE) and usability testing. This stage relies on various reference materials, including journals, books, and prior research, to support the current study. Document analysis is the process of reviewing or evaluating documents both printed and electronic in a methodical manner. The document analysis method, like many other qualitative research methods, involves examining and interpreting data to uncover meaning, gain understanding, and come to a conclusion. Secondary data was obtained through document analysis, including organizational policy strategies and a literature review, to gain a deeper understanding of the principles of e-tax portal us abilities, as well as their associations.

3.2.2.2. Data Analysis

Based on the method of data collection, data processing will be carried out: Through voice recordings of the usability testing process and user interviews, then transcribed into written form to become a verbatim transcript; through a usability assessment questionnaire form which is processed using the system usability scale method. Identified usability experts independently engage with the product's interface by performing typical user tasks to uncover existing usability issues and assign specific heuristic violations to each identified problem Georgsson et al., (2014). The usability of the e-Tax portal was assessed using the heuristic evaluation method, resulting in a compilation of potential usability concerns. Through this evaluation, usability experts examine the site's interface for web usability and accessibility, using established usability principles (Buguna, 2018). This analysis reinforces usability principles and draws upon related studies (Silvis et al., 2020).

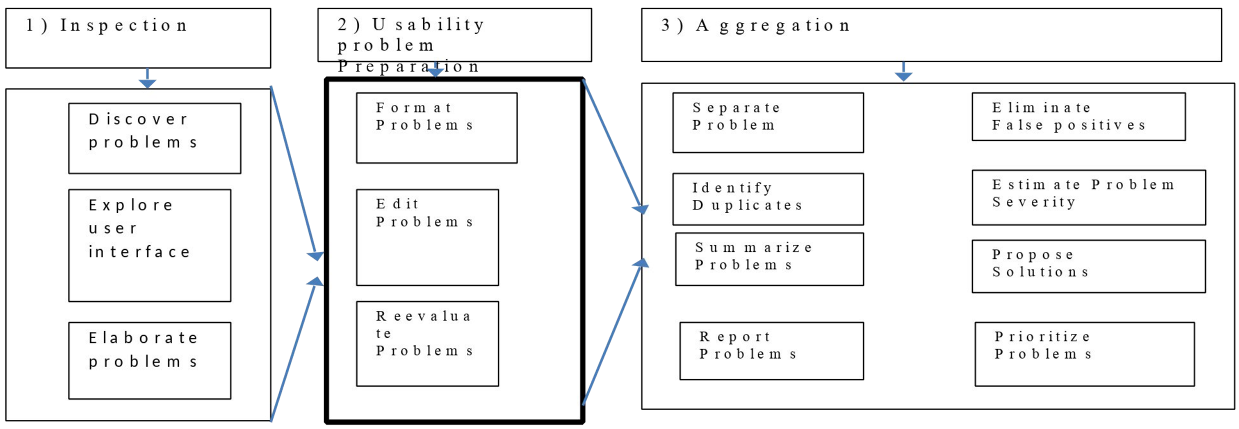

Figure 3. Heuristic Evaluation Phases

A critical aspect of heuristic evaluation is the aggregation of issues identified by different evaluators and the assessment of their severity. The pilot study revealed that evaluators identified problems at varying levels of granularity, sometimes duplicating issues or using different terminology to describe them. Prior to aggregating the problems, it was essential to standardize the granularity of the issues across all evaluators. To establish a consistent and repeatable methodology for aggregating and rating the severity of problems, the following steps were undertaken, as outlined in Nielsen's conditions (Jaferian et al., 2011): 1) Problem Synthesis: The first step involved breaking down compound problems into their individual components, each potentially having a different severity and priority for resolution. Unknown issues and false positives (problems that could not be reproduced by the researchers) were eliminated. 2) Aggregating Problems: Following problem synthesis, each expert began with an initial empty aggregated problem list. Each identified issue was compared against this list; if it was not present, it was added. If it was already listed, the description was refined. Additionally, if the set of heuristics associated with the existing problem differed from that of the new problem, the association was updated to reflect a unified set. 3) Tagging Problems with Heuristics: Researchers reviewed each issue on the list and tagged it with one or more relevant heuristics. This tagging was conducted without reference to the original heuristics provided by evaluators when each problem was identified.

Assigning Severity Ratings: The researcher utilized a five-point severity scale: 0 (not a usability problem), 1 (cosmetic), 2 (minor), 3 (major), and 4 (catastrophic). Four usability and security experts, knowledgeable in heuristic evaluation, were asked to independently assess the severity of each problem based on its frequency, impact, and persistence. The mean of their severity ratings was calculated to determine the overall severity for each issue. Following Jaferian et al. (2011), the researcher classified the problems into two categories based on the mean severity rating: major (mean severity > 2) and minor (mean severity ≤ 2).

3.2.2.3. Validity and Reliability

Reliability and validity are both crucial concepts that assess the effectiveness of a measurement method. Reliability pertains to the consistency of a measure, while validity relates to its accuracy. Validity is used to evaluate whether the research measures what it intends to measure and approximates the truthfulness of the results. In other words, it indicates the extent to which the measurement process is free from error. A method is considered valid if it accurately measures what it claims to and if its results align closely with real-world values. Additionally, validity assesses how well a test can predict a specific outcome or how closely the results of one test mirror those of another.

The validity of usability problems is a significant concern, particularly as it pertains to presenting real issues to users. The validity of a complete set of usability problems can be supported by two main arguments. First, many of these design issues are deemed “obviously” problematic based on established knowledge in the field of usability. Second, empirical evidence gathered from experiments provides strong support for identifying these issues as genuine usability problems. On the other hand, reliability refers to the consistency with which a method measures something. If the same results can be consistently obtained using the same methods in similar circumstances, the measurement is regarded as reliable. Reliability also involves whether research methods can yield the same results repeatedly over time. If a method produces consistent results, it is likely reliable and not significantly affected by external factors. This information is valuable for determining whether evaluations of the e-tax portal's interface principles accurately gather data that supports the study's objectives and reviews of the system.

3.3. Chapter Summery

This chapter, the researcher outlines the study methodologies that will be implemented, detailing the research strategy, methodologies, approach, sampling method, data collection techniques, data sources, and data analysis processes aimed at addressing the research objectives. The primary goal of this study is to propose a usability evaluation of the e-tax system based on Nielsen's 10 Heuristic Evaluation principles. To achieve this, a mixed-methods approach comprising both qualitative and quantitative research has been adopted.

A survey study has been utilized as the research strategy, with purposive sampling employed to select relevant respondents. To gather pertinent data, a combination of interviews, surveys, and questionnaires has been implemented, aligning with the qualitative and quantitative approach. Additionally, this chapter discusses the design, construction, and validation processes of the methodology, emphasizing how the reliability and validity of the research were upheld to minimize biases.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.1. Overview

This section presents the data collected from interviews and questionnaires conducted with the Ethiopian Revenue and Customs Authority (ERCA), now referred to as the Ministry of Revenue (MOR) e-tax portal. The evaluation results from four experts are summarized, taking into account their severity rating values, along with insights from four experts who were interviewed. Subsequently, an analysis is performed to identify potential improvements for the Ethiopian e-tax system's website interface, based on Nielsen's ten usability heuristics, incorporating the severity ratings analysis. At this stage, discussions are held through face-to-face interviews and questionnaires with experts regarding the analysis of the identified issues, including the severity values assigned to each problem. This discussion also focuses on prioritizing recommendations for potential solutions.

4.2. Respondents' Information

The study participants included one application server administrator, one business analyst, and two digital tax filing support and follow-up officers. Data collection was conducted through distributed questionnaires. Initially, the evaluators were not familiar with Nielsen's heuristic usability evaluation. To address this, the researcher provided a brief training session and distributed guidelines along with the questionnaires to clarify the principles of Nielsen's heuristic usability evaluation. In the first phase, the four evaluators worked independently to identify potential usability issues. In the second phase, they engaged in a 30-minute group discussion to examine the usability problems identified during the initial evaluation. During this discussion, the evaluators shared their findings, explanations, and uncertainties regarding the identified e-tax system usability issues, as well as their potential impact on usability.

Following the discussion of the e-tax portal interface design, the participants compiled a list of usability problems, eliminating any duplicates. Each participant then assigned severity ratings to the usability issues on this list, using Nielsen's severity rating scale (Nielsen, 1994c) to determine which problems to retain or discard. Although the evaluators rated similar usability issues, they were encouraged to assign their ratings independently, allowing the researcher to calculate the mean value as the final rating for each usability problem (Nielsen, 1994c).

Evaluator	Gender	Age	Occupation	Educational Background	User Expertise	
					Usability	e-tax
1	M	18-30	Business Analyst	Degree	No.	Yes
2	M	18-30	Digital Tax Filing Support and follow up Officer	Degree	Yes	Yes
3	F	18-30	Digital Tax Filing Support and follow up Officer	Degree	Yes	Yes

4	M	30-40	Application Server Administrator	Master	No.	Yes

Table 7. Profile of evaluators

No	Variable	Frequency	Percentage (%)
1	Gender		
	Male	7	70
	Female	3	30
2	Age		
	Between 18-29 years	4	40
	Between 30-3 9 years	4	40
	Between 40-49 years	2	20
3	Level of education		
	Bachelor	7	50
	Master	3	30
4	Category of Evaluation		
	Database Administrator	4	40
	Tax Officer	3	30
	Data Encoder	1	10
	Non-Filler Follow-up signor Officer	2	20

Table 8. Profile of Participates

The above table 7 and 8 includes experienced usability evaluators who are familiar with usability principles relevant to the evaluation and have previously conducted heuristic evaluations of other interfaces. These evaluators are recognized as experts in the e-tax system, possessing experience with the portal within this institution.

4.3. Challenges during Data Collection Process

Over time, several personal visits and phone calls were made to arrange convenient face-to-face discussions and interviews, as well as to distribute questionnaires and collect the necessary data from the evaluators and participants. A significant challenge faced by the respondents was the knowledge gap regarding Nielsen's heuristic usability evaluation. Additionally, various factors beyond the set of usability heuristics can impact the effectiveness of heuristic evaluation, such as evaluator training, knowledge of the application domain, task coverage, problem extraction and description, and merging.

Following the completion of user testing and heuristic evaluation, this section examines the identified issues, detailing the quantity and frequency of problems uncovered by each method. It also highlights common issues identified by both approaches and categorizes the problems based on their impact on user usability. The table below (Table 4.1) illustrates the number of issues identified through heuristic evaluation and usability testing, along with the count of shared problems. Collecting data proved to be particularly challenging, especially for sensitive topics like the e-tax system within the Ministry of Revenue, due to security concerns. However, the researcher was able to establish a good rapport with the participants, which helped in gaining their trust and cooperation. When clarification on certain concepts was needed, phone calls were utilized to facilitate communication. Ultimately, the transcribed interview data and completed questionnaires were collected, with more than 100% of the respondents confirming the accuracy of the information provided.

4.4. Data Presentation

This section presents the findings from the heuristic evaluation and usability testing conducted to assess the usability of the e-tax applications were utilized to identify usability issues within the interface designs and to offer recommendations for improvement. The e-tax portal, developed by the Ethiopian revenue and customs authority before, now call as ministry of revenue features a homepage with six sections: Home, Taxpayer Service, Message Center, Validity Checks, Taxpayer Information, and Change Password.

The main interface for taxpayers is the taxpayer service page, which includes five subpages: Tax declaration, tax \account, potential refund, refund, and potential Clearance. The e-tax portal supports various functions, such as user registration, filing declarations, submitting refund and clearance requests, updating taxpayer information, validating tax identification numbers (TIN), and managing tax clearance and message center communications. The results of the evaluation are organized according to Jakob Nielsen's 10 usability heuristics.

4.4.1 Nielsen's 10 Heuristic evaluation

4.4.1.1. Heuristic evaluation

The questionnaires were sent to experts, particularly case workers. The discussion questions focused on the e-tax portal interface and included ten categories derived from Nielsen's 10 usability heuristics: visibility of system status; alignment between system and real-world concepts; user control and freedom; consistency and standards; error prevention; recognition over recall; flexibility and efficiency of use; aesthetic and minimalist design; assistance in recognizing, diagnosing, and recovering from errors; and help and documentation, as detailed in the literature review. As a result, different elements of the e-tax dimensions were linked to these heuristics.

This section outlines the findings from the usability evaluation of the Ethiopian Ministry of Revenue's e-tax portal, following Jakob Nielsen's 10 usability heuristics. The initial independent assessments revealed 189 usability problems and 272 heuristic violations. Evaluator 1 identified 65 issues, Evaluator 2 found 57, Evaluator 3 reported 42, and Evaluator 4 discovered 25. The identified problems varied in detail and some overlapped. The evaluators then analyzed the usability issues comprehensively, discussing and consolidating them where possible.

Out of the initial problems, 35 were identified by all evaluators, which were consolidated into 14 overarching usability issues. Three evaluators identified 36 similar problems, leading to 15 consolidated issues, while two evaluators found 23 overlapping problems, which were combined into 7 issues. Additionally, another pair of evaluators also identified 17 similar problems, resulting in another set of 7 consolidated issues. The remaining 78 issues were unique to specific evaluators. Ultimately, this process yielded a final master list comprising 121 usability issues. Evaluators assigned the same severity score to 14 out of 121 identified problems, three of the four evaluators agreed on the ratings for 15 issues, two of the four evaluators agreed on the ratings for 14 issues, while there were no similarities for the remaining 78 usability problems.

At this stage of the analysis, Nielsen suggests calculating mean severity scores; however, the researcher was interested in exploring the level of variability among the ratings. The percentage of agreement among the four evaluators across all issues was 13.18%. The calculated reliability result was notably low at 0.0825 (see Table 9).

A	Units	Observers	Decisions

0.016	121	4	272

Table 9. Reliability Estimate

In the evaluation of the Ethiopian e-tax web interface design by four experts, code H2 Match between system and the real world was identified as having 4.1% the fewest issues. The percentage distribution chart highlights that codes H1, H5, H4, and H3 are the heuristics with the most identified issues, each exceeding 10%. Based on the issue findings presented in Table 4.3, calculations were conducted to identify the heuristic principle most frequently encountered during the evaluation of the e-tax portal. Code H1, representing the principle of Visibility of System Status, emerged as the most commonly identified principle, comprising 19.00% of the 121 issues noted. All heuristic principles were found to be violated in the assessment of user experience on the e-tax portal.

After analyzing the consolidated list of issues identified from the heuristic evaluation of the portal, it was found that all heuristics were violated. Figure 3 illustrates the percentage of issues associated with each heuristic. Notably, the heuristics for Visibility of System Status (H1), Error Prevention (H5), Consistency and Standards (H4), and User Control and Freedom (H4) exhibited the highest number of detected problems, with percentages of 19.0%, 15.7%, 15.0%, and 14%, respectively.

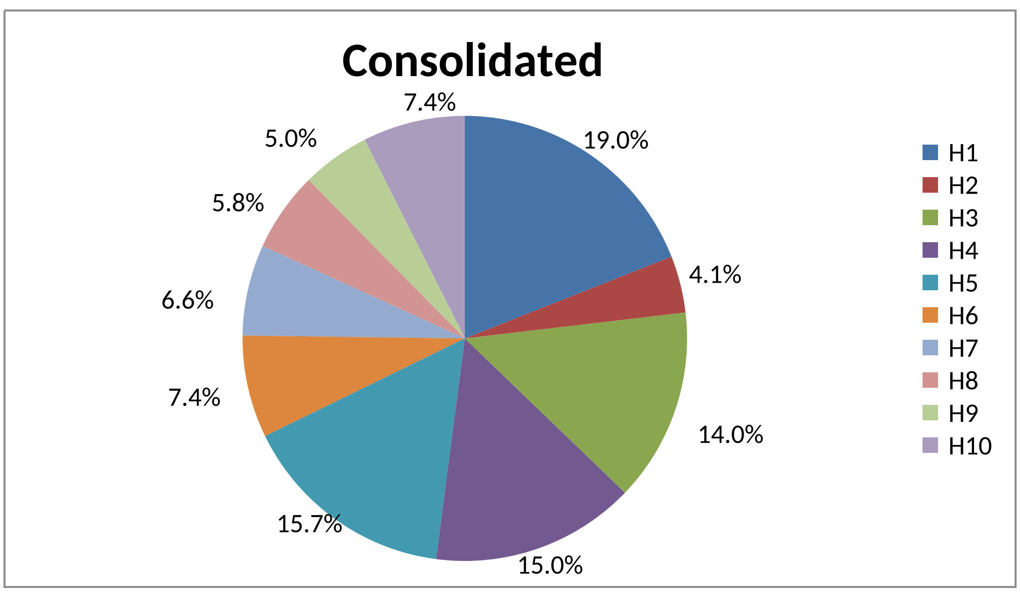

Figure 4. Percentage of Problems Identified Heuristics

This section presents the results obtained from the usability evaluation of Ethiopian e-tax portal using 10 usability heuristics principles by Jacob Nielsen heuristic usability evaluation method.

Heuristic 1 - Visibility of system status

This principle emphasizes the importance of keeping users informed about ongoing processes through timely and relevant feedback. To evaluate the e-tax portal's adherence to this principle, the researcher assessed the visibility of user actions and the feedback provided during the upload and download of content, particularly focusing on forms. So the researcher emphasis on forms arises from the variety required by taxpayers during registration and for submitting returns for different taxes. Ethiopian e-tax portal includes several primary categories of forms: user registration, filing declarations, and refund and clearance requests, updating taxpayer information, validating tax identification numbers (TIN), and managing the message center. Additionally, the portal offers forms and templates for e-tax services, which encompass tax declarations, tax accounts, potential refunds, refund requests, and clearance request lists. A further breakdown of tax declarations includes various schedules, such as excise tax, private employee pension contributions, Schedule D for dividends, Schedule D for gains on shares, Schedule A for monthly payments, Schedule C for normal tax, value-added tax (VAT), and withholding tax. This level of tax declarations are either without detailed information or with detail information which are generally the same, except for those requiring supporting documents. In contrast, tax declarations with detailed information include schedule A for PAYE (Income Tax), withholding tax, and schedule C for Normal/Mining (Annual Profit Tax).

Issue one the pages under each menu tab are not straightforward that is the content under each menu tab is not clear or easy to navigate. "Not straightforward" means that the information or layout is unclear, complicated, or difficult to understand. This could manifest as confusing navigation, ambiguous labels, overwhelming content, or inconsistent design, making it hard for users to find what they need or to understand the information presented. For example the progress measures are not accurate. If it says it takes one minute, it doesn't really take one minute. The feedback doesn't appear immediately, it take a long time. Not holding more than 24 tax periods. Issue two: Users must first convert their entire data information sheets prepared in PDF, Word, or Excel formats to CSV format before uploading them to the e-filing system, since the contents can't upload except CSV format. During the download and upload of any forms, users receive updates regarding the process. Two forms were specifically downloaded: the tax identification number (TIN) for individual registration and the income tax return form for individuals with business income. Issue four as illustrated in Figure 4.2, the download process for each form displayed progress through a visual indicator of the file size increment being downloaded is affected and according to expert two," the system as a whole do not load a large number of files when needed". Therefore, at the time of this study: the e-tax portal effectively met this principle/guideline and keeps the user informed through constructive, appropriate and timely feedback, responds to user-initiated actions and no surprise actions by the site or tedious data entry sequences.

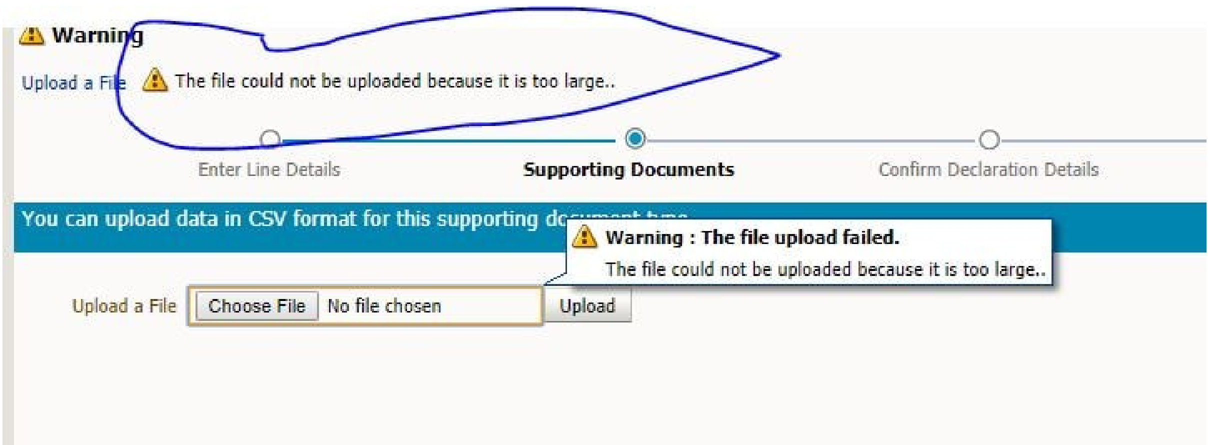

Figure 5. Tax declaration uploads file detail

Issue five: While the current page location is displayed, several pages lack clear tab names. Since most links on the website open in new tabs, users navigate through multiple pages as shown from the figures 4.3, figures 4.4 and figures 4.5 This creates lengthy and tedious processes for performing simple tasks, such as returning to the homepage or logging into e-filing. Remembering the steps each time can be challenging, so users would benefit from assistance in navigating these procedures.

Figure 6. Login page on e- filing (A)

The interpretation here may vary, but according to the expert three, “productivity is reduced due to time spent in front of the computer in frustration”, which indicates the need to evaluate the current documentation systems user interface has long steps to perform.

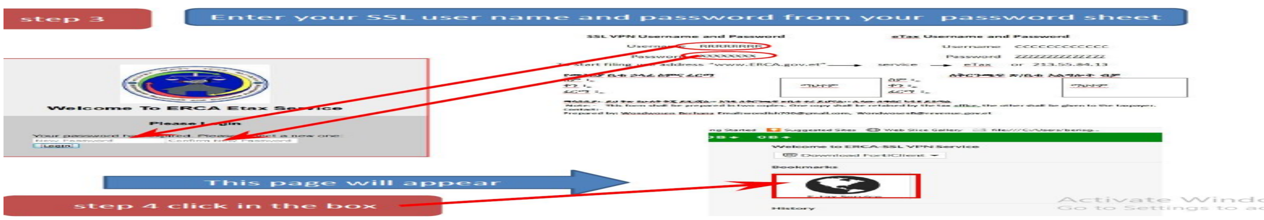

Figure 7. Login page on E- Filing (B)

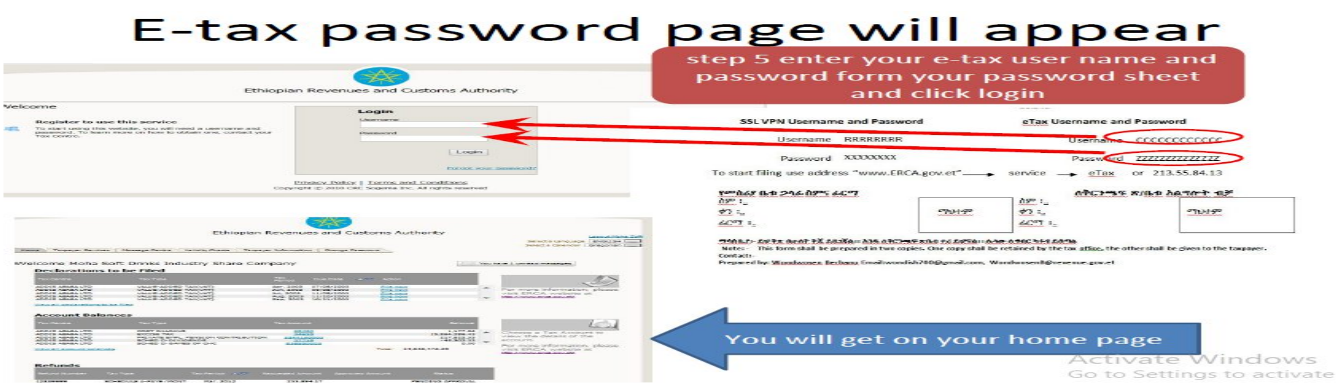

Figure 8. Login page on E- Filing (C)

From the figure 4.3 to 4.5 users should know and perform tasks what they are capable of doing in the system at any given moment, they should know what system they are in and where they are located within the system, they also should know how far they are from accomplishing their goal and should explicitly know that their goal was accomplished regardless of the outcome.

Heuristic 2 - Match between system and the real world:

This principle highlights the importance of using user-friendly language that resonates with users, rather than relying on technical jargon or system-specific terminology. In evaluating the usability of the e-tax portal, an expert reviewer who is also a regular user of the plat form assessed the clarity and familiarity of the language used throughout the site. The review focused on the homepage and its subpages, revealing a well-organized layout that includes a top navigation menu, a taxpayer service section showcasing key events, and a detailed tax declaration menu on the left side.

The lower section of the homepage features updates from the Ministry of Revenue regarding excise tax, private employee pension contributions, Schedule D for dividends, Schedule D for gains on shares, Schedule A for monthly payments, Schedule C for normal tax, value-added tax (VAT), and withholding tax. The footer contains essential links, including buttons for canceling, clearing, and saving contact information.

The main navigation menu comprises six items, with the e-tax service section covering tax declarations, tax accounts, potential refunds, refund requests, and clearance request lists, all of which were found to be intuitive. The dropdown menu system further enhanced the reviewer's understanding by allowing them to preview sub-menu items without needing to click through. For example, the tax declaration submenu includes options such as excise tax and other relevant categories; however, there are no indicators or information to assist users in registering and proceeding to the next step. The section dedicated to excise tax expands to include a "File Now" option, which appears when hovering over the menu item that leads to the registration process.

Expert 1 noted as issue one, "The e-tax service doesn't maintain transparency; sometimes the information provided results in a null outcome." Expert 2 added that as issue two "the email icon doesn't link to an email address." Expert 3 noted also that "the footer contains essential links, including buttons for canceling, clearing, and saving contact information but not processing our return, and clearance request."

Overall, the language and structure of the e-tax portal were found to be accessible and comprehensible, enabling users to easily navigate and locate the information they need. This evaluation underscores the importance of employing familiar terminology in digital platforms to enhance user experience and facilitate efficient interactions with the system.

Heuristic 3 - User control and freedom:

This principle emphasizes the necessity for the system to provide support for undo and redo actions and the user should be able to quit any undesirable situation on the system as users frequently make mistakes and need a straightforward way to recover from them. To evaluate how well the e-tax portal adheres to this principle, the expert reviewer who is also the researcher assessed the portal's capability to allow users to reverse accidental actions. This evaluation focused on specific areas of the site where users are required to perform actions, such as logging in and conducting online inquiries to request or process services like e-tax filing. Issue 1: expert 1 and expert 2 emphasis on “There is no undo and redo buttons and mentioned that the action is possible using the Ctrl + Z keys for UNDO” and Issue 2: “Branches don’t re-do the transaction by stating effective date as the original date of tax payment”

During the login assessment, the expert reviewer encountered a common issue i.e issue three: she /he forgot the username, password, and the answer to his/her security question. Upon attempting to log in, there is a received notification that her user ID or password was invalid. Fortunately, the portal included a login assistance menu with a "forgot password" option conveniently located on the side. This option doesn’t work properly. To reset username and password, user must go the tax center and they will have opportunity to get his/her username and password through the process of recovering their credentials. If taxpayers do not use the password in the 30 days and in addition if the password is forgotten, it will need to be reset, so they will physically have to go to their respective tax centers in order to have the tax officer reset the passwords for them. The last issue four; user should be able to quit any undesirable situation on the system but the Ethiopian e-tax portal has no an exit button, which user or still experts escape from any unnecessary situation in the system.

Regarding these condition users should be able to undo and redo any action they take on the system when looking at the different elements (links, buttons, etc.), know what he/she can do. When any changes happen in the system, they are immediately reflected in and should be able to quit any undesirable situation on it. Users should know why the system is asking them to enter certain information, and they should know how the information will be handled. This condition is not complying.

Heuristic 4- Consistency and standards:

Users should not be left unsure about whether different words, situations, or actions convey the same meaning. Nielsen emphasizes that standards help maintain a consistent vocabulary in interface design. To evaluate this principle, the researcher assessed how closely the e-tax portal adhered to common web conventions identified by Nielsen, which suggest that following established web standards, promotes a more coherent design. Nielsen outlined seven key web conventions: Placing the logo in the upper left corner of the page, positioning the main navigation bar at the top of the site, using underlined or differently colored text exclusively for links, employing buttons strictly for navigation, utilizing standard icons for widely recognized functions, applying visual hierarchy to indicate the importance of information and its sequence and providing clear names for navigation links.

Placement of the logo in the upper left corner: The Ministry of Revenue logo was prominently displayed in the upper left corner of the page, along with the phrase "Welcome to ERCA E-Tax Service" presented in both small and capital letters and main navigation bar at the top of the site did not fully comply with this guideline, featuring a navigation menu with six items situated across the top of the page, directly below the logo. The convention suggests having between five to seven primary navigation options, with a maximum of three levels for sub-navigation. The researcher identified a key issue with the e-tax portal interface, as it presented eight or more sub-navigation options. This can overwhelm users with excessive content and impede their ability to locate the information they need efficiently.

Use of underlined or differently colored text for links: Issue two the portal did not fully comply with this guideline, as some text, such as "logout" with plc name and "cancel" on the homepage, appeared in the same color as the links but did not function as links and no different text color. Only the corresponding images next to the text were functional. This usability issue may indicate insufficient testing of the site. Using buttons only when they link to something: The e-tax portal complied with the use of buttons on various online forms; however, some buttons, such as those for Facebook, Mozilla Firefox, and Google on the homepage, did not link properly is the third issue.

Using standard icons for common functions: The homepage of the portal complied fully with this principle, featuring six icons that represent commonly understood functions. Using visual hierarchy to guide users: The main content of the homepage is positioned above the fold (the portion of the webpage visible without scrolling), making it easy to identify the information and services provided. Jacob Nielsen's 2006 study indicated that 77% of website visitors do not scroll. The upper portion of the page includes the logo area, the main navigation menu, tax declaration area, and buttons linking to the company’s social media pages. The section below the fold includes news alerts and a footer area with contact information, links to downloadable forms, exchange rates for various taxable goods, and other useful links. While placing contact information in the footer is common practice, many websites also feature it in more prominent locations, such as in the main or secondary navigation menus. Using Clear Names for Navigation Links: All navigation link names were straightforward, with many employing conventional terms such as “Home,” “About Us,” and “Contact Us.” For specialized terms lacking conventional names, the best possible wording was used, and content under these links was presented in a dropdown menu that displays the contents when the mouse hovers over the menu item.

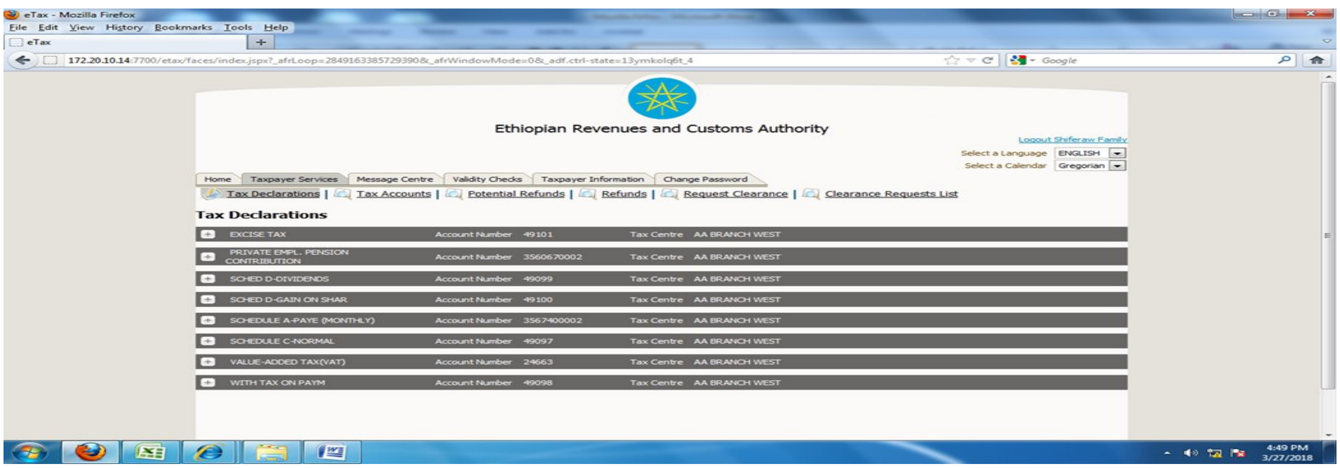

Figure 9. Tax declaration with its sub navigation

Heuristic- 5 Error prevention:

This principle emphasizes that it is more effective to design systems that prevent errors from occurring rather than merely providing good error messages. Errors can be categorized into slips, which happen when users unintentionally perform an incorrect action due to lack of skill or attention, and mistakes, which are conscious errors. To prevent slips, the design should focus on guiding users during task execution. The principle was tested using strategies recommended by Laubheimer, including constraining user input, offering contextual suggestions while typing, and implementing forgiving formatting that is easy for users to scan. Details on how each strategy was evaluated and the results are provided below.

The evaluation of the Tax Identification Number (TIN) application form revealed issues with user input constraints. When users entered incorrect data types in fields such as date of birth, mobile number, maiden name, and email, the system became unresponsive, causing confusion. Submissions only succeeded once the entries were corrected. This highlighted that, despite implementing input constraints, the lack of clear feedback hindered user understanding and navigation, indicating a need for improved guidance and communication within the system. Additionally, the issue of inadequate support for new taxpayers was noted, emphasizing the importance of addressing the needs of individuals unfamiliar with the tax system to ensure compliance and engagement.

The evaluation examined the effectiveness of contextual suggestions in three online forms: the Tax Identification Number (TIN) application, service desk help requests, and non-compliance reporting. It was found that none of these forms provided contextual suggestions during user input, which could lead to errors or slips while completing the forms. This presents an opportunity to enhance user experience by incorporating real-time suggestions to assist users. Additionally, the issue of the system not generating document numbers indicates a directive to refrain from assigning unique identifiers for specific documents or transactions, likely due to process control, system configuration, or specific situational requirements.

The research highlighted the importance of forgiving formatting as part of Laubheimer's strategies for error prevention, which include adhering to design conventions, communicating usage clearly, previewing results, displaying contextual information, confirming destructive actions, allowing undo options, and providing real-time error warnings. While some of these strategies were implemented, the report calls for further testing to evaluate their overall effectiveness in enhancing user experience and reducing mistakes. Additionally, the issue of users not receiving reminders about impending deadlines indicates a gap in notifications, leaving users unaware of important time constraints.

The assessment of the portal's design conventions revealed that while it adhered to some common standard such as using familiar icons and placing the main navigation menu in the upper left corner certain elements fell short. For instance, buttons linked to functional elements lacked distinct colors or underlining for hyperlinks, failing to meet established conventions. The report included detailed evaluations of which conventions were successfully implemented and which were not. Furthermore, the usability study did not effectively demonstrate how to assess the portal's usability, highlighting a lack of pages or features for testing this aspect. This indicates a need for clearer guidance to help users navigate and utilize the portal more effectively.

The study emphasized the importance of reducing cognitive load for users by providing contextual information in forms. For instance, the "initiate service request" and "report non-compliance" tax forms utilized drop-down lists, enabling users to select options instead of relying on their memory, which helps minimize errors and enhances the overall user experience. However, the research identified a lack of suitable pages or functionalities to test recommendations related to confirming actions before destructive events and offering an undo option. Since the focus was on the public-facing interface, critical features likely available in the internal interface used by staff were not assessed. Additionally, while the ability to undo recent actions may exist for business owners submitting returns, specific user requirements for this group were not addressed. This gap highlights the need for further exploration of these functionalities to improve user safety and experience.

The issue of "inability to make corrections when the taxpayer informs" suggests that when a taxpayer alerts the relevant authority (like a tax center) about an error, the authority may be unable to implement the necessary corrections. This could indicate systemic limitations in processing such requests or a lack of responsive mechanisms to address user-reported issues.

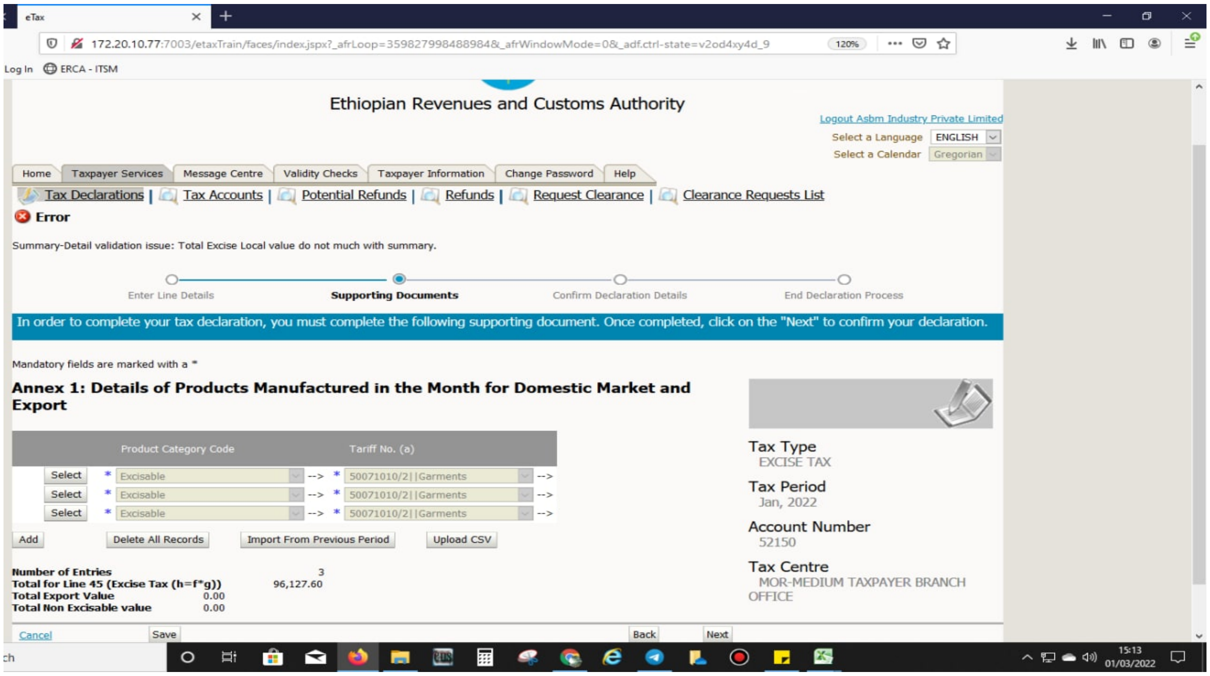

Figure 10. Declaration details

The analysis found that the forms included contextual error warnings for some fields, prompting users with messages like “please enter a proper value for the text” and “enter numeric data in this field.” However, fields such as username, request summary, and request description did not have similar warnings, despite being prone to incorrect entries. This highlights the need to identify additional fields that would benefit from contextual error warnings to enhance user experience and minimize errors. Additionally, there was no distinction between the excise on summary and detail pages, yet discrepancies in the amounts were reported, indicating a potential issue that requires attention.

Heuristic- 6 Recognition rather than recall

This principle advises interface designers to minimize the user's memory load by ensuring that objects, actions, and options are clearly visible. According to Nielsen, users should not need to recall information from one part of the interface to another; instead, instructions for using the system should always be visible or easily retrievable when needed. This principle was assessed based on Nielsen's recommendations, which advocate for making content and interface functions visible and accessible, including providing access to recently visited pages and previous searches, as well as ensuring that interface elements such as buttons and menus are both visible and intuitive.

Making Content and Interface functions Visible: This functionality was intended to be linked to a user's personal account on the portal. However, during the evaluation, the evaluators were unable to access user account, and their request for assistance through the online service desk went unanswered. Issue one according to expert three" Not processing our return, clearance request", It suggests that a request for the return of something (such as a tax return, merchandise, or documentation) or a request for clearance (possibly related to customs, security, or compliance) is not being acted upon or is being delayed indicates that a request for return or clearance is not being processed, potentially due to delays, missing information, compliance issues, or other administrative factors. The system should provide users with suggestions to make the process of remembering their needs easier i.e the system don't exactly recall but provide with suggestions.

Heuristic – 7 Flexibility and efficiency of use:.

This principle suggests that interface designers should develop interfaces that cater or provide to the needs of both expert and novice users. This can be accomplished by integrating accelerators that are not visible to all users but are accessible to more experienced users, enabling them to expedite interactions and customize frequently used actions, such as adding commonly visited websites to their favorite's folder in the browser. However, the study found no evidence of such accelerators, including shortcuts or options for saving frequently visited pages in the portal's favorite's folder. The system should provide users with different ways to accomplish the same goal to accommodate different users and different situations with different paths toward accomplishing the same goal. This indicates that the information may not have been entered correctly or may have been omitted entirely during the data entry process or there could be technical issues, such as software glitches or filtering settings, preventing the information from being displayed.

Issue two as expert two assessment "Not seeing what we announced 2 years ago" suggests that there was a previous announcement made by an individual (likely a leader, executive, or public figure) two years prior, and currently, there is a lack of evidence or realization of that announcement's promises or outcomes. This phrase conveys a sense of disappointment or confusion regarding the follow-through on a past announcement, suggesting that the expected outcomes or changes have not materialized as initially communicated. Here are some potential interpretations consequently; the Ethiopian e-tax center should consider incorporating this functionality to improve the portal's usability and efficiency for regular users.

Heuristic – 8 Aesthetic and minimalist design:

This principle highlights the importance of avoiding the inclusion of irrelevant or rarely needed information in an interface, as each additional piece of information competes with essential content and diminishes its visibility. Nielson notes that interfaces should only present elements and content that is relevant to the goals and tasks of the page. This principle was assessed on the home page, which, during the study, featured only content pertinent to the portal's objectives. This included the main navigation menu (Home, user registration, filing declarations, and refund and clearance requests, updating taxpayer information, validating Tax Identification Numbers (TIN), and managing the message centre. Additionally, the portal offers forms and templates for e-tax services, which encompass tax declarations, tax accounts, potential refunds, refund requests, and clearance request lists, and a more detailed navigation menu for services located in the middle left section of the page. The footer contained links for contacting e-tax portal downloading forms. Overall, all content on the home page was relevant to supporting the objectives and tasks of Ethiopian taxpayers. But according to expert two "the system interface elements appear to be not in a harmony or combination of related elements, the content of the system should not organized in a way that allows the user to distinguish each related elements, it contain any unnecessary content that would distract the user or extraneous content on the system (features, icons, texts, etc.) omitted, The system contain any unnecessary content that would distract the user. The content that users need to accomplish certain goals should be clearly presented to them, and they should not need to rely on their memory to remember them.

Heuristic – 9 Help users recognize, diagnose, and recover from errors:

This principle advocates for error messages to be presented in plain language, clearly identifying the issue and offering constructive solutions. Duggirala underscores the necessity of explaining errors to users in a way that is easy to understand. Most systems do not provide error-free information, leading to confusion for both taxpayers and officers. For instance issue one the system files information only after 24 hours without an error message, additionally, issue two when the bank does not utilize the document number, Issue three issuing with depositing funds into the wrong account, and issue four mistakenly deducted taxes from customers' accounts multiple times the error message did not tell whether the problem happed or not.

Furthermore, Issue five when registering for VAT, if the main TIN is not registered, it is incorrectly rejected as "not registered for VAT" during e-filing. Issue six for withholding payments, the system allows data entry up to line 40 but then generates an error that cannot be resolved. Despite attempts to remove the entered details one by one, the error persists. Lastly, tax type supporting documents often display an "unexpected error occurred." Furthermore, the guidance provided for resolving this issue was inadequate; after struggling to recall the answer to the secret question, it was unable to proceed with the recovery process. In such cases, offering options could have enabled a more effective resolution to the error. Users should be able to easily identify when an error has occurred. They should also clearly understand the nature of the error. Furthermore, the system should offer recommendations on how to resolve the issue.

Heuristic - 10 Help and documentation:

This principle advises that if help and documentation is provided in a Website, it should be easy to search, focused on the user's task, list concrete steps to be carried out, and not too large. Therefore, the test was focused on establishing availability of help and documentation, ease of search, extent of focus on the user's task, list of concrete steps to be carried out and size. Issue one Evaluator three observed that "the system is complex as a help tool" and recommended that it should provide users with a clear navigation structure on a single page. Additionally, while the search results are organized by relevance, the filtering options do not deliver the expected results, making it difficult for users to find the companies' TIN in the e-tax user list."

The system should also facilitate easy access for users to contact the help team. The portal also has a service desk option on you tube where users can initiate service desk requests as well as search the status of a service request. However, it would have been better to consolidate all these forms of help and documentation in one place or link them to each other to provide one stop help and documentation centre instead of scattering them as was the case at the time of the study. Issue two Evaluator two emphasizes that "the system should provide users with sufficient resources to understand its functionalities and tackle any potential challenges. Currently, there is a lack of adequate learning materials to help users navigate the system and overcome obstacles while searching for content. Additionally, materials should be prioritized based on action frequency."

The system should offer suggestions to help users easily recall their needs. Catering to diverse users and varying situations. Additionally, the sequence of tasks within the system should be streamlined for simplicity. Evaluator four pointed out that an issue "the system does not allow users to quickly identify the most relevant resources. Additionally, there are no short video or audio tutorials available to help users consolidate all these forms of help and documentation in one place or link them to each other and learn the system and address potential challenges. Contextual documentation should be presented alongside major tasks to offer users immediate guidance”. And evaluator two emphasized that "user’s lack straightforward access to learning materials, effective search capabilities, and prioritized content based on action frequency, and contextual documentation for major tasks." Overall, the system needs to provide users with adequate resources to support their learning and help them navigate any challenges they may encounter. And also the content required for users to meet specific objectives should be clearly displayed, eliminating the need for them to rely on memory.

4.4.1.2. Problems identified by expert evaluators

Heuristic evaluation of the e-tax system was conducted by four evaluators, leading to the discovery of usability problems. Following this evaluation, distinct usability issues were identified, with unique problems initially reported by the group of experts as mentioned above. This underscores the value of heuristic evaluation in uncovering usability challenges. To eliminate duplicates, the researcher meticulously reviewed the findings and merged closely related issues, resulting in a consolidated list of problems. Table 11 outlines the number of issues identified by each evaluator across various categories. The "Consolidated" column shows the total number of problems after the consolidation process for each specific heuristic, while the "By single expert" column indicates the issues flagged by individual evaluators (which may not be the same expert). For example, of the thirty-four problems associated with Heuristic 1, nine were identified by individual experts, suggesting that only twenty-five were recognized by more than one evaluator.

Table 11 shows that each expert identified between 25 and 65 problems (13.2% to 34.4% of the total), with an average of 45 issues per evaluator. The identification of 78 out of 121 problems by individual experts underscores the effectiveness of a collaborative team approach. Evaluator 1 and 2 noted more issues than the others, as they were the evaluators who completed the task within the allotted timeframe, with minimal assistance from a researcher to clarify certain points or document findings. These evaluators finished the assessment in two days, dedicating only two hours to the task, while the other evaluators, who collaborated with a researcher to record issues during their evaluations, took between one to one-and-a-half hours. This aligns with suggestions from Nielsen and others that such support can streamline the evaluation process.

The number and nature of problems identified by the evaluators are closely linked to their backgrounds and areas of expertise. Evaluator 4 noted fewer issues, which can be attributed to a focus on usability evaluation and a strong background in HCI, despite lacking prior experience with heuristic evaluations. In contrast, Evaluators 1 and 2, both possessing extensive HCI expertise and familiarity with the e-tax system, identified a larger number of issues. Evaluator 1 has specialized knowledge and trains professionals in evaluating the e-tax system, making them highly skilled in this area. Evaluator 2, holding a degree in Business, is considered a "double expert" and uncovered the most problems in the application. While Evaluator 4 was initially viewed as an expert, they also identified several issues, likely due to their background in e-tax applications and computer science. Evaluator 3, also with a degree in Business and recognized as an experienced expert, identified a moderate number of issues, focusing on improving the existing system in collaboration with team members and addressing usability concerns based on taxpayer feedback. These findings indicate that evaluators possessing both domain knowledge and HCI expertise are more adept at identifying usability problems. This aligns with the conclusions of Nielsen and Phillips, who found that usability specialists are more effective than non-specialists in detecting usability issues.

Heuristic No.	Heuristics	Evaluator 1	Evaluator 2	Evaluator 3	Evaluator 4	Consolidation	Consolidated	By single Expert
H1	Visibility of system status	7	10	9	8	34	23	9
H2	Match between system and the real world:	3	1	2	1	7	5	5

H3	User control and freedom	4	9	3	4	20	17	7
H4	Consistency and standards	12	12	10	0	34	18	13
H5	Error prevention	16	1	6	0	22	19	15
H6	Recognition rather than recall	3	3	2	0	8	9	5
H7	Flexibility and efficiency of use	2	11	5	1	19	8	8
H8	Aesthetic and minimalist design:	6	3	0	1	10	7	3
H9	Help users recognize, diagnose, and recover from errors	4	4	4	7	18	6	6
H10	Help and documentation:	8	3	1	3	14	9	7
Sub-Total		65	57	42	25	189	121	78

Table 10. Number of problems identified by experts

Solving the problems

While heuristic evaluation (HE) primarily aims to identify issues rather than provide solutions, in many instances, the solutions are inherently suggested by the problems themselves. Experts pinpointed issues that, if addressed, could enhance both taxation efficiency and usability. Table 12 presents the problems that contravene Heuristic 3. These issues are clearly defined, and most solutions can be directly inferred from the corresponding problem statements.

Heuristic 3: User control and freedom
Taxpayers registration not active as soon as created
There are no facilities for Undo and Redo.
Sometimes the system is slow to respond.
There is no system exit button.

Table 11. Sample of problems identified by experts

4.4.1.3. Severity Rating

Table 13 illustrates that the four expert evaluators independently assessed the severity of problems identified in the combined list of 272, using a rating scale from 1 to 4, where 1 represents cosmetic issues and 4 signifies catastrophic problems (as shown in Table 13). The average severity rating across all evaluators was 3.0, with a standard deviation of 0.8, suggesting that most problems were perceived as moderate in severity, allowing users to adapt quickly and continue using effectively. The mean scores for Evaluators 1 through 4 were 4.4, 3.6, 2.6, and 1.5, respectively, all of which are close to the overall mean of 3.0.

An analysis of the source data reveals that the expert evaluators assigned similar scores to most issues. Furthermore, the evaluators demonstrated objectivity, as evidenced by their high ratings for certain problems they did not personally identify, thus acknowledging and validating the concerns raised by their peers from different specialties. This underscores the importance of leveraging diverse expertise and highlights the advantages of conducting severity ratings after evaluations, utilizing a consolidated set of problems identified by a balanced group of experts and a substantial number of end users. The overall mean score of 3.0, along with general comments from the experts, indicates a positive evaluation of the site's usability and its support for e-tax collection. This is further substantiated by qualitative feedback gathered from the open-ended sections of the questionnaire. Two examples of experts comments include: "The site isn’t well organized and easy to navigate," and "I don’t appreciate the variety declaration styles. It inspires the study." Severity levels can guide the allocation of resources to address the most critical issues and provide a rough estimate of the additional usability efforts required (Nielsen J, 1994). The severity levels are categorized as follows: 0 indicates no issues, 1 signifies cosmetic issues, 2 represents minor issues, 3 denotes major issues, and 4 indicates problems that should not exist prior to product release. Among the identified issues, there are categorized as severity level 1, meaning these 213 issues are cosmetic and do not significantly impact users, suggesting that fixes may not be necessary if time is constrained. There are 26 issues classified as severity level 2, which are minor usability concerns that could affect users' interactions with in Ethiopian e-tax website and warrant low-priority fixes. Additionally, there are 33 issues at severity level 3, classified as major usability problems that require high-priority attention. Lastly, 0 issues fall under severity level 4, indicating there is no critical problems that should be resolved, as they represent issues that should not be present when the system or website is launched or used.

Id	Heuristics Principles	Severity				Total		Average (mean range) Severity
		Cosmetic	Minor	Major	Catastrophe	Frequency	%	
H1	Visibility of system status	37	3	5	0	45	16.5	0.70(0-2.31)

H2	Match between system and the real world	13	1	2	0	16	5.9	0.80(0-2.6)
H3	User control and freedom	19	0	0	0	19	7	0.68(0-2.71)
H4	Consistency and standards	15	9	4	0	28	10.3	0.55(0-1.6)
H5	Error prevention	38	6	4	0	48	17.7	0.75(0-2.38)
H6	Recognition rather than recall	16	3	1	0	20	7.4	0.84(0-2.6)
H7	Flexibility and efficiency of use	9	1	1	0	11	4.0	0.92(0.3.00)
H8	Aesthetic and minimalist design	17	0	4	0	21	7.7	0.75(0-2.43)
H9	Help users recognize, diagnose, and recover from errors	22	2	4	0	28	10.3	0.86(0-2.75)
H10	Help and documentation	27	1	8	0	36	13.2	0.75(0-2.25)
Total		213	26	33	0	272	100	
		78.3 %	9.6 %	12.1 %	0.0 %		100.0	

Table 12. The frequency of Severity of usability issues of e-tax portal

4.4.1.4. Major and Minor Problems

Problems can be categorized as major or minor. Based on the severity ratings, issues with an average score of 4 to 5 were classified as major problems, while those with an average score of 1 to 2 were categorized as minor problems (see table 13). Following this classification, a comparison was made between the findings of experts. Table 13 outlines the number of problems and their corresponding percentages within the major and minor categories. A total of thirty three problems were classified as major, while twenty six were deemed minor. Problems with ratings between 2 and 4 were considered neither major nor minor. In terms of minor and major problems identified by experts as shown in table reveals that fifty nine issues were identified by experts, representing 55.9% major and 44.6% minor.

The table shows that of the twenty six minor problems, experts 1, expert 2, expert 3 and expert 4 identified 11.5%, 73%, 15.5% and 0 respectively. Expert four not recognize this issue whereas major problems represents by experts with total of thirty three issues recognized by expert 1, expert 2, expert 3 and expert 4 are 78.9%, 33%, 12% and no issue respectively. Evaluator four exhibited a low percentage or no activity both issues of agreement regarding major and minor problems, indicating little consensus. These findings are consistent with similar studies, which suggest that major problems are more readily identified than minor ones. Nielsen noted that while major usability issues are easier to detect, the total number of minor problems often exceeds that of major ones when all issues are considered. This observation is also supported by the results of the present study

4.4.2. Usability Testing

The user tests (UT) were conducted to find out how many of the predicted problems reported by the evaluators using the heuristic evaluation were real problems for users. The task sets for the user tests were derived from the results of the heuristic evaluation, asking the users to use those features of e-tax system that were found to be problematic in the heuristic evaluation. This method was adopted to increase the power of the user tests for validating the predicted usability problems. 10 participants (P1, . . ., P10) were asked to solve eight tasks (Table 14) while thinking aloud. First, the participants answered a pre-test questionnaire about their personal and technical background. Then, they solved the task scenarios one by one and answered a so-called 'After Scenario Questionnaire.

No.	List of tasks
1	Apply to for e-tax portal user account
2	Login and edit user preferences
3	Browse the catalogue of the e-tax portal
4	Search e-tax profile video on you tube
5	Tax validate
6	Filing private employee pension
7	Filing tax on payment
8	Change users password

Figure 14. List of tasks

In the study conducted by (Lewis, 1991) participants' subjective satisfaction regarding the task was measured. A mobile camera was utilized to capture everything that occurred on the screen, recording both sound and video during the session. Upon completing the eight tasks, users were asked to fill out a post-test questionnaire using the System Usability Scale (SUS) developed by Brooke (1996), which assessed their overall satisfaction with the e-tax portal. The SUS is a widely recognized, reliable, and cost-effective tool for measuring usability in various industries. The study involved ten participants, all of whom were staff members with experience in the e-tax system. The group consisted of seven males and three females, with four participants in their twenties, four in their thirties, and two in their forties. Participants self-assessed their competence with the e-tax portal at an average score of 3.5 out of 5 (N = 10; SD = 0.8). When asked about their experience with the e-tax system, they reported an average score of 3.5 out of 5 (N = 10; SD = 1.27). Among the participants, four were database administrators, three were tax officers, one was a data encoder, and two were non-filer follow-up officers.

All of the participants were activated in e-tax portal either developed or organized online tax content. An experimenter observed the users unobtrusively, in the same room, while they were performing the task scenarios. For each task, they reported the user's performance (start-time, end-time, number and type of errors, instance and type of help seeking, instance of expressed frustration), comments and problems with a template on a laptop. The experimenter checked these data against the screen captures and audio recordings to ensure their accuracy.

Learnability (Task Completion): As the success level, five users were unable to complete task #1 because they could not register the tax payer account after they login into e-tax service. These users age were not the factor but due to lacked experience with computers, and had limited skills in using e-tax system. In Task #4, four users failed to complete the task due to misunderstanding the steps for searching e-tax profile leafs to misconception of the system. Instead, they mistakenly clicked on the option to template information, as reflected in their comments regarding this e-tax service. Notably, most of these users didn't perform task #2 and task #3 as either their second or third attempt. Furthermore, four users struggled with task #4, as they were unsure how to enter in to the e-tax system and search the link that helps to communicate with e-tax profile to the browser, and all of these users either had no computer skills or had poor computer skills. Five users were unable to complete task #5 because they could not validate the taxpayer's or organization's TIN which were suspected to be false, when it is valid it should shows the owner of the tin and couldn't show and message displayed or invalid. These users lacked experience and skills to perform the task. In Task #6, three users failed to complete the task notably to file employee pension in the file declaration page. They unable to fill the withholding summary lines that link would help to call the previous period declaration detail information. They couldn't link on the side of the tax period to that of file now link to file. They missed the steps for searching e-tax profile to misconception of the system. Instead, they mistakenly clicked on the option to template information, as reflected in their comments regarding this e-tax service.

The success rate was calculated following Jakob Nielsen's method. Partial success (p), defined as 50% of a full success, was added to the total number of successful attempts (S) and then divided by the overall number of attempts using the formula (S + (p * 0.5)) / Number of attempts. The overall success rate for the design, based on 80 attempts, was 88%. Nielsen found that most websites typically achieve success rates below 50% when users encounter the design for the first time. Additionally, (Alduhailan and Alshamari, 2016) indicated an average success rate of 78%, Ismail's system achieved a success rate of 73.18%Thus, a success rate of 75% is considered reasonable and commendable, as it exceeds the 50% threshold noted by Nielsen for first-time users and is comparable to Ismail's finding of 73.18% for a similar design., despite his results being based on a diverse range of users and software domains.

Efficiency (Time on Task): During the usability testing session, the observed efficiency in task completion increased with the order in which tasks were performed. Specifically, the time taken for each task decreased when users completed it as their 2nd, 3rd, 7th or 8th task, regardless of their individual profiles or characteristics. This improvement can be attributed to users becoming more familiar with the design, making it more learnable after completing more than two tasks (Alduhailan and Alshamari, 2016). Notably, all tasks have been included from this analysis due to more than five successful completions. To calculate the average time for each task, geometric means were used, as recommended by (Jeff Sauro and Jakob Nielsen, 2010). The geometric mean is preferred in this context because extreme values can distort the results of an arithmetic mean, particularly when the sample size is less than 20 (Jeff Sauro and Jakob Nielsen, 2010). As previously mentioned, excluding task #1, task #4 exhibited the highest geometric mean, reflecting the greater number of steps required to complete it compared to the other tasks. Task #5 presents the geometric means for Tasks #2, #3, and #4, all of which involve a dropdown menu that necessitates certain computer skills. The most frequently encountered user error was related to the design of the Reporting Missing Documents icon, which users found difficult to understand. This confusion manifested as an error while navigating the dropdown menu in Task #4. #2 has influenced an increase in the number of errors in Task #2 after Task #1 is in place.

Task	Geometric Mean (sec.)
Task #1	75 sec.
Task #4	130 sec.
Task #5	120 sec
Task #6	85 sec

Table 13. Geometric mean of Task Time

Satisfaction: User satisfaction was assessed through a single question aimed at evaluating the overall experience and contentment after interacting with the e-tax interface. To measure this, the researcher utilized Single Ease Questions (SEQs), as recommended by Jeff Sauro, due to their simplicity and ease of collection, particularly for e-tax users (Jeff Sauro, 2010.) Participants were presented with a 5-point Likert scale, with each point clearly explained to help them make their selection. Responses were collected orally by the observer following the test session. Despite varying levels of success and some errors among users, all participants expressed a positive reaction and a willingness to use the e-tax interface if it were available on government websites.

Number of errors: The majority of issues arose during Task #1, task #4 and task #5 accounting for approximately 50% (5 user errors out of 10), 40% (4 user errors out of 10) and 50% (5 user errors out of 10) of the total error rate observed during usability testing respectively. These problems were primarily related to users' e-tax performance skills, specifically in selecting options from checkboxes. In contrast, Task #2, and Task #3 had both 10% (1 user error out of

10)for each and Task #6 had the lower error rate of, 30% (3 user error out of10) at just as it did not require any specific computer skills and relied solely on clicking or touching. Tasks #7 and #8 had no any user error just it did not require any computer skill. Tasks #1, task #4 and Task5 both included dropdown menus that demanded some level of computer proficiency. A significant number of user errors were linked to the design of the reporting missing page link, which was often misunderstood. The unclear meaning of each link with complex steps to complete the task contributed to an increase in errors during Task #4, particularly after users had already encountered difficulties in Task #1 and Task #5.

4.5. Document analysis

The full implementation of the Ethiopian e-tax system began in December 2011, incorporating all high taxpayers and ministry of revenue offices. Additionally, commercial banks have trained their customers on using the e-payment system and set up user accounts for them. The e-announcement system provides a secure connection between taxpayers and the institution's system, utilizing usernames and passwords supplied by taxpayers. The e-payment system relies on e-notifications of payments and generated document numbers, facilitated through an API developed in collaboration with commercial banks and the National Bank. Taxpayers using the e-tax system can complete their required payments, and their information is entered into the main core system (Sigtas), activating their tax accounts. A payment receipt is automatically generated by the system and sent to their registered email addresses. But there is no document about e-tax system that help the researcher take essential data for the research except the comment or issues given by users (customers), experts and user guides in the form of pdf and power point found in e-filing system of the email.

However, several challenges have arisen within the e-tax system. These include issues such as non-functional document numbers, failure to accurately record taxpayers' current email addresses and phone numbers, and the non-delivery of invoices to some taxpayers. Additionally, at the end of the month, there can be system interruptions or outages, authorization problems with the bank, discrepancies where amounts are deducted from the customer’s account but not credited to the office’s account, and errors caused by banks not utilizing the correct document numbers, leading to deposits in the wrong accounts. There have also been instances where tax amounts have been deducted multiple times from a customer's account. These issues must be carefully considered moving forward.

Usability is a crucial factor in the success of any digital system, especially in government services like e-tax platforms, where user satisfaction and accessibility directly impact the system's effectiveness. Jakob Nielsen's 10 Usability Heuristics for user interface design provide widely recognized principles for evaluating the usability of software systems. These heuristics help assess aspects such as ease of use, functionality, and user satisfaction, making them ideal for evaluating e-tax platforms in various countries. This analysis applies Nielsen's heuristics to assess the usability of Ethiopia's e-tax system, aiming to identify areas for improvement in user experience and system performance.

Jacob Nielsen's 10 Usability Heuristics for evaluating user interfaces focus on principles that ensure systems are user-friendly and efficient. These heuristics include providing timely feedback to keep users informed, using language that aligns with the user's own terminology, and offering the ability to undo or redo actions to prevent errors. The system should maintain consistency in design, follow established platform conventions, and prevent issues by addressing error-prone conditions early on. It should minimize cognitive load by making actions, options, and objects easily visible, and cater to both novice and expert users by offering shortcuts for experienced users while remaining simple for beginners. The interface should focus only on essential information to avoid overwhelming users, use clear and understandable error messages to assist in problem recovery, and, although ideally self-explanatory, provide accessible help and documentation when needed.

Heuristic Evaluation of Ethiopia's E-Tax System

The Ethiopian e-tax system, developed by the Ethiopian Revenue and Customs Authority (ERCA) today ministry of revenue, enables citizens and businesses to file taxes, make payments, and manage their tax-related activities online. The following is an evaluation of the system using Nielsen's heuristics:

Positive: The e-tax system provides users with feedback on transaction progress, such as confirmation messages when forms are submitted or payments are completed, and uses familiar terminology like "Income Tax," "VAT," and "Tax Payment" that users could easily understand. While the platform allowed users to cancel actions and return to previous pages, it does not always offer easy ways to correct mistakes in certain sections. The design generally follows common web conventions, with buttons and menus in standard locations, and the system checks for basic errors during data entry, such as invalid tax identification numbers or missing fields. Key options, including tax filing, payments, and payment history, are easily accessible on the homepage, and the system provides advanced features for experienced users, like the ability to view tax history and make recurring payments. The design is somewhat simple and organized, with essential functions clearly presented, and the platform offers help documentation and support contact for user queries. Additionally, error messages are provided when users make mistakes during tax filing or payments, though further clarification could be helpful.

Negative: In some instances, feedback from the e-tax system is delayed, causing confusion about whether actions have been successfully completed. The system also fails to update users in real-time about the status of their requests, such as processing times or error messages during payments. Additionally, certain legal or technical terms may be too complex for the average user, and inconsistent language across the platform can further confuse less experienced users. Once a tax filing is submitted, making changes, particularly regarding payment issues, is difficult, and the process for correcting errors is not clearly documented. Visual inconsistencies, such as varying button styles across different forms, contribute to user confusion. Users can also inadvertently enter incorrect information, such as incorrect tax payment amounts, without receiving immediate feedback, and the system does not always provide warnings about potential errors before submission. For less experienced users, the system's complexity can be overwhelming, and there are no apparent shortcuts or customizable workflows for experienced users. Some pages contain excessive information or complex forms that could overwhelm users, and the design would benefit from more white space to ease cognitive load. Error messages are often vague and lack sufficient guidance, particularly in cases of payment failures, leaving users frustrated. Additionally, the help documentation is often too technical and inaccessible for average users, with a lack of interactive or step-by-step guides to assist those unfamiliar with the system..

Improvement: To improve the e-tax system, real-time notifications, progress bars, or status indicators should be implemented to keep users informed of their actions. Simplifying language and ensuring consistency in terminology across the platform would enhance clarity. Users should be given more control over their actions by allowing easy edits to submitted information, especially before final submission. Consistency in design elements, such as button styles, layout, and form fields, is essential throughout the platform. A more robust input validation system should be introduced to catch errors before submission, along with proactive prompts to prevent mistakes. To reduce memory load, users should have easy access to their tax filing history and previous actions, with clear navigation for returning users. Customization options, such as a dashboard for frequently used features and keyboard shortcuts for advanced users, would improve flexibility. Simplifying the interface by removing unnecessary elements and applying minimalist design principles will help users focus on essential tasks. Error messages should be clear, specific, and provide actionable suggestions for recovery, such as "Invalid payment method; please try again with a different data." Finally, the help documentation should be revised to be more user-friendly and interactive, potentially incorporating video tutorials or step-by-step guides to assist users.

4.6. Result and Discussion

4.6.1. Heuristic evaluation results

In the evaluation of the Ethiopian e-tax web interface by four experts, the heuristic principle "Match between system and the real world" (H2) was found to have the fewest issues, at 4.1%. A percentage distribution chart indicated that the principles of Visibility of System Status (H1), Error Prevention (H5), Consistency and Standards (H4), and User Control and Freedom (H3) had the highest number of identified issues, each exceeding 10%. Specifically, H1 emerged as the most frequently encountered principle, accounting for 19.00% of the 121 total issues noted. Analysis of the consolidated list confirmed that all heuristic principles were violated during the evaluation. Figure 13 illustrates the percentage of issues related to each heuristic, highlighting that H1 (Visibility of System Status), H5 (Error Prevention), H4 (Consistency and Standards), and H3 (User Control and Freedom) had the highest problem rates at 19.0%, 15.7%, 15.0%, and 14%, respectively.

Severity levels can be utilized to prioritize resources for addressing the most critical issues and to provide a rough estimate of the additional resources required for usability improvements (Nielsen J, 1994). The severity levels are typically with value 0 no issues, 1 cosmetic issue, 2 minor issues, 3 major issues, and 4 Critical issues that should not exist before the product is released. According to the findings, there are 213 issues classified as severity levels 1, which are cosmetic in nature and do not significantly affect user experience. If time is constrained, these issues may not require immediate fixes. In terms of minor usability concerns, there are 26 issues rated as severity level 2. While these issues have the potential to affect user interaction with the Ethiopian e-tax portal website, they are considered low priority for resolution. There are also 33 issues identified as severity level 3, categorized as major usability problems that require high-priority fixes. Lastly, 0 issue falls under severity level 4, representing no critical problems that should be addressed, as they indicate flaws that should not be present at the time of the system or website's launch.

Usability of System Status

The usability of the status indicators presents several issues. Users often struggle to locate the relevant page and find it difficult to understand the information presented. Progress measures are frequently inaccurate; for instance, when the system indicates that a task will take one minute, it often exceeds that timeframe. Additionally, feedback is not provided immediately and tends to be delayed, complicating the user experience further. The system also has trouble accurately interpreting user feedback and does not retain data for more than 24 tax periods. Users encounter limitations when trying to upload large files, and both active and passive progress indicators are absent. Moreover, the e-tax system fails to deliver error-free information due to user input errors and does not accurately record data. Finally, users face an error message when attempting to upload an excel file, stating that "e-Payment is not enabled."The e-tax portal struggles to efficiently manage large file uploads and downloads, often failing to provide timely and constructive feedback to users. This results in unexpected outcomes, lengthy data entry, and cumbersome navigation, especially due to unclear tab labels and the frequent opening of new tabs. Such design flaws hinder user productivity and complicate basic tasks like returning to the homepage or logging into e-filing. A comprehensive reassessment of the interface is needed to streamline processes, enhance user awareness of their progress, and ensure clearer task completion notifications.

Heuristic 2 - Match between system and the real world:

The match between the system and the real world is inconsistent across various elements, including meaning, function, and organization, effort, and user experience. For instance, the email icon does not link to an email address, which can lead to confusion. Additionally, the e-tax system takes about five hours to file information, and the steps required to complete tasks do not follow a logical order, leaving users unclear about what the next step should be. Furthermore, the system fails to recognize unit measure, which adds to the overall lack of coherence and usability within the platform. Overall, the evaluation found the language and structure of the e-tax portal to be accessible and easy to navigate, highlighting the importance of using familiar terminology in digital platforms to improve user experience and facilitate effective interactions with the system.

Heuristic 3 - User Control and Freedom:

User control and freedom are essential for taxpayers, allowing them to become active immediately upon creation, rather than waiting 24 hours. Delays can occur when creating files, and it's important that changes made to the main system do not disrupt user access. Additionally, the system currently allows data entry up to line 40 regarding TIN number withholding on payments, but errors have arisen that cannot be resolved. This principle highlights the importance of enabling users to easily undo and redo actions, as mistakes are common and users need straightforward recovery options. An expert reviewer, who is also a researcher, evaluated the e-tax portal's ability to help users reverse accidental actions, particularly during tasks like logging in and processing e-tax filings.

During the login assessment, the reviewer encountered a common issue, forgetting the username, password, and the answer to the security question. Upon entering invalid credentials, a notification appeared. Although the portal offers a "forgot password" option, it does not function properly. Users must visit the tax center to recover their credentials, and if a password is not used within 30 days, it must be reset in person. The e-tax portal does not include an exit button. Overall, users should be able to undo and redo actions and understand their options within the system. Changes should be immediately reflected, and users should know why certain information is requested and how it will be used. Currently, the portal does not meet these conditions effectively.

Heuristic 4- Consistency and standards:

The e-tax service suffers from significant inconsistencies and a lack of organization. The website fails to provide up-to-date and satisfactory information to help users resolve errors, and its layout does not resemble that of other similar systems, leading to a disjointed experience. Currently, the 11th edition of the system is in use, even though the 12th edition is available, which contributes to confusion. Users frequently encounter interruptions and downtime due to data issues and the system does not effectively support future transactions, requiring regular updates. Ambiguities during the confirmation process further complicate the experience, and the service often falls short in delivering comprehensive online support. Additionally, users struggle to obtain clear information regarding payment adjustments, and past experiences with other systems do not seem to aid in navigating this one. Overall, the various components of the e-tax service do not function cohesively, detracting from its usability.

The researcher evaluated the e-tax portal's alignment with Nielsen's web conventions, noting several shortcomings. While it featured a six-item navigation menu, the inclusion of over eight sub-navigation options could overwhelm users. The portal also lacked standard icons for common functions and did not place key elements at the top, as Nielsen recommends. Additionally, some navigation terms were unclear, and specialized content was hidden in dropdowns, indicating areas for improvement to enhance user experience and streamline navigation.

Heuristic- 5 Error prevention:

The e-tax system exhibits numerous issues related to error prevention. It allows the creation of duplicate document numbers and fails to effectively support new taxpayers. Users often encounter error-prone information despite entering accurate data, and there are instances where transaction statuses inexplicably shift from "paid" to "unpaid." Additionally, the system tends to lose data at the end of the month and does not permit null values in fields such as invoice numbers in the excise annex. When taxpayers with TIN numbers attempt to e-file, they may receive a "null" message instead of a document number, indicating a failure in the process. The system does not automatically save users' work, leading to lost input, and it restricts data entry formats for fields like dates, phone numbers, and weights. Instructions are often unclear, difficult to read, or overly lengthy, making them challenging to follow. Furthermore, users are not notified about pending deadlines, and the system fails to deduct payments accurately, leading to additional confusion and frustration.

The research emphasized the importance of error prevention strategies, including clear communication, action confirmation, and real-time warnings, as outlined by Laubheimer. However, it found gaps in testing recommendations for confirming destructive actions and offering undo options. A key issue was the inability to correct errors after taxpayers report them to authorities, suggesting systemic limitations. The analysis also revealed that while some fields had contextual error warnings, others, such as username and request description, lacked them, highlighting areas for improvement to reduce user errors and enhance the system's responsiveness. Additionally, discrepancies in excise amounts across summary and detail pages were noted, signaling the need for further attention.

Heuristic- 6 Recognition rather than recall

The e-tax system falls short in facilitating recognition over recall, making it difficult for users to find error-free information. When browsing, the system fails to offer suggestions similar to other search targets, and if users cannot remember specific details, the system does not display relevant entries in the search results. Additionally, in empty states, there are no prompts on how to proceed; which adds to user frustration. The system also struggles with basic login functionalities, as it does not accept all usernames and passwords, limiting access primarily to corporate users rather than individuals. Overall, the lack of helpful suggestions and guidance hinders effective navigation and use of the e-tax services.

According to Nielsen, users should not need to recall information from one part of the interface to another; instead, instructions for using the system should always be visible or easily retrievable when needed. This principle was assessed based on Nielsen's recommendations, which advocate for making content and interface functions visible and accessible, including providing access to recently visited pages and previous searches, as well as ensuring that interface elements such as buttons and menus are both visible and intuitive. The system should provide users with suggestions to make the process of remembering their needs easier i.e the system don’t exactly recall but provide with suggestions.

Heuristic- 7 Flexibility and efficiency of use:

The e-tax service suffers from organizational issues and a lack of clarity, causing confusion for both taxpayers and officers. Errors often go unresolved, and the system provides unclear or null information, leading to transparency issues. Frequent interruptions, especially during deadlines, can result in system outages and undelivered invoices, while network connectivity problems further disrupt e-filing and e-payment processes. Navigation is challenging due to poorly labeled menu pages, and transactions may be rejected by the National Bank of Ethiopia, leading to automatic reversals by the Commercial Bank of Ethiopia. The system lacks flexibility, offering only one pathway to complete tasks, which is difficult for users with varying skill levels. Additionally, it primarily serves corporate users, lacks bank authorization for some actions, and requires a high level of technical expertise. Users also face issues such as unrecorded deductions and disorganized data on VAT pages, further complicating the user experience.

The principle suggests that interface designers should create systems that accommodate both expert and novice users, offering multiple ways to achieve the same goal. However, the study found that the e-tax portal lacks accelerators, such as shortcuts or a favorites folder for saving frequently visited pages. This limits efficiency, particularly for experienced users. Additionally, issues like missing or incorrectly entered data, along with potential technical glitches, were noted as obstacles to smooth user experience. The phrase "Not seeing what we announced 2 years ago" reflects user frustration over unmet promises, suggesting a gap between expectations and actual outcomes. To enhance usability, the Ethiopian e-tax portal should consider adding features that cater to both novice and expert users, improving functionality and system reliability.

Heuristic – 8 Aesthetic and minimalist design:

The e-tax system's design lacks aesthetic appeal and minimalism, contributing to user confusion and frustration. Error messages are often unclear and hinder rather than assist users, making it difficult to address issues effectively. Additionally, the templates do not include any tutorials for navigating the system, leaving users without guidance. The interface elements lack harmony, and the organization of related elements fails to illustrate their relationships clearly. Extraneous content, such as unnecessary features, icons, and text, clutters the interface, creating distractions that impede task performance. Furthermore, the system struggles with processing returns and clearance requests, and transactions can be rejected by the National Bank of Ethiopia (NBE) for various reasons, only to be automatically reversed by T24 (a core banking system (CBE)) and credited back to the respective bank accounts. Overall, these design flaws significantly detract from the user experience.

Heuristic – 9 Help users recognize, diagnose, and recover from errors:

This principle advocates for error messages to be presented in plain language, clearly identifying the issue and offering constructive solutions. Duggirala underscores the necessity of explaining errors to users in a way that is easy to understand. Most systems do not provide error-free information, leading to confusion for both taxpayers and officers. For instance issue one the system files information only after 24 hours without an error message, additionally, issue two when the bank does not utilize the document number, Issue three issuing with depositing funds into the wrong account, and issue four mistakenly deducted taxes from customers' accounts multiple times the error message did not tell whether the problem happed or not.

The e-tax service faces significant issues that hinder users' ability to recognize, diagnose, and recover from errors. Error messages are often ambiguous, leaving even expert users unsure about the cause of issues. Some errors are difficult to detect or read, and users are unable to make necessary corrections. The system fails to promptly identify or notify users of errors, leading to delays and confusion, such as incorrect transactions or misapplied tax deductions. Specific problems include incorrect VAT registration messages, unexpected errors related to tax documents, and issues with withholding payments that cannot be resolved. These recurring issues need to be addressed to improve error handling and ensure a smoother user experience.

Heuristic - 10 Help and documentation:

This principle advises that if help and documentation is provided in a Website, it should be easy to search, focused on the user's task, list concrete steps to be carried out, and not too large. Therefore, the test was focused on establishing availability of help and documentation, ease of search, extent of focus on the user’s task, list of concrete steps to be carried out and size. Issue one Evaluator three observed that "the system is complex as a help tool" and recommended that it should provide users with a clear navigation structure on a single page. Additionally, while the search results are organized by relevance, the filtering options do not deliver the expected results, making it difficult for users to find the companies' TIN in the e-tax user list."

The e-tax system needs to improve user access to help and support resources. While it offers a YouTube service desk for submitting requests and checking statuses, these resources are scattered across different platforms. A consolidated help center, linking all forms of support and documentation, would provide a more streamlined experience. Additionally, there is a lack of adequate learning materials to assist users in navigating the system, and resources are not prioritized based on frequency of use. Evaluators noted that the system should provide easier access to relevant resources, such as short video or audio tutorials, and contextual documentation alongside major tasks. Overall, the system should improve its learning resources, streamline task sequences, and ensure users can quickly find relevant support to tackle challenges. should be clearly displayed, eliminating the need for them to rely on memory.

4.6.2. Usability Testing Results

Users found the e-tax system easy to learn, which positively impacted their performance, aligning with studies by A'bas et al. (2021) and others that highlight its user-friendly design. The system enabled users to complete tasks accurately, reinforcing its effectiveness, and allowed them to work efficiently, with quick task completion, as noted by A'bas et al. (2021) and similar research. Participants also felt confident in remembering how to navigate the portal in future sessions, indicating strong usability and ease of navigation, echoing findings from Alturki et al. (2020). Additionally, users reported fewer errors, suggesting the system minimizes mistakes effectively, and expressed overall satisfaction with its features, functionality, design, and display quality, which is consistent with the observations of A'bas et al. (2021), indicating that the system is generally well-received.

4.7. Chapter Summary

The evaluation of the Ethiopian e-tax system, conducted through heuristic evaluation and usability testing, highlights a combination of usability challenges and strengths. From a heuristic usability evaluation of the Ethiopian e-tax system, applying Nielsen's ten usability heuristics to assess the system's effectiveness, efficiency, and user experience. The evaluation revealed several usability issues, primarily related to clarity, navigation, and feedback mechanisms. One of the key issues identified was the system's lack of timely and constructive feedback, particularly during critical user interactions like form submissions and payment processing. Users often experienced uncertainty about whether their actions were being processed, leading to frustration and a diminished sense of trust in the system. The evaluation also found that some of the system's terminology and iconography were confusing for users, with technical terms such as “Taxable Income” and “Tax Filing Status” not adequately explained, leaving many users struggling to understand these concepts in the context of their real-world tax experiences.

Another significant finding was the lack of flexibility in the system. For example, there were limited options for undoing or revising actions once a form had been submitted, especially during the payment process, which caused difficulties for users attempting to correct mistakes. The system's inconsistent button labels and action flow across different pages contributed to user confusion. The evaluation also highlighted the lack of error prevention mechanisms and effective error messages. Users frequently encountered errors that were not clearly communicated until after submission, such as forms with missing or incorrect information, and had difficulty navigating back to correct those mistakes. Furthermore, the system failed to provide clear instructions or contextual help during critical tasks, leading to confusion about how to proceed when errors occurred.

Overall, the evaluation emphasized the need for significant improvements in the Ethiopian e-tax system, particularly in terms of simplifying navigation, improving feedback, reducing cognitive load, and providing clearer error messages. The results suggest that a user-centered redesign, with a focus on usability and accessibility, is essential to enhance the system’s overall effectiveness and ensure a smoother experience for both novice and experienced users. Lack of Help and Documentation: The absence of help and documentation resources poses challenges for novice users, a common concern highlighted in usability evaluations.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

This section presents an analysis of data collected from research experts, participants and secondary documents, utilizing Nielsen's heuristic usability evaluation and usability testing methods. The usability evaluation was enriched by a detailed inspection of the e-tax system, identifying key contextual factors and user challenges. Expert input from four usability specialists and ten participants from ministry of revenue were synthesized to pinpoint the system's shortcomings, with recommendations for improvement. The findings underscore that experts with both domain knowledge and human-computer interaction (HCI) expertise are more effective at identifying usability issues, confirming previous research by Nielsen and Phillips. The evaluation, which combined expert reviews, usability testing, and other research methods like surveys and interviews, revealed several areas for enhancement in Ethiopia's e-tax system. While the system follows some fundamental usability principles, significant issues were identified.

Given Ethiopia's unique technological landscape and the varying digital literacy levels of its users, the system must be improved to enhance its efficiency and user-friendliness. Real-time feedback mechanisms, such as progress indicators and confirmation messages, would alleviate user anxiety and improve confidence in the system, especially for those unfamiliar with online tax processes or experiencing slow internet connections. By addressing these issues and aligning the system more closely with user needs, the e-tax platform could become more accessible and promote higher adoption rates, leading to better tax compliance in Ethiopia. Simplifying the system's design, improving clarity, and providing more intuitive guidance would be crucial in ensuring that all users, regardless of their technical proficiency, can navigate the platform with ease. In Ethiopia, many users face challenges in navigating the e-tax system due to limited understanding of taxation terminology, especially if they are new to digital systems or have limited formal education. To enhance usability, the system should use simpler language and replace technical terms with more accessible alternatives.

Adding tooltips, explanations, and real-world examples could make the system more intuitive and accessible to a broader range of users. Future iterations should prioritize reducing cognitive load, improving error prevention, and making the system easier to navigate for users with varying levels of digital literacy. Allowing users to correct mistakes easily or reverse actions is essential for boosting user confidence, particularly for infrequent users or first-time filers. Without the option to undo or revise actions, users may become frustrated and abandon the process. The system should offer clear, accessible options for users to make changes without penalties. Additionally, inconsistent terminology and user interface (UI) elements can cause confusion and mistakes. Standardizing labels, buttons, and navigation flows is crucial to ensuring users understand how to move through the system with ease. To further improve usability, the system should reduce the need for users to remember information across multiple pages by incorporating features like auto-fill, session-saving, and contextual help. Displaying previously entered information or providing a summary of tax categories before submission could simplify the process, especially for users in developing countries with limited experience in digital systems. Simplifying these elements will make the system more user-friendly and promote wider adoption, ultimately supporting Ethiopia's goal of digital transformation.

The Nielsen’s heuristic usability evaluation of the Ethiopian e-tax system revealed several critical usability issues that hinder the system's overall effectiveness and user satisfaction. Key problems identified include a lack of timely and clear feedback, confusing terminology, inconsistent navigation, and an overwhelming user interface, all of which contribute to user frustration and confusion. The system's failure to provide adequate error prevention mechanisms, clear error messages, and easy-to-use recovery options further exacerbates these issues. Despite these challenges, the evaluation also highlighted areas where the system performs well, such as basic task completion and efficiency for users with technical expertise. However, for the system to be truly effective and user-friendly, it needs to be redesigned with a stronger focus on meeting the needs of both novice and experienced users. This includes simplifying navigation, clarifying terminology, providing better feedback, and ensuring that users can easily recover from errors without confusion.

To improve the system's overall usability, it is essential to address these issues through a user-centered approach, considering the diverse skills and experiences of its users. By implementing the insights gained from this evaluation, the Ethiopian e-tax system can be transformed into a more intuitive, efficient, and accessible platform, ultimately fostering greater trust and satisfaction among its users.

5.2 Study Limitations

This research contributes to the existing body of knowledge on the usability evaluation of the Ethiopian e-tax system and aims to enhance the usability of e-government services. However, this study has several limitations. Firstly, the knowledge gap among respondents may have influenced the assessment of the e-tax system's usability. Additionally, the study focused solely on e-services within the Ethiopian e-government portal. Due to time constraints, the number of participants was limited, and citizens were not included in the study, which may restrict the comprehensiveness of the findings.

5.3. Recommendations

General Recommendations:

Based on the evaluation results of the e-tax portal, the researcher presented the following lessons that, if implemented, and could enhance the usability of e-tax systems. Web designers should adhere to common web conventions wherever applicable. In cases where standard conventions do not apply especially for content specific to a particular domain they should utilize appropriate interaction styles to structure and present the content effectively. This approach would help ensure that menus and submenus are easily accessible and that the language, phrases, and concepts are easily understandable to users.

Furthermore, web designers should conduct thorough testing of all pages and related processes on their websites, particularly with actual users. This testing is crucial to ensure that the site provides adequate support for users who may accidentally take actions or forget personal details issues that commonly arise with infrequently used websites. It is also essential to verify that all elements and features function as intended. Failing to do so could render parts of the website unusable for some users, potentially leading them to abandon the site. In addition to the typical content areas known to require contextual error warnings such as email and telephone field’s web designers, in collaboration with their clients, should identify other unconventional content types that may benefit from similar constraints. They should incorporate these contextual warnings accordingly and ensure that each constraint comes with appropriate feedback to informed users about what is happening and guide them on the next steps.

To improve the Ethiopian e-tax system, it is essential to provide real-time feedback to users about the system's status, such as confirmation messages, and loading indicators. These features will help users understand the progress of their actions, reduce uncertainty, and improve the user experience, especially during tasks like file uploads and form submissions. Additionally, simplifying the language used throughout the system is crucial for aligning the interface with users' mental models. Replacing technical tax terminology with user-friendly language, along with adding tooltips or explanations for more complex terms, would make the system more intuitive. Including real-world examples or scenarios can further aid users in understanding the processes. Offering users the option to undo or correct mistakes easily is also vital. Features like an "undo" button or the ability to return to a previous page without losing entered data, especially during critical actions like tax form submission, would reduce user anxiety and help first-time filers navigate the system with confidence. Consistency in the design and functionality of the system is another key improvement. Standardizing labels, buttons, icons, and navigation elements would make it easier for users to intuitively understood how to use the system without second-guessing. Implementing real-time validation to prevent common errors, such as checking for missed fields or incorrect data formats, was also necessary. Clear, actionable error messages, such as “Please enter a valid id number” or “This field cannot be empty,” will guide users in correcting mistakes before they submit their forms.

Minimizing cognitive load is another important consideration. Features like auto-fill for commonly used fields, session-saving, and the ability to view a summary of tax entries before submission would reduce the amount of information users need to remember across multiple pages. These changes would improve usability and minimize the likelihood of errors. For experienced users, providing advanced features such as the ability to save progress, auto-fill recurring data, and navigate frequently used sections will enhance efficiency and accommodate both novice and seasoned taxpayers. A clutter-free design will further improve usability by allowing users to focus on essential tasks and reducing visual distractions. Important information and actions should be easy to locate, with clear distinctions between essential and non-essential elements. Error messages should also be improved to be more clear, concise, and actionable. For instance, if a user enters an incorrect tax amount, the message could read, “The amount entered exceeds the allowed range for this category. Please review your entry and try again.” Including links to FAQs or support resources would help guide users in resolving common issues.

Finally, providing easily accessible help and documentation, such as user guides, video tutorials, and FAQs, within the system is crucial. Contextual help in the form of tooltips or pop-up explanations on complex sections will assist both new and returning users in completing their tasks with confidence and efficiency. Implementing these recommendations, grounded in Nielsen’s 10 Usability Heuristics, will significantly enhance the usability of the Ethiopian e-tax system. By improving system feedback, simplifying the interface, reducing errors, and offering better support for users at all levels, the e-tax portal can become more user-friendly, efficient, and inclusive. These changes would not only increase user satisfaction but also encourage higher adoption rates, helping to achieve Ethiopia’s digital tax transformation goals.

5.4. Future Works

The purpose of this study was to identify issues with the Ethiopian e-tax portal using Nielsen’s 10 heuristic usability evaluation and usability testing methods. The following suggestions outline potential directions for future research to build upon this study. The researcher recommends that future usability studies incorporate several essential qualitative research techniques into heuristic evaluations. Specifically, it is advisable to develop a coding manual, calculate inter-rater reliability and inter-rater agreement among evaluators, and provide detailed information about the evaluators and the settings in which evaluations are conducted. Implementing these modifications will enhance consistency among evaluators, ensure that results are reproducible, and contribute to a more cohesive body of knowledge in the field of usability evaluations.

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APPENDICES

Appendix A: Questionnaire Survey

Questionnaire Survey: E-tax Heuristic usability evaluation measurement tool validation to be filled by experts.

Section I - Participants' / Demographic Information

1. Have you ever used Ethiopian online tax web site for filing your e-tax? If no then please do not proceed with the survey 1. Yes 2. No
2. What is your gender: 1. Male 2. Female
3. What is your age 1. 18 -30 2. 30-40 3. 40-50 4. 50-60 5. Above 60
4. What is your education? 1. Secondary School 2. Graduation 3. Post-graduation and above
5. What is your occupation?
6. How many years have you been using e-tax services of Ethiopia (work experience)?

Section II – Human computer interaction background

1. How many years of professional or research experience do you have in the area of Human Computer Interaction (HCI)?
2. Do you have formal training in human computer interaction (university courses, tutorials, workshops)? Please answer with "Yes" or "No". If your answer is "Yes" please specify the list of courses
3. Do you have professional experience in the area of human computer interaction? Please answer with "Yes" or "No". If your answer is "Yes", provide a summary of your experience in this field
4. Do you have research experience in the area of human computer interaction? Please answer with "Yes" or "No". If your answer is "Yes", provide a summary of your experience in this field
5. Have you specifically been trained to perform a heuristic evaluation? ☐Yes ☐No
6. Have you performed heuristic evaluation before? Please answer with "Yes" or "No". If your answer is "Yes", provide a summary of your previous experience in performing heuristic evaluation including number and type of systems you have evaluated

Section III. A comprehensive set of heuristics/criteria for evaluation of e-tax environment. General interface usability criteria (based on Nielsen's heuristics, modified context).

1. Visibility of system status: The website keeps the user informed through constructive, appropriate and timely feedback. The system responds to user-initiated actions. There are no surprise actions by the site or tedious data entry sequences.
2. Match between the system and the real world i.e. match between designer model and user model Language usage in terms of phrases, symbols, and concepts is similar to that of users in their day-to-day environment. Metaphor usage corresponds to real-world objects/concepts, e.g. understandable and meaningful symbolic Research Article SACJ, No. 4., July 2010 representations are used to ensure that the symbols, icons and names are intuitive within the context of the task performed Information is arranged in a natural and logical order.
3. Learner control and freedom Users control the system. Users can exit the system at any time, even when they have made mistakes. There are facilities for Undo and Redo.
4. Consistency and adherence to standards The same concepts, words, symbols, situations, or actions refer to the same thing. Common platform standards are followed.
5. Error prevention, in particular, prevention of peripheral usability-related errors.The system is designed in such a way that the users cannot easily make serious errors. When a user makes an error, the application gives an appropriate error message.
6. Recognition rather than recall: Objects to be manipulated, options for selection, and actions to be taken are visible. The user does not need to recall information from one part of a dialogue to another. Instructions on how to use the system are visible or easily retrievable whenever appropriate. Displays are simple and multiple page displays are minimised.
7. Flexibility and efficiency of use: The site caters for different levels of users, from novice to expert. Shortcuts or accelerators, unseen by novice users, are provided to speed up interaction and task completion by frequent users. The system is flexible to enable users to adjust settings to suit themselves, i.e. to customise the system.
8. Aesthetics and minimalism design: Site dialogues do not contain irrelevant or rarely needed information, which could distract users.
9. Recognition, diagnosis, and recovery from errors: Error messages are expressed in plain language. Error messages define problems precisely and give quick, simple, constructive,

specific instructions for recovery. If a typed command results in an error, users need not retype the entire command, but only the faulty part.

10. Help and documentation: The site has a help facility and other documentation to support users' needs. Information in these facilities is easy to search, task-focused, and lists concrete steps to accomplish a task

Section IV: Evaluation Guide

Evaluation Steps:

Go through the list of heuristics to have a sense of each.

Read the description of the scenario and understand the business logic.

Perform each task as described on the e-tax system.

1. Identify usability problems while doing each task or after finishing the task. For each problem, please record the task in which you found the problem, and the heuristic with which you identified the problem. Use the scenario description and heuristics to check if the system supports the activity described in the scenario.
2. Please record the problems in Here.
3. If you want to edit any of the identified problems which you already entered in the form, you can do it from Here.

Section V. Operational usability heuristics

1. Based on a comprehensive set of heuristics/criteria for evaluation of e-tax environment of interface usability (on Nielsen's heuristics, modified for e-tax context) please tick one of the following given alternatives 0 = I do not agree that this is usability problem, 1 = cosmetic problem at all, 2 = minor usability problem, 3 =major usability problem, 4 = usability catastrophe.

H1● Visibility of system status a. State: Users should know what they are capable of doing in the system at any given moment.	0	1	2	3	4
i. When looking at the different elements on the system (links, buttons, etc.), do you know what you can do with them?					

ii. When any changes happen in the system, are they immediately reflected in the system?					
iii. Do changes happen immediately, or do they take time? Previous (Back), next (Forward) and Home.					
b. Location: Users should know what system they are in and where they are located within the system.					
i. Do you know in which system you are located, and can you determine this easily?					
ii. Do you know the page you are on? Can you find out easily?					
iii. Do you know where you are in relation to other parts of the system? Can you determine this easily?					
c. Progress: The user should know how far they are from accomplishing their goal					
i. When you work on an action, does the system tell you how long it will take for completion?					
ii. When you complete a multi-page task, does the system tell you how many steps are left?					
iii. When there is limited capacity in the system (storage, memory, etc.) does the system tell you how much is left?					
iv. Are progress measures accurate? If it says it takes one minute, does it really take one minute?					
v. Are both active and passive progress measures provided?					
d. Closure: Users should explicitly know that their goal was accomplished regardless of the outcome.					
i. When you finish a task, does the system provide you with feedback?					
ii. Does the system give you feedback if you got either a right or a wrong result?					
iii. Does feedback appear immediately, or does it take a long time?					
iv. Can you easily interpret the feedback?					

v. If what you did was wrong, does the system offer an explanation?					
H2● Match between system and the real world: a. Understand ability: The content of the system should be understandable by the users of the system.					
i. Is every piece of system content (text, icons, images, etc.) understandable, specifically, by the target audience?					
b. Natural and logical order: The connection and the tasks in the system should follow a natural and logical order.					
i. Do the steps required to complete a task follow a natural order, i.e., do they follow the order of how the task would be done in the real world? Predict what the next step should be?					
ii. If not, are the steps required to complete the task logical, i.e., can you predict what the next step should be?					
c. Appropriateness: The content of the system should be appropriate to the users of the system,					
i. Is every content element in the system (text, icons, images, etc.) appropriate? Do they match the identity of the system?					
ii. Is there an aspect of the system that might be offensive to the target audience?					
H3● User control and freedom: a. Reversibility: Users should be able to undo and redo any action they take on the system.					
i. When looking at the different elements on the system (links, buttons, etc.), do you know what you can do with them?					
ii. When any changes happen in the system, are they immediately reflected in the system?					
iii. Do changes happen immediately, or do they take time? Previous (Back), next (Forward) and Home.					
b. Emergency exit: The user should be able to quit any undesirable situation on the system.					
i. Can you escape from any situation in the system?					
ii. Is it easy to do?					

c. Informing users: Users should know why the system is asking them to enter certain information, and they should know how the information will be handled.					
i. When the system asks you for personal/sensitive information, does it tell you why it is wanted?					
ii. Does the system tell you how this information is going to be stored and handled?					
H4● Consistency and standards: a. Consistency: Elements of meaning, function, organization, effort, and feeling should be consistent throughout the whole system.					
i. Does the system always refer to the same element by the same name across the system?					
ii. Do elements that appear identical across the system always do the same thing?					
iii. Do the interface layout and organization have a similar appearance across the system?					
iv. When you work on a multi- page task, is the same effort needed for each page, i.e., is there consistency in the effort needed for each page?					
v. Do the multiple parts of the system have the same feel, i.e., do you perceive the different parts of the system as belonging to one unit?					
b. Standards: The system should take advantage of common practices in similar systems and follow them.					
i. Do you feel that your past experiences with similar systems helped you in using this system?					
ii. Does this help you in understanding content meaning?					
iii. Does it help in performing actions on the system?					
iv. Does the system organization look similar to that of other similar systems?					
H5● Error prevention: a. Instructions: Sufficient instructions should be provided to the user before any given task.					
i. Does the system provide you with instructions on how to					

complete a certain task that requires a specific thing to be done?					
ii. Are instructions clear and easy to understand?					
iii. Are instructions clearly visible?					
iv. Are instructions too long?					
b. Constraints: The system should not allow the user to take action that will lead to obvious errors.					
i. In situations where the action/input is clearly wrong or will lead to erroneous outcome, does the system prohibit that action/input from taking place?					
ii. When you are prohibited from performing a certain action/input, do you have an idea why this has happened?					
c. Confirmation: The system should ask users to confirm their actions to make sure that the action is intended.					
i. When committing to a major action that has a long- lasting impact, does the system ask you to confirm the action?					
d. Notification: The system should notify users when changes on the system are happening.					
i. When an important/serious event occurs, does the system notify you?					
ii. Does the system tell you what is going to happen if you do not take a recommended action?					
e. Auto saving: The system should auto-save users' input to make sure their effort will not be lost if something goes wrong.					
i. When you are entering/writing input that takes considerable time/effort, does the system automatically save your work?					
ii. Do you know when your input is being auto-saved?					
iii. Is input retrieval easy or automatic?					
f. Flexible inputs: The system should give users a choice to enter the inputs in a form with which they feel comfortable.					
i. When the system asks you to enter an input that comes in different forms (date, phone number, weight, etc.), does it					

allow you to enter it in the form you want?					
ii. When it takes a form you like and converts it, can you see the conversion?					
g. Defaults: The system should use the most expected defaults.					
i. When you are in an empty state, are the system defaults the expected ones?					
ii. Is there any indication of exactly what the defaults are?					
H6● Recognition rather than recall: a. Availability: The content that users need to accomplish certain goals should be clearly presented to them, and they should not need to rely on their memory to remember them.					
i. Is everything you would need to accomplish your goal clearly presented to you?					
ii. When completing a multi- step task, is the information presented in one step also needed in other steps presented to you?					
b. Suggestions: The system should provide users with suggestions to make the process of remembering their needs easier.					
i. When you are in the empty state, does the system provide you with suggestions on how to proceed?					
ii. When you search for something within the system and don’t exactly recall it, does the system provide you with suggestions?					
iii. When you browse the system, does it provide you with suggestions of things similar to your browsing targets?					
iv. Are these suggestions accurate?					
H7● Flexibility and efficiency of use: a. Flexibility: The system should provide users with different ways to accomplish the same goal to accommodate different users and different situations.					
i. Does the system provide you with different paths toward accomplishing the same goal?					
ii. Will users with a variety of abilities and skills be able to use the system?					

b. Efficiency: The tasks sequence of the system should be in its simplest form.					
i. Could the amount of steps/time/effort required to accomplish a goal be reduced?					
H8● Aesthetic and minimalist design: a. Aesthetic: The system should be aesthetically pleasing to users.					
i. Is the system aesthetically pleasing to you?					
ii. Do the interface elements appear to be in harmony?					
iii. Are audio/video well- presented in the system?					
b. Organization: The content of the system should be organized in a way that allows the user to distinguish each element.					
i. When looking at the interface, are related elements organized in a way that shows their relationships?					
ii. When looking at the interface, could you easily distinguish among the different elements (menus, paragraphs, etc.)?					
c. Simplicity: The system should not contain any unnecessary content that would distract the user					
i. Is there any extraneous content on the system (features, icons, texts, etc.) that could be omitted?					
ii. Is there anything in the interface that distracts you from properly focusing?					
H9● Help users recognize, diagnose, and recover from errors: a. Recognizing errors: The user should easily recognize that an error happened.					
i. When an error occurs, do you notice it?					
ii. Is the error indication the expected one, or did it take some time to notice it?					
b. Understanding errors: The user should easily understand what error occurred.					
i. When you notice an error, do you know exactly what it is?					
ii. Can you read it easily?					
iii. Is error information written in an appropriate way?					
iv. Is it written in a way that might intimidate or try to blame you?					
c. Recovering from errors: The system should provide the user with a recommendation on how to					

resolve the error.					
i. When you know of an error, do you know how to resolve it?					
ii. Is the solution presented to you in an appropriately actionable manner?					
H10● Help and documentation: a. Help: The system should provide the user with means to contact the help team.					
i. Does the system provide you with the capability to contact the support team?					
ii. Are there multiple ways to contact the support team or only one?					
iii. Do you receive an explanation of how long it will take to receive a support team response?					
b. Documentation: The system should provide the user with sufficient material to learn the system and to know how to overcome any potential obstacles.					
i. Is there documentation from which you can find solutions or learn more about the system?					
ii. Can you find all possible solutions?					
iii. Is the material easy to understand?					
iv. Can you easily find the material?					
v. Can you easily search within the material?					
vi. Does the material prioritize the action frequency?					
vii. Is the material categorized?					
viii. If there are video/audio tutorials, are they too long?					
ix. Is contextual documentation displayed next to the major tasks?					

Appendix B: System Usability Scale checklist

System Usability Scale © Digital Equipment Corporation, 1986.

Strongly disagree ………………………………………..Strongly agree.

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

Appendix c: Respondents issues

H1. Visibility of system status

1. I can't find out the page where it is and easily understand it.
2. The progress measures are not accurate, If it says it takes one minute, it doesn't really take one minute The feedback doesn't appear immediately, it take a long time .
3. The system can't easily interpret the feedback.
4. Not holding more than 24 tax periods.
5. Do not load a large number of files.
6. Both active and passive progress measures are not provided.
7. The e-tax system doesn't provide error free information due to customer and also doesn't input exact information;
8. When you uploaded an excel file called e-Payment not Enabled;

H2. Match between system and the real world:

9. Elements of meaning, function, organization, effort, and feeling aren't consistent throughout the whole system.
10. email icon doesn't link to the email address;
11. The e-tax system will file information after 5 hours.
12. the steps required to complete a task don't follow order, what the next step should be.
13. Still the system does not recognise unit measure code 9 and 10.

H3● User control and freedom:

14. Use for taxpayers to become active as soon as it is created (waiting 24).
15. Delay when you make a file .
16. Not to be taken when changing from the main system.
17. Tin number withholding on payments allows entering the data up to line 40, but shows error and could not be fixed.

H4● Consistency and standards:

18. The e-tax service has lack of organization.
19. E-tax website doesn't provide latest and satisfactory information to clear the error
20. the system doesn't organization look similar to that of other similar systems.
21. I don't perceive the different parts of the system as belonging to one unit?
22. The e-tax service doesn't provide latest and satisfactory information for citizen due to the time now production 11th edition is deployed but 12th edition is available usable;
23. E-tax web service mostly interrupted and become down on due data,
24. I don't perceive the different parts of the system as belonging to one unit.
25. E-tax system do not continue for the future transaction and must be update;
26. E-tax system has an ambiguity during confirmation;
27. The e-tax system always does not provide full service to customers online.
28. The e-tax system can't give good information when tax payers pay their payment adjustment;
29. I don't perceive the different parts of the system as belonging to one unit I don't feel that my past experiences with similar systems helped me in using this system .
30. the system organization don't look similar to that of other similar systems .

H5● Error prevention:

31. Do not create document number number of times.
32. Not dealing with new taxpayers.
33. The e-tax system doesn't provide error free information due to customer and input exact information;
34. Derash update the transaction status from "paid" to "unpaid "status.
35. At the end of the month, the system loss the data.

36. We cannot insert null value for fields like Invoice number in excise annex;
37. After taxpayer with TIN number, declare during e-filing doesn't give document number rather it says Null;
38. In situations where the action/input is clearly wrong or not doesn’t provide erroneous outcome
39. the system doesn’t automatically save work
40. input isn’t being auto-saved
41. The system doesn’t allow to enter an input in different forms (date, phone number, weight, etc.),
42. Mostly instructions are not clear and easy to understand
43. Instructions aren’t clearly visible
44. When I convert a form as I like, the conversion cant seen
45. Some instructions are too long
46. We cannot insert null value for fields like Invoice number in excise tax;
47. A taxpayer with TIN number, tax type excise tax can’t declare by e-filing. It says “unexpected error..." and finally it doesn't give document number, rather it says Null;
48. We cannot insert null value for fields like Invoice number in excise annex;
49. Not deducting the money you paid
50. Reminder (not receiving a message saying that the remaining days are running out)

H6● Recognition rather than recall:

51. I can’t find error free information in the system
52. When I browse the system, it doesn’t provide me with suggestions of things similar to other browsing targets
53. When searching for something within the system and don’t exactly recall it, the system do not provide suggestions
54. Not seeing the information entered in the list
55. In the empty state, the system doesn’t provide you with suggestions on how to proceed
56. When searching for something within the system, and don’t exactly recall it, the system doesn’t provide suggestions
57. The system doesn’t accept User name and Password ;

58. The e-tax system doesn't offers all operational functional e-tax service, Example user name and password it uses only Plc not in individual

H7● Flexibility and efficiency of use:

59. The e-tax service has lack of organization.
60. E-tax service has an ambiguity; due to the error doesn't clear for tax payers even if for officers.
61. The e-tax service doesn't maintain transparency, that is because sometimes give the information null
62. There is an interruption of e-tax system at due date max be total down
63. Non-delivery of invoices to several taxpayers;
64. The e-tax system fail to perform due to network connection so we can't say always perform e-filing and e-payment
65. The pages that are classified under the menu (The name of the page tab are no user friendly or not simple)
66. E-tax web service mostly interrupted on due data, it becomes down
67. Transactions can be rejected by NBE for any reason
68. Transactions rejected by NBE, automatically reversed by T24 (CBE) & credited back to account holding branches.
69. the system not provide different paths toward accomplishing the same goal
70. The system doesn't provide users with different ways to accomplish different situations
71. Most the system is belongs to out off users abilities and skills be able to use it
72. The system not authorizing at the bank;
73. The e-tax system doesn't offers all operational functional e-tax service, Example user name and password it uses only for Plc. not for individual;
74. The system easy to use but needs lots of technical understanding;
75. The problem of being deducted from the customer's account at the bank, but not being credited to the office account;
76. The new data place on VAT purchase detail page comes randomly on top, bottom or on middle; it is misleading when the data entered is large;

H8● Aesthetic and minimalist design:

77. Error messages are not easy to understand, on the contrary they are confusing and hinder

rather than help.

78. The templates have no tutorial for system in general.
79. The interface elements don't appear to be in harmony
80. The related elements organization in an interface doesn't show relationship
81. Extraneous content on the system omitted (features, icons, texts, etc.)
82. There are some distracts in an interface that users perform tasks properly from
83. Error messages are not easy to understand; on the contrary they are confusing and hinder rather than help.
84. The templates have no tutorial for system in general.
85. Not processing our return, clearance request
86. Transactions can be rejected by NBE for any reason Transactions rejected by NBE, automatically reversed by T24 (CBE) & credited back to account holding branches

H9● Help users recognize, diagnose, and recover from errors:

87. E-tax service has an ambiguity; due to the error doesn't clear for tax payers even if for expert.
88. Some errors indication are not expected and it take some time to notice
89. Errors are not noticed , not exactly known
90. Sometimes errors can't read easil
91. Inability to make corrections when the taxpayer informs
92. When an error occurs, the system doesn't notice it
93. I shouldn't easily understand what error occurred.
94. The e-tax system will file information after 5 hours;
95. Due to the bank not using the document number, the problem of depositing with the wrong account number;
96. The bank deducts a tax from the customer's account more than once;
97. the customer's account more than once;
98. Still the system does not recognise unit measure code 9 and 10 ;
99. After registered for VAT with the main TIN, the message displayed as "not registered for VAT" on e-filing;
100. Pls solve the error of all Tax types supporting documents displayed r but the

system displayed "UNEXPECTED ERROR OCCURED"

101. Withholding on payments. First it it allows entering the data up to line 40 not more than it and shows error and could not be fixed. we tried by removing the entered detail one by one but this error could not be escaped.

102. To registered for VAT but the main TIN is not registered and rejected as "not registered for VAT" on e-filing;

103. On withholding on payments first it it allows to enter the data up to line 40 but it shows error and could not be fixed. we tried by removing the entered detail one by one but this error could not be escaped;

104. Tax types supporting documents displayed "unexpected error occurred" ;

H10● Help and documentation:

105. The site map is too complex as a help tool, provide users with a clear structure of the navigation on one page,

106. The system doesn’t provide you with the capability to contact the support team

107. There are no ways to contact the support team

108. Materials can’t find easily find

109. Materials can’t easily search

110. the material cant prioritize the action frequency

111. video/audio tutorials, are not linked to the system

112. H10 - The search results are sorted by relevance and the filter it doesn’t give expected response

113. Payment document number is not available

114. Not seeing what he announced 2 years ago?

115. Most of the the tax payers do not know how to use e-tax service and file e-tax due to lack of training.

116. Most of the time we can’t find the companies TIN in e-tax users list;

117. Tax payer with TIN 0040416458 example MERAHI INTERNATIONAL PRIVATE LIMITD COMPANY is MTO taxpayer but we can't find in e-tax users list.

118. The search results are sorted by relevance and the filter it doesn’t give expected response

Respondents Redundant Issues Taken One common from each Redundancy

1. H1 - Branches don’t re-do the transaction by stating effective date as the original date of tax payment;
2. H1 - The e-tax system doesn’t provide error free information due to customer and also doesn’t input exact information;
3. H1 - the pages that are classified under the menu (The name of the page tab) aren’t simple;
4. When there is limited capacity in the system (storage, memory, etc.) the system doesn’t tell how much is left;
5. H1 - The e-tax service doesn’t maintain transparency, that is because sometimes give the information null;
6. H1 - Plc with TIN number uploading 900 rows VAT purchase detail it stacked and no further action. even can't add the detail(stack problem,
7. VAT upload the system takes n-1 data from the CSV form and the sum is not working correctly. Try to upload theses data 1. This is blocking error;
8. H1 - Most of the the tax payers do not know how to use e-tax service and file e-tax due to lack of training;
9. H3 - There is no undo button and that the action is not possible using the Ctrl + Z;
10. H4 - The e-tax system at the end of the month is very busy and it becomes down and doesn’t work totally ;
11. H4 - Sometimes the system completely down,
12. Redundant problems Rejected
13. H1 - The e-tax system doesn’t provide error free information due to customer and also doesn’t input exact information;
14. H1 - the pages that are classified under the menu (The name of the page tab) aren’t simple);
15. When there is limited capacity in the system (storage, memory, etc.) the system doesn’t tell how much is left –H1;
16. H1 - The e-tax service doesn’t maintain transparency, that is because sometimes give the information null;
17. H1 - On VAT upload the system takes n-1 data from the CSV form and the sum is not working correctly;
18. H1 - Most of the the tax payers do not know how to use e-tax service and file e-tax due to

lack of training;

19. H1 - Plc with TIN number uploading 900 rows VAT purchase detail it stacked and no further action. even can't add the detail(stack problem;
20. H3 - There is no undo button and mentioned that the action is possible using the Ctrl + Z keys and UNDO;
21. H3 - Branches don’t re-do the transaction by stating effective date as the original date of tax payment;
22. H3 - Branches re-do the transaction by stating effective date as the original date of tax payment;
23. H3 - There is no undo button and that the action is not possible using the Ctrl + Z;
24. H3 - Branches re-do the transaction by stating effective date as the original date of tax payment;
25. H4 - The e-tax system at the end of the month is very busy and it becomes down and doesn’t work totally ;
26. H4 - Sometimes the system completely down;

Observation

27. H1 – there is no undo button and mentioned that the action is possible using the Ctrl + Z keys.- H1
28. H7- Regarding the Pdf generating (,generated pdf as an output, graphic, the preview of the text written in the generated pdf, not accept words excel and other format .
29. H8- error messages are intuitive or easy to understand, on the contrary are they confusing and hinder rather than help.
30. H1, H7, H8 - the pages that are classified under the menu (The name of the page tab are no user friendly or not simple)
31. H2 – Sometimes the email icon doesn’t link to the email address.
32. H10-The search results are sorted by relevance and the filter it doesn’t give expected response
33. H4 - The page, the title of the left-side navigation bar and the right navigation bar correctness (pages to provide a consistent set of navigational elements)
34. H6, H7- Is the interface is too complex, and the navigation path not provides the current location, or the whole path.

35. H10- The site map (the whole system), too complex as a help tool, provide users with a clear structure of the navigation on one page,
36. H1, H7, H8 - the pages that are classified under the menu (The name of the page tab) aren't based on the standards)
37. H2 - The search results aren't sorted by relevance and the result filter with expected response
38. H1 - There is no undo button and mentioned that the action is possible using the Ctrl + Z keys and UNDO.
39. H2 -Some keywords are difficult for users to adopt this language.
    a. H3 –errors are not shown in real time and others only after compilation.
40. H4 –there are synchronization problems,(the environment warns that changes are made in a certain period of time and that they may not have been saved).
41. H5- The environment does not have confirmation boxes or buttons for actions.
42. H7- Except Pdf regarding the upload and download process not applied other formats like excel, word etc. (generated pdf as an output, graphic, the preview of the text written in the generated pdf).
43. about colour change,
44. H8- Error messages are not intuitive or easy to understand, on the contrary they are confusing and hinder rather than help.
    a. H9 –The templates have no tutorial for system in general.