

Usability and Accessibility Analysis of Online Banking Systems in Sri Lanka

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Abstract—With the wide expansion of internet usage in Sri Lanka, e-banking is bucking the trend amongst the banking sectors and the customers. Since the online banking systems are the critical source of information for all kind of customers, accomplishing available e-services regardless of the time and location has become the aim of the banking sectors. Therefore, this study focuses on analyzing the usability and accessibility of online banking systems as they were identified as the crucial requirements for the successful adaptability. The analysis comprised of two approaches: experience directed and tool-based evaluation. For the experience-directed approach, eight significant criteria were identified to efficiently assess the usability and accessibility with the aid of a structured questionnaire, on the other hand, some benchmarked web analytical tools like PageSpeed desktop, Pingdom, Google mobile-friendly, PageSpeed mobile and SortSite were selected for tool-based evaluation. This study tends to find the combined outcomes of the usability and accessibility evaluation which is believed to be useful to encourage the customers who are using the online banking systems once in a blue moon. Further, considering the results gained from both approaches, obviously significant improvements have been made in the online banking systems comparing to state where it started but also the study proved that the online banking systems have a considerable amount of usability and accessibility issues to be taken care of to achieve the aim along with some suggestions too.

Keywords – e-banking; accessibility; usability; PageSpeed; SortSite; Pingdom; Google mobile-friendly; WCAG.

I. INTRODUCTION

Since the globe has already realized the significance of innovation, every entrepreneur and institution try to boost the market demand by introducing a new concept associated with the technology. e-banking or virtual banking or online banking or internet banking is one of the favorable innovation, the world soon grabbed owing to the significant convenience it presented to the banking industry. As stated by Telecommunication Regulatory Commission of Sri Lanka (TRCSL), the number of mobile broadband connections has increased in double each year since their introduction in 2009 [1]. Accompanied by this phenomenal growth of mobile broadband connections and fixed internet connections, online banking facility has become an accepted standard of financial transactions which is developed with the objective of upbringing the convenience of banking anywhere anytime.

The banking sector of Sri Lanka has a longstanding history which has been started several decades back and currently, there are nearly 25 licensed commercial, state banks and other licensed specialized banks. With the increased competition in the banking industry, banks are likely to introduce the online banking facility as a tool to attract and retain the internet-based customers who expect the services 24/7. The history of internet banking began in the United States and the banking sector of Sri Lanka quickly embraced the technology as this is the earliest and most substantial industry which used the Information Communication Technology to cater their core business functions.

Internet banking is the term that refers to a system which enables the web-based customers to access the banking services and relevant information through a personal computer or an internet enabled smart device without going to the bank in person. This method of banking offers plenty of benefits to customers who adopt internet banking over traditional visit such as convenience, better services, mobility, speed, reliability, etc. Even though it put forward world of comfort, it has its few own in-built drawbacks which need to be taken care of. As a result, some of the statistics on world context are given below [2],

- 50% of the customers registering for online banking are giving up before signing up the systems.
- 10% of the people who used online banking services gave up due to usability or security issues.
- Most of the difficulties in internet banking were encountered by the differently abled people and senior citizens.

In the Sri Lankan context, online banking operation is insignificant in comparison with the international scenario. Suraweera and other researchers found that in 2011, Sri Lanka's online banking system usage was less than 1% of the overall banking customers in general, which is a bad sign compared to the developed countries [3]. However, there is no reason to lose hope. By analyzing the annual reports of the Central Bank of Sri Lanka, we still can be happy with the progress made so far. Even though the banks and customers move towards virtual banking, there is a vast gap between the bank account holders and the online banking users. Therefore, there is a reliable necessity to analyze the usability and accessibility of online banking systems as they are the

essential factors having a direct impact on how people are using new technology. In addition, usability and accessibility are vital components to gain the customers' first and best impression, improve the customers' trust and improve the perception of customers about online banking systems which will elevate the tendency to take away the customers from traditional banking activities to the trend.

Evaluation of usability and accessibility of selected licensed banks of Sri Lanka has been done in two different ways – customer experience-directed analysis and tool-based analysis by considering various factors such as ease of use, performance and trust, system availability, customer support, transaction response, information quality and site aesthetics.

II. RELATED WORK

As technology in the financial sector is progressing, traditional banks let the customers explore the banking services online. Since the online banking systems are becoming common among the public, by considering the importance and the benefits of internet banking, the researchers from all over the world have started evaluating the accessibility and usability of online banking systems and other websites to draw some conclusions and suggestions that will be advantageous for both customers and organizations.

Yakup A. has carried out a study on accessibility, usability and security evaluation for banking websites in Turkey where the researcher has used a tool-based analysis suggested by W3C to analyze different banking websites and concluded that developers of online banking systems should consider the critical and crucial quality criteria while developing to provide better services [4]. AlAbdullah F. and others did an analytical study on internet banking systems found that the non-functional requirements are not addressed while developing the online banking websites where they have identified the crucial functional and non-functional requirements [5]. Moreover, Kariyawasam N.J. and Jayasiri N.K. developed a conceptual framework to assess the awareness and usage of online banking facilities in Sri Lanka. Further, the authors concluded that the usage of internet banking in Sri Lanka residues at a low level compared to the developed and developing countries and suggested the banks, regulatory bodies and policy makers to place great emphasis on improving customer's knowledge on e-banking [6].

Similarly, there are more researchers who have evaluated the government and most commonly used government websites of Sri Lanka to analyze the accessibility and usability by concerning the differently abled and the senior citizens. Gopinath S. and fellow researchers have used a tool-based analysis to examine the loading speed, mobile adaptability and accessibility standard of e-government websites where the study revealed that the design and development stages are not aligned with the usability and accessibility standards in most of the selected websites which may affect the sustainability of those online systems [7]. Similarly, another study carried out in Alabama on government websites by Youngblood N.E. and Mackiewicz revealed that there is a room for improving the usability of the systems via elevating the standards of site aesthetics, layouts and navigation [8]. A visitor-based

evaluation has been carried out by Rita O.R.J.I. on the analysis of usability and accessibility issues in the websites of financial sectors and also concluded that an effective maintenance strategy is available and sites seem to contain most of the relevant information a customer would require; however, there are several usability issues which should be addressed if the site is to achieve its goals [9]. Alexiei D. and Sarah C. have worked on an intelligent framework for website usability to present a tool which automates the process of website usability evaluation [10].

Based on the previous studies it is understood that even though the online systems became common and have the capability to make the life easier still there are usability and accessibility issues that need to be concerned while designing and developing the systems. Consequently, this study focuses on the evaluation of online banking systems in Sri Lanka that also aims to suggest the banking sectors on their systems' usability and accessibility properties.

III. METHODOLOGY

The crucial part of this study is to pinpoint the key concerns of online banking systems which could be able to relate with the customer usability and accessibility contentment. As a result, several factors were identified and assessed in two different approaches those are customer experience-directed approach and tool-based analysis.

A. Experience-Directed Approach

In order to analyze the usability and accessibility of online banking systems, it is vital to align the research with customer experiences. Therefore, by considering customer expectations the criteria are selected for evaluation that covers eight major measures such as ease of use, system availability, performance, safety and trust, transaction response, customer support, information quality and site aesthetics.

The study used a quantitative approach as the questionnaire is developed based on measurable criteria. Structured questionnaire is used as a tool for data collection since the sample population is high; moreover, it is also easy to distribute and analyze since it is prepared as a Google form and it was distributed among the employees in private and public sectors with different designations and undergraduates as well. A pre-coded questionnaire was prepared where the banking customers have to rate the criteria based on their experiences from various banks like Commercial Bank, Bank of Ceylon, Hatton National Bank, Sampath Bank and People's Bank.

Table 1 represents the summary of the pre-coded questionnaire including the factors that have great impact on usability and accessibility where the customers had to rate the criteria among strongly agree, agree, neutral, disagree and strongly disagree. In addition to these criteria the customers were also asked to provide some general information for analysis like gender, age group, the name of the bank and the number of transactions per month.

TABLE 1: Summary of Questionnaire

Criteria	Questions
1. Ease of Use	1.1 Easy to find what you need on the website
	1.2 Using Online Banking Systems (OBS) does not require a lot of effort
	1.3 The website structure and content is flexible to follow
	1.4 Convenient and easy to remember where to find what is needed in OBS
	1.5 Visibility of transaction progress
2. Performance	2.1 The service delivered through the bank's website is quick
	2.2 OBS delivered the services that are expected
3. System Availability	3.1 OBS is always available
	3.2 OBS services are accessible by differently abled customers
4. Transaction Response	4.1 OBS responds quickly to the requests
	4.2 Problems arise during online transactions are resolved quickly
	4.3 Error messages pop up during the online transactions are helpful
5. Customer Support	5.1 OBS is easily accessible via mobile phone
	5.2 OBS has an online customer representative for support
	5.3 OBS is well-suited to first-time visitors
6. Safety and Trust	6.1 I feel my transactions are safe with the bank
	6.2 I consider security as a threat to do online transactions
7. Information Quality	7.1 The right amount of information is displayed
	7.2 Information displayed is relevant and accurate
	7.3 Bank oriented jargon is explained
8. Site Aesthetics	8.1 OBS has a good balance of graphics versus text
	8.2 The website design is attractive
	8.3 Navigation and page layouts are clear and consistent

Through the experience-directed approach, the study analyzes the customer satisfaction in all the above-identified aspects.

B. Tool-Based Analysis

The second approach of usability and accessibility assessment is totally based on the tools to analyze the selected online banking system which is an objective approach of analysis. The selected online banking systems were analyzed based on three main criteria as follows [7],

- Loading speed of online banking systems
- Adaptability of online banking systems to mobile phones
- Adherence of online banking systems to Web Content Accessibility Guidelines (WCAG)

There is no general agreement on which tool is most suitable for an accessibility evaluation; therefore, various tools were selected to analyze the systems aligned with the three identified criteria. Loading speed plays an important role as it has a great impact on performance and productivity of both system and customers. Since nobody likes to suffer from a sluggish system, it is vital to analyze this factor. In order to

analyze the loading speed of systems, two different tools were used such as PageSpeed Insights which is used to score and analyze the loading speed of the system whereas Pingdom is used to analyze the loading time of the system. The second criteria is the adaptability of systems to mobile phones which is also a significant factor since then the introduction of smartphones to the world. As people started searching for handy solutions to make their lives easier, it is inevitable to assess whether online banking systems can be accessed in portable devices. Therefore, Google mobile-friendly test and Google PageSpeed Insights tools were selected. Analysis of adherence to WCAG has to be aligned with the priorities based on the accessibility of web content, for instance,

- able to use web documents
- remove major barriers in accessing web documents
- improve access to web documents

For analysis purposes, the SortSite tool is selected that can be used to test for usability, accessibility, broken links, compatibility, search engine optimization, privacy and web standards.

IV. RESULTS AND DISCUSSION

A. Customer Experience-Directed Analysis

The study aims to conclude the usability and accessibility of online banking systems by analyzing the results from two different approaches that cover customer experience and tool-based analysis. By way of the study has dealt with two

different approaches, it is an advantage that the result is comprised of the exploration of various concerns in online banking systems. Table 2 below discusses the score received for eight major criteria identified for the analysis based on customer experience. Even though some of the criteria satisfy the customer from various banks, still there are features to be critically taken care of.

TABLE 2: Summarized results for customer experience-directed approach

Criteria	Question	Percentage (%)				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	1.1	1.1	9.4	22.9	42.7	24
	1.2	3.1	6.3	19.8	42.7	28.1
	1.3	1	12.5	22.9	42.7	20.8
	1.4	3.1	8.3	16.7	55.2	16.7
	1.5	2.1	6.3	18.8	38.5	34.4
2	2.1	2.1	6.3	18.8	41.7	31.3
	2.2	3.1	6.2	14.6	53.1	22.9
3	3.1	2.1	8.3	18.8	45.8	25
	3.2	5.2	16.7	32.3	31.3	14.6
4	4.1	0	12.5	17.7	44.8	25
	4.2	2.1	11.5	32.3	35.4	18.8
	4.3	5.2	8.3	20.8	40.6	25
5	5.1	1	14.6	11.5	34.4	38.5
	5.2	Yes – 37.5		No – 13.5	Not Aware - 51	
	5.3	4.2	17.7	34.4	28.1	15.6
6	6.1	2.1	11.5	15.6	37.5	33.3
	6.2	5.2	12.5	27.1	34.4	20.8
7	7.1	3.1	6.3	15.6	51	24
	7.2	2.1	8.3	9.4	50	30.2
	7.3	0	7.3	40.6	39.6	12.5
8	8.1	0	13.5	21.9	51	13.5
	8.2	4.2	11.5	25	37.5	21.9
	8.3	2.1	9.4	28.1	40.6	19.8

• Ease of use

It is one of the concerns of usability where human learns to use a device or tool in order to achieve the objective efficiently with satisfaction. Under these criteria, five questions were analyzed and nearly 35% of customers felt that finding something that they need is hard and structure of online banking system is not easy to follow. Still, positive feedback is received where nearly 75% of the banking customers found it easy to remember things on system on the next visit, identify the progress of transaction which requires less effort.

• Performance

Performance is another measurable factor that used to assess whether the services promised are supported by the systems at high speed since no one on Earth like to work with real slow systems. The analysis under performance criteria presented that 76% of the customers are satisfied with the services provided by systems and 70% among the customers found is fast which can be considered as one of the good signs for sustainability of the system.

• System availability

This measure is used to analyze whether the system is always available as needs may arise at any time; in addition to

checking whether it also can be efficiently used by differently abled customers. Based on the results, banking systems failed to satisfy nearly 30% of customers on the availability of system and also nearly half of the responded customers felt that the banking systems are not disability-friendly.

Based on the observation, the following features are not accomplished in our banking systems which should be considered before designing the systems.

- ✓ alt tags are missing for some images (analyzed using SortSite)
- ✓ include periods in abbreviated form (use O.B.S instead of OBS) since the screen reader wouldn't recognize.
- ✓ selection of colours that support colourblind user (not to use red, green and blue closer together)
- ✓ adjustable font sizes that support short and long sight users.

• Transaction response

Transaction response is used to measure the time taken to accomplish a transaction in the systems where the objective is to make sure that the systems work perfectly even under load. The results revealed that only 70% of the customers are happy about the response time shows that there is a room for development. Moreover, only 53% of the customers agreed that the problems during transactions are handled smoothly by the systems.

• Customer support

It is the responsibility of the banking sectors to attract their customers towards online systems by providing them sufficient support since they are used to accomplish their banking needs in queues. It is important that the online systems should not be a nightmare for the first-time visitors and the study found that only 44% of the customers figured the online systems are easy to work with even though at the first visit. In addition, it would be better if there is online customer support to figure out their issues where half of the customers were not aware whether they are provided with such a facility.

• Safety and trust

Since the online banking systems transactions involve money and sensitivity data, customers will be at stake if security issues are not fixed. Even though online banking systems became so common, it is sad to see that only 70% of the customers found their transactions safe with their banks. Moreover, more than half of the customers found security as a threat to do online transactions which may have a direct impact on the number of transactions made by a customer in a month which is found as very low.

• Information quality

The information appears on the online systems should be correct, up-to-date and displayed at right amount can be considered as an advantage whereas the absence of information expected will be a weakness. The study revealed that 75% of the customers found that the information is displayed at the right amount and 80% of the customers found that the information presented is accurate and relevant. This is also considered as a good feature of disability-friendly

systems to keep the copy simple. Also, only 55% of the customers understood the banking terms appearing in the system in which the attention is required as the system is developed to address all unique banking customers with different levels of knowledge and understanding.

• Site aesthetics

Site aesthetics is related with the human perception about the system which can be used to evoke the content registered in mind at every visit by making the site attractive and organized. Three different areas were analyzed that comprised with the attractiveness of the pages, clear and consistent navigation/layout and a good balance of text vs graphics which were failed to address by the designers and developers where only 60% of the customers found those interesting.

The understanding resulted from the analysis on eight different criteria proved that the standards of online banking systems are much developed from the place we have started, on the other hand, no one may deny on the fact that the room for development is still not addressed for system sustainability. In precise, the aspects of system availability, safety and trust, information quality and customer support are at risk which may hold back the customers from wide usage. Although there are possibilities for higher adaptability of the online systems with the proliferation of internet and mobile phone facilities, it cannot be ignored that the banking sectors are in a position to build up the path for the customers to access the systems without any obstacle.

B. Tool-Based Analysis

This is the second approach of this study to analyze the banking system with the aid of selected tools such as Google PageSpeed for Desktop and Mobile, Pingdom, Google mobile-friendly tool and SortSite to assess the loading performance, adaptability and adherence towards the standards. For the tool-based analysis, online banking systems of BOC, People's Bank were selected in addition top three government websites of Sri Lanka ranked by a study carried out by Gopinath S. and fellow researchers also were selected. Table 3 discusses the performance resulted for the selected online systems under different tools.

Examination of page loading speed is done with two tools; PageSpeed Insights and Pingdom. PageSpeed for Desktop is a tool which analyzes the real-world performance of a site for Desktop and produces the report regarding First Contentful Paint (FCP) and DOM Content Loaded (DCL). FCP measures the time taken to see a visual response from the page and DCL measure the time taken for HTML document to load and parse where the faster times are more likely to keep the visitors engaged to the system. In addition to FCP and DCL PageSpeed also tends to find the page speed performance of a system.

FCF and DCL were not resulted for certain websites because of security concerns and the tools were not allowed to analyze the contents of those pages. However, with the available result we can say that the website for Parliamentary loads the graphic and HTML document bit slower than

People's Bank online banking system which is a benefit of People's bank system to elevate customer engagement. When the PageSpeed is considered, the table shows that the banking systems are faster than government websites in providing services which is an expected quality as customers more likely to deal with banking systems than government websites. Still,

People's bank is lacking behind Bank of Ceylon in page speed in the desktop. Pingdom is also another tool that monitors the performance and load time for better end-user-experience which found out the Bank of Ceylon system got the best grade of performance as well as least load time.

TABLE 3: Tool-based analysis for selected government websites and banks

	Name	Criteria	Websites				
			<i>Social Services</i>	<i>STLDA – for Travel</i>	<i>Parliamentary Reforms and Mass Media</i>	<i>BOC Bank</i>	<i>People's Bank</i>
Tools	PageSpeed – Desktop	FCP	N/A	N/A	3.2 s	N/A	0.5 s
		DCL	N/A	N/A	3.2 s	N/A	0.3 s
		Page Speed	Low 58%	Good 81%	Low 50%	Good 100%	Good 89%
	Pingdom	Performance Grade	D	D	C	A	F
		Load Time	3.24 s	5.32 s	4.56 s	1.09 s	-0.0 s
	PageSpeed – Mobile	FCP	N/A	N/A	4.2 s	N/A	0.7 s
		DCL	N/A	N/A	4.5 s	N/A	0.5 s
		Page Speed	Low 48%	Medium 63%	Medium 71%	Good 100%	Good 98%
	Google Mobile-friendly tool	Compatibility	Yes	Yes	Yes	N/A	No
		# pages cannot be loaded	27	51	31	N/A	N/A
	SortSite	Overall Quality	72 issues	36 issues	43 issues	1 issues	36 issues
		Errors	64 issues	35 issues	37 issues	1 issues	10 issues
		Accessibility	68 issues	36 issues	43 issues	0 issues	20 issues
		Compatibility	1 issues	36 issues	36 issues	0 issues	15 issues
		Search	69 issues	36 issues	12 issues	1 issues	10 issues
		Standards	66 issues	36 issues	36 issues	0 issues	12 issues
		Usability	71 issues	36 issues	36 issues	0 issues	17 issues

Similar to the page speed, mobile adaptability is also examined using PageSpeed for a mobile and Mobile-friendly tool where PageSpeed mobile provided the same overall results where People's Bank shows the best performance among the results received. Still, the loading time in mobile is higher than the time in the desktop which has to be improved since people tend to use mobile devices more than a Personal Computer. The second tool, Mobile-friendly is used to analyze whether a system is adaptable to mobile devices and unfortunately as the presence of security issues all the results could not be retrieved. The People's bank is found not as a mobile-friendly system since the tool has identified some drawbacks that the bank should consider to fix the issue.

- Text too small to read
- Uses incompatible plugins
- Viewport not set
- Content wider than the screen

- Clickable elements too close together

The last tool SortSite is used to analyze the adherence of the online systems to the standards defined. This test also ended up with positive results that the banking systems have better performance over government websites. Even though the result is desired to a certain extent, to achieve the objectives of online banking systems, the features identified to be developed should be taken into account and analyzed critically.

V. CONCLUSION

With the increased Internet usage in Sri Lanka, for the banking customers, there is a huge tendency to move towards online banking systems to acquire the banking needs. Therefore, to analyze the status of usability and accessibility of banking systems this study is carried out by including two different approaches in the analysis: experience-directed and

tool-based. On the basis of both approaches, it can be concluded that there are still opportunities for further improvements in usability and accessibility of online banking systems. Based on the customer experience-directed evaluation, it is found that the customer expectations are not highly met in all eight aspects considered and specifically the customers feel the systems are not available for all kind of users as well as the information is not displayed with quality.

Moreover, most of the respondents were not aware whether they have prompt online responders in banking systems to tackle their instant queries. Therefore, the study suggests that it would be great if the online banking systems had online customer support and made the systems available in all three languages (Tamil, Sinhala and English) as they need to address all kind of customers. Also, the study has revealed that the customers found the online transactions vulnerable even though the banking systems are highly secured. This is where the banking sectors could deposit their effort to organize awareness programme on the security aspects of their systems to encourage the customers to use online systems without any hesitation. The study found that the online banking systems have better features and higher degree of adaptability compared to the selected government websites of Sri Lanka (based on an existing study) based on the tool-based evaluation, and also it suggests that the developers should more focus on the load speed, mobile friendliness and standard guidelines to keep the obstacles in using online banking systems at bay. In order to support the differently abled customers, the systems should be available with suitable text and graphical arrangement which also can be considered as a valuable suggestion. Overall, though most of the banks of Sri Lanka made their services available at the doorsteps of customers, a little more effort is required to see the light at the end of the tunnel of success.

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