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A Comparative Analysis of the Usability for Internet Banking in Saudi Arabia

Dr. Monzer Moh'd Qasem

Information Systems Department, College of Computer and Information Sciences
Princess Nourah Bint Abdul Rahman University, Riyadh,
Kingdom of Saudi Arabia

Abstract—Banks develop inventing new ways to attract customers because of the intense competition between them. Like provides online services where customers can perform transactions rather than traditional. So, the banks should encourage their customers to perform an online transactions through online banking with guarantee of a secure environment as they claim. This research paper is based on a survey to evaluate the usability by opening personal accounts in five major Saudi banks using Evaluation Framework by extracting the evaluation metrics from the conducted literature review which are: usability evaluation framework including several novel evaluation metrics suited for the Saudi banking market in particular and to compare between the five selected banks against specific criteria in order to represent important features regarding usability. Furthermore to determine a comprehensive aspects such as the registration process, provided services, security threats and awareness, and authentication methods. Moreover, by conducting a user survey to measure the usability of password recovery and authentication methods used in the Saudi online banking. The survey of 47 participants with different backgrounds shows that SMS-based authentication is the most adapted method. On the other hand, password recovery method shows low usability.

Keywords—Authentication, Online Banking, Security and Usability trade-off, Secure Sockets Layer, Threats, Usability.

I. INTRODUCTION

The Internet completely altered the way in which business operate including banks. Recently banks started offering online banking services to their consumers, but some of them did not feel safe to deal with their confidential information online. However the main reasons for the customer's concerns are lack of security and usability awareness. Security and usability are the most important factors that can affect the adoption of the online banking services anywhere. All banks in Saudi Arabia are using online banking; providing their customers with the ability to access their bank accounts and make transactions anytime and anywhere. In contrast, online banking has revealed some types of security threats that can endanger the use of such services; since customers provide very confidential information and exposing such information would affect the customer as well as the bank relationship with their customers. [1]

Furthermore, privacy and security of online banking transactions and confidentiality of personal information are among the biggest concerns for both the banking industry and the online banking customers. Therefore, customers need to ensure that their confidential information given in the online banking website is secure. Banks claim secure and easy access through their websites to customers' accounts where they can perform most of their daily transactions online. The balance between practical security and reasonable usability of online banking is considered to be a vital question. Where the increasing of security doesn't affect the usability and vice versa. The five major Saudi Banks; NCB (Alahli), Alrajhi Bank, Riyad Bank, SABB Bank, Samba Bank are the concern of this survey, and the main focus is to examine their online banking websites' to evaluate them in the context of *usability*.

II. BACKGROUND

Usability means making products and systems easier to use, and matching them more closely to user needs and requirements [2]. Usability as defined by the ISO: the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. Usability issues and tests in the field of e-banking will naturally revolve around security, as most user actions in e-banking systems are security-induced, which is also reflected in the next section. Most works have focused on the balance between security and usability in regard to authentication methods, often in a comparative fashion or on individual solutions [3].

In Saudi Arabia, most banks offer online services and strongly encourage their customers to do payments and transactions online. What mostly attracts customers to online banking is the round-the-clock availability. Online banking allows users to manage their money from different locations and offers various services such as bank accounts viewing, money transfers, and bill payments. However, the online banking systems have associated information security threats and risks which are serious concerns for both the banking industry and online banking customers. Further, there are some additional Internet banking security threats and risks that impact both the banks and the online banking customers. These

include security awareness of the online banking customers and the banks, online banking customers' online behavior and threats (both authentication and authorization), and exposure to new potential threats[1].

III. RELATED WORK

Möckel [3] analyzed the relation and interaction between security and usability in the context of e-banking systems, by forming security and usability criteria with the aim of developing a robust evaluation framework specific to e-banking, the required criteria is derived from a comparison between various categories of e-banking security solutions, which is then followed by a security threat model of these solutions and complemented by relevant extrinsic influence factors.

Subsorn and Limwiriyakul [1] examined Internet banking security systems in Australian banks by deploying a comparative analysis approach in generating a proposed Internet banking security checklist. The results uncovered were lack of Internet banking security in all the 16 selected Australian banks. Better Internet banking security information, two-factor authentication and stronger encryption in use are some of the example recommendations.

Mannan[5] conducted a survey of 123 technically advanced users from a university environment that strongly supports the view of an emerging gap between Canadian banks' expectations and users' actions related to security requirements and usability of online banking. Moreover, participants failed to satisfy common security requirements stated by the banks. The survey and analysis focused on the usability of major online banking requirements such as, SSL certificates, anti-malware requirements, documentation and agreements, software updates, user authentication, and other issues.

Ramzan and Pervaiz [6] studied a variety of authentication solutions that online banks offer to their users from both security and usability perspective; like Two-factor authentication methods to increase security, which involves two basic factors: (1) something user knows, like password, PIN, pass phrase etc.; And (2) something user has, like smart card, hardware token etc. Then performed risk analysis based on the presented authentication solutions.

Mujinga and Eloff [7] researched ways to improve the usability of online banking security systems. Investigated the design principles and human capabilities in terms of the effort needed to use security systems securely, and studied the phenomenon of what influences the behavior of users of online banking services and look at their interaction with online security technologies, then presented a framework for the design principles for usable online security and tested it using the heuristic evaluation method.

Hertzum et al.[8]evaluated and surveyed six Danish web-based electronic banking systems that have serious weaknesses with respect to ease of use. The analysis of the weaknesses suggested that security requirements are among their causes.

Braz and Robert[9] studied the usability-security trade-off of two-factor authentication methods. They propose two rating scales: security and usability, respectively, and use them to compare user authentication methods; including two-factor authentication. They concluded that two-factor authentication increases "redundancy," thus augmenting security but decreasing usability.

Casaló et al.[10]studied the influence of perceived security, privacy, usability and reputation on the consumer trust in the context of online banking, also, analyzed the trust-commitment relationship in the context of financial web sites by formalizing a hypothesis; proceeding with the data collection and measure validation processes. Finally, comparing the proposed model with a rival one and offering multiple alternatives for improving the levels of consumer trust and commitment in the context of online banking.

Al-Somali et al.[11]identified and examined a number of factors that encourage customers to adopt and accept online banking in Saudi Arabia based on a technology acceptance model (TAM) and incorporated some extra important control variables. The examination was done to 400 customers. The findings of the study suggests that the factors are: (1) quality of the Internet connection; (2) awareness of online banking and its benefits; (3) social influence; (4) trust; (5) resistance to change; (6) computer self-efficacy; And (7) demographics characteristic. These factors have significant effects on the perceived usefulness (PU) and perceived ease of use (PEOU) of online banking acceptance. Moreover, age, gender, education and income factors are considered.

Uusitalo et al.[12] surveyed the situation of phishing attacks in Spain and discussed some of the countermeasures. They focused on the authentication and transaction signing methods. They gave examples of "two-factor" and "two-factor, two-channel" authentication and transaction signing methods that are more resistant to phishing than the username/password and coordinates card method. Also, they considered the costs usability and security of these more robust methods.

Li et al.[13]proposed hPIN/hTAN, which is a low-cost hardware token based PIN/TAN system for protecting online banking systems against the strong threats model where the adversary has full control over the user's computer. This threat model covers various kinds of attacks related to untrusted terminal computers, such as keyloggers, screen scrapers, session hijackers, Trojan horses and transaction generators. The main design goal of the hPIN/hTAN system is to achieve a better trade-off between security and usability with a low-cost and easy-to-use USB-token.

Zarifopoulos and Economides [14] aimed to provide a holistic evaluation framework for mobile banking and to investigate the worldwide situation of mobile banking. This framework consists of 164 criteria categorized into six categories. Also, the paper evaluated the mobile banking portals of thirty major banks from all over the world using the framework. Strengths and inefficiencies are identified and suggestions for improvement are made.

Just and Aspinall [15] presented a review of 10 UK banks and their implementation of credential authentication using two text-based credentials. They modeled the authentication protocols based upon several deployment choices. The

results indicated some variation and inconsistency across the UK banking industry, from which they offered some suggestions for improved authentication protocol design.

Al Somali and Ghinea[16] prepared a questionnaire that investigates the development of e-banking in Saudi Arabia from both banking sectors and consumers perspective. They aimed to identify the factors which affect consumer adoption of e-banking services among Saudi Arabian consumers. This research founds that perceived usefulness, age, Internet access, facilitating conditions, social influence and perceived risk have significant impact on Attitude towards using the e-banking services.

Cristofaro et al.[17]presented a comparative usability study of two-factor authentication. The paper showed that users' perception of the usability of two-factor authentication is often correlated with their individual characteristics rather than with the actual technology or the context in which it is used. The paper concluded that user-centered design of two-factor authentication technologies should focus on the target population as well as the context by which these technologies will be used.

Yoon and Steege[18] designed a survey to investigate the main factors that affect Internet banking use focusing on security and usability perceptions to include four key dimensions: personality, security, usability, and social influence. The findings of this research have important contributions by demonstrating the roles of various factors that influence Internet banking use and the moderating roles in relation between antecedents and Internet banking use.

IV. PROPOSED EVALUATION FRAMEWORK

Evaluation Framework which represents the evaluation method of the online banking websites which compares between the five Saudi banks in terms of security and usability. OBSUEF captures the most important features for secure yet usable online banking. It considers all the important factors from the first visit to the site, to the registration process, authentications methods and up to the completion of the transaction. Evaluation Framework consist of two large comparison tables usability table, while the evaluation metrics extracted from the conducted literature review [1][14] to establish: (1) security evaluation framework; and (2) usability evaluation framework.

A. Evaluation Framework (Usability Table)

Seven tables consists of seven main categories of usability criteria: (1) Interface, (2) Navigation, (3) Content, (4) Services Offered, (5) Reliability, (6) Technical Aspects and (7) Multi- factor Authentication Methods. Although the categories are self-explanatory.

Category 1: Interface

The Interface category consists of four subcategories: (1) Design Principles, (2) Graphics & Multimedia, (3) Style & Text and (4) Flexibility & Compatibility. Interface examines criteria related to the effective use of color, graphics, and multimedia. It also examines the right use of the text and language, and the pages' adjustment to various situations.

Category 2: Navigation

The Navigation category consists of five subcategories: (1) Logical Structure,(2) Ease of Site's Use, (3) Ease of Online Banking Pages Use, (4) Search Engine, and (5) Navigational Necessities. Navigation examines the easiness of navigating the bank portal. The site organization, menus, site map and effective search engine are important factors. A user should easily navigate the site and find exactly what he is looking for. Of course, there should not exist broken links and "under construction pages".

Category 3: Content

The Content category consists of six subcategories containing (1) Online Banking Information, (2) Bank Information & Communications, (3) Advertisement, (4) Web Site Users' Support, and (5) Competency of the Provided Assistance .Information about all banking services should be comprehensive and clear. The portal should provide Information not only about financial, accounting, investment issues but also about technical requirements in using and communicating with the site. The content should be current and updated. Finally, the portal must provide detailed help for both expert and novice users.

Category 4: Services Offered

The services offered category consists of two subcategories: (1) Provided Services and (2) Provided Transactions. It is important that the website provides multiple services. The Provided Services are classified into General and Financial .Similarly, the portal should provide multiple transactions types.

Category 5: Reliability

The Reliability category consists of two subcategories containing: (1) Registration, and (2) Transaction Procedure. This category examines the reliability of the registration process and the transaction procedure. It also examines the continuous availability of the online banking services anywhere.

Category 6: Technical aspects

The technical aspects category is concerned with the proper operation of the online banking system with respect to the loading speed.

Category 7: Multi-factor authentication methods

Finally, the multi-factor authentication methods category consists of three subcategories: (1) token devices, (2) SMS and (3) site keys. This category examines the usability of the authentication methods in terms of ease of use, effectiveness, and adaptability.

B. Comparative Analysis (Usability perspective)

The tables below are comparisons for evaluating the five Saudi bankswebsites, from usability perspectives.

Table1, Usability Evaluation and Comparison

Saudi Banks							
Usability Feature Categories			NCB	Al Rajhi	Riyad	Samba	SABB
Category- 1: Interface							
1.1Design Principles							
1.1.1	(0-5)	Home page is concise and clear	5	5	4	5	4
1.1.2	(0-5)	Effective use of white space	5	5	5	5	4
1.1.3	(0-5)	Effective and consistent use of color, color combination and backgrounds	5	5	5	5	5
1.1.4	(0-5)	Effective graphics	5	4	4	4	4
1.1.5	(0-5)	Aesthetics and Minimalist Design - apply appropriate visual representation of security elements and not provide irrelevant security information	5	5	5	4	4
1.2Graphics & Multimedia							
1.2.1	(0-5)	Site is visually attractive	4	4	3	3	4
1.2.2	(0-5)	Graphics and multimedia help the navigation	5	3	4	4	4
1.2.3	(yes/no)	Icons are easy to understand	Yes	Yes	Yes	Yes	Yes
1.2.4	(yes/no)	Not excessively used	Yes	Yes	No	yes	No
1.2.5	(yes/no)	No negative impact on loading times	Yes	Yes	Yes	Yes	No
1.3Style & Text							
1.3.1	(yes/no)	Consistent use of pages' style and format	Yes	Yes	Yes	Yes	Yes
1.3.2	(yes/no)	Consistent use and easy to read fonts	Yes	Yes	Yes	Yes	Yes
1.3.3	(yes/no)	Correct spelling and grammar	Yes	Yes	Yes	Yes	Yes
1.3.4	(yes/no)	Text is concise and relevant	Yes	Yes	Yes	Yes	Yes
1.3.5	(0-5)	Purpose of site is made clear on home page	5	5	5	5	5
1.3.6	(0-5)	User Language - the use of plain language that users can understand with regard to security	5	4	4	5	4
1.4Flexibility & Compatibility							
1.4.1	(yes/no)	Pages sized to fit in browser window	Yes	Yes	No	Yes	No
1.4.2	(yes/no)	Printable versions of pages are available	Yes	Yes	Yes	Yes	Yes
1.4.3	(yes/no)	Text-only version is available	No	NI	Yes	NI	NI
1.4.4	(yes/no)	Options of many available languages	Yes 2 lang.	Yes 2 lang.	Yes 2 lang.	Yes 2 lang.	Yes 2 lang.
1.4.5	(yes/no)	Accommodation made for users with special needs	No	No	No	No	No
1.4.6	(yes/no)	User Suitability - provide options for users with diverse levels of skill and experience in security	No	No	No	No	No

NA represents not applicable, NI represents no information, A represents AES 256-bit encryption, R represents RC4 128-bit encryption

Table 2, Usability Evaluation and Comparison

Saudi Banks							
Usability Feature Categories			NCB	Al Rajhi	Riyad	Samba	SABB
Category-2: Navigation							
2.1 Logical Structure							
2.1.1	(0-5)	Intuitively progressing (proceeding)	4	4	4	4	4
2.1.2	(0-5)	Rational design of the content	4	4	3	4	3
2.1.3	(yes/no)	Menus are understandable and straightforward	Yes	Yes	Yes	Yes	Yes

2.1.4	(yes/no)	Sitemap is available	Yes	Yes	Yes	Yes	Yes
2.1.5	(yes/no)	Consistent navigation throughout the site	Yes	Yes	Yes	Yes	Yes
2.1.6	(yes/no)	Navigation bar is available	Yes	Yes	Yes	Yes	Yes
2.2Ease Use of the Site							
2.2.1	(0-5)	Easy to find the site	5	5	5	5	5
2.2.2	(0-5)	Easy to learn and navigate the site	4	4	3	5	3
2.2.3	(0-5)	Easy to use the navigation bar	5	5	5	5	5
2.2.4	(yes/no)	Easy to return to main page	Yes	Yes	Yes	Yes	Yes
2.2.5	(0-5)	Easy to modify user's settings	4	3	5	4	4
2.3Ease Use of the Online Banking Pages							
2.3.1	(0-5)	Easy to access complete online banking range	4	4	4	4	4
2.3.2	(yes/no)	Separation of online banking pages from the rest pages	Yes	Yes	Yes	No	No
2.3.3	(yes/no)	Separation between individual and business customers, as well among various channels	Yes	Yes	Yes	Yes	Yes
2.4Search Feature							
2.4.1	(0-5)	Easy to use search engine	4	5	NA	NA	5
2.4.2	(0-5)	Search engine provides accurate and useful results	3	5	NA	NA	0
2.4.3	(0-5)	Good description of search engine findings	3	4	NA	NA	0
2.4.4	(0-5)	No search engine errors	3	4	NA	NA	0
2.5Navigational Necessities							
2.5.1	(0-5)	No broken links	5	5	5	5	5
2.5.2	(0-5)	No "under-construction" pages	5	5	5	5	5
2.5.3	(0-5)	Links are clearly discernible, well labeled and defined	5	4	5	5	4
2.5.4	(0-5)	Clear label of current position on the site	5	5	5	5	5
2.5.5	(0-5)	Effective use of frames, non-frames version is available	4	3	3	3	3

Table 3, Usability Evaluation and Comparison

Saudi Banks							
Usability Feature Categories			NC B	Al Rajhi	Riyad	Sam ba	SAB B
Category-3: Content							
3.1Online Banking Information							
3.1.1	(0-5)	Full information about the purpose of each service	3	3	5	3	5
3.1.2	(0-5)	Full information about the charges	5	5	5	5	5
3.1.3	(0-5)	Terms and conditions are easily accessed	2	5	5	5	5
3.1.4	(0-5)	Full information about Technical Requirements	3	4	4	5	4
3.1.5	(yes/no)	Familiarity programs and demo are available	Yes	Yes	Yes	Yes	Yes
3.2Bank Information & Communications							
3.2.1	(yes/no)	Full bank information is available	Yes	Yes	Yes	Yes	Yes
3.2.2	(yes/no)	Different ways for communication with the bank's employees are available	Yes	Yes	Yes	Yes	Yes
3.2.3	(yes/no)	Telephone and fax numbers are available	Yes	Yes	Yes	Yes	Yes
3.2.4	(yes/no)	Postal and physical addresses are available	Yes	Yes	Yes	Yes	Yes
3.3Advertisement							
3.3.1	(0-5)	Adequate advertisement of bank's services	4	3	3	4	4
3.3.2	(yes/no)	Controlled amount of advertisements by other companies	Yes	Yes	Yes	Yes	yes
3.3.3	(0-5)	Careful advertisement use	5	3	4	5	4
3.3.4	(0-5)	Effective use of advertisement techniques	5	4	5	4	4
3.4Web Site User's Support							
3.4.1	(yes/no)	Feedback forms are available	Yes	No	Yes	Yes	Yes
3.4.2	(yes/no)	Telephone and e-mail numbers for providing help	Yes	Yes	Yes	Yes	Yes
3.4.3	(yes/no)	Round the clock support	Yes	Yes	No	Yes	Yes

3.4.4	(yes/no)	Free or toll free telephone assistance	No	No	Yes	Yes	Yes
3.4.5	(0-5)	Security help are relevant and apparent to users	5	4	4	4	4
3.5 Competency of the Provided Assistance							
3.5.1	(0-5)	Detailed information about every step	4	2	4	3	3
3.5.2	(0-5)	Easily understandable assistance for amateur users	3	4	3	4	4
3.5.3	(0-5)	Assistance regarding settings is provided	4	3	4	3	4
3.5.4	(0-5)	Transaction guide is provided	4	5	4	3	4

Table4, Usability Evaluation and Comparison

Saudi Banks							
Usability Feature Categories			NC B	Al Rajhi	Riyad	Samba	SABB
Category-4: Services Offered							
4.1 Provided Services							
General							
4.1.1	(0-5)	Information about bank's announcements	5	4	5	5	5
4.1.2	(0-5)	Profile/ username/ password management	5	4	5	5	5
4.1.3	(0-5)	Ease use of services	4	4	5	5	4
4.1.4	(yes/no)	Revocability - allow users to revoke security actions where appropriate	NI	Yes	Yes	NI	Yes
4.1.5	(yes/no)	Tools such as organizer and calculator are available	Yes	Yes	Yes	Yes	Yes
4.1.6	(yes/no)	Extra services such as ticket booking, shop on line, charity	No	Yes	Yes	Yes	Yes
Financial							
4.1.7	(yes/no)	Account and loan information	Yes	Yes	Yes	Yes	Yes
4.1.8	(yes/no)	Credit card and check information	Yes	Yes	Yes	Yes	Yes
4.1.9	(yes/no)	Loan request	No	Yes	No	Yes	No
4.2 Provided Transactions							
4.2.1	(yes/no)	Bill payments	Yes	Yes	Yes	Yes	Yes
4.2.2	(yes/no)	Mobile phone bill or card recharge	Yes	Yes	Yes	Yes	Yes

Table 5, Usability Evaluation and Comparison

Saudi Banks							
Usability Feature Categories			NC B	Al Rajhi	Riyad	Samba	SABB
Category-5: Reliability							
5.1 Registration							
5.1.1	(0-5)	Easy to register	4	4	3	5	4
5.1.2	(0-5)	Easy to log on to the site	5	5	5	5	5
5.1.3	(0-5)	Adjustable customer profile is stored	5	5	5	5	5
5.1.4	(0-5)	E-mail request for receiving offers or information	0	0	3	5	5
4.1.5	(0-5)	Easy modification of user's profile	5	5	5	4	5
5.2 Transaction Procedure							
5.2.1	(yes/no)	Foreign language support is available	Yes	Yes	Yes	Yes	Yes
5.2.2	(yes/no)	Disconnection management	Yes	Yes	Yes	NI	Yes
5.2.3	(yes/no)	Actions' history is available	Yes	Yes	Yes	Yes	Yes

Table 6, Usability Evaluation and Comparison

Saudi Banks							
Usability Feature Categories			NCB	Al Rajhi	Riyad	Samba	SABB
Category-6: Technical Aspects							
6.1 Loading Speed							
6.1.1	(0-5)	Fast loading speed of the home page as well the rest pages	5	5	5	5	5

6.1.2	(0-5)	Consideration of non-broadband users	4	2	3	2	4
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Table 7, Usability Evaluation and Comparison

Saudi Banks							
Usability Feature Categories			NCB	Al Rajhi	Riyad	Samba	SABB
Category-7: Multi- factor Authentication Methods							
7.1Tokens							
7.1.1	(yes/no)	Hardware Tokens	No	No	Yes	Yes	Yes
7.1.2	(yes/no)	Software Tokens	Yes	Yes	No	No	No
7.1.3	(yes/no)	Easy to get the code from the device	Yes	Yes	Yes	Yes	Yes
7.1.4	(yes/no)	Security & Stability	Yes	Yes	Yes	Yes	5
7.1.5	(0-5)	User Adoption	2	3	2	2	2
7.1.6	(0-5)	Total Cost of Ownership (TCO)	5 (25 SR every 5 years)	5 (50 SR)	5 (50 SR)	5 (50 SR)	5 (free)
7.1.7	(yes/no)	Replacement of the token in the event of defects	Yes	Yes	Yes	Yes	Yes
7.2SMS							
7.2.1	(yes/no)	Multiple mobile numbers allowed (maximum)	No (1)	No (1)	Yes (2)	No	No (1)
7.3SiteKey							
7.3.1	(0-5)	Effective use of SiteKey	5	NA	NA	2	NA

V. RESULTS AND DISCUSSION

After identifying the evaluation criteria for the usability features, then evaluated each bank against those criteria, and finally compared the five Saudi banks against each other as you can see in tables from 1 to 7. Next paragraphs will discuss the results of the evaluation framework and the comparison between the five banks.

First category Interface: It has been shown that, First subcategory, Design Principles: the five Saudi banks have good design principles in implementing their websites and made an effective use of white space, color, and graphics.

Second subcategory, Graphics & Multimedia: expresses how the website of each bank is attractive and whether the graphics and multimedia helps the navigation. NCB bank focuses on the multimedia and uses attractive graphics to help users navigate the website easily. In contrast, Al Rajhi does not make a rich usage of graphics nor multimedia. Similarly, Riyadh bank does not make an effective use of graphics nor multimedia. Third subcategory, Style & Text: indicated that all the five banks use a consistent text and page format. Moreover, all banks' websites except for NCB website showed that user language - the use of plain language that users can understand with regard to security - need to be improved a little to educate the users and enhance their knowledge about security threats and terminologies..

Fourth subcategory, Flexibility & Compatibility: has evaluated the five banks' websites in regard to the flexibility and compatibility. First, the pages capability to fit the browser window vary from one bank website's to another; for instance, NCB bank and Al Rajhi bank pages fit perfectly in the browser window, where Riyadh and SABB pages have a problem fitting the browser window. Second, printable versions of pages are available in each website of the five banks; in addition, all banks offer their websites in two languages (Arabic, English). Sadly, websites of the five Saudi banks have not shown any accommodations for users with special needs, nor provided options for users with diverse levels of skill and experience in security.

Second category, Navigation: has specified the navigational necessities that would provide an easier flow and navigation through the website. First, all of the five banks' websites can be intuitively proceeded by the normal users but need more effort from the users with no computer background. Second, rational design of each bank is different than the other; for example, NCB Al Ahli bank and Samba provide more consistent and clear design than the other banks. Furthermore, all the banks' websites include sitemap and navigation bar. Second, upon our examination of the websites' we found that all the banks' websites are easy to use, find and learn; if the user gave it his/her full attention. Third, all the online banking pages are easy to access, and they are separated from the rest pages except for SABB and Samba bank. The search feature in NCB and Al Rajhi is in use and can return similar results, unlike SABB search feature that does not return any results and need to be enhanced. In contrast, Riyadh bank and Samba have no search feature at all; users will lack the ease to find information quicker. Most of the pages in the five banks' websites use frames including the home page.

Third category, Content: has shown an excellent rate in providing information about the charges, however not all the five bank's has a full description about each service like samba. Terms and conditions are easily accessed in all the five banks except the NCB Al ahli, it seems more difficult to reach. Technical requirement information varies from one bank to another bank. For example, in Samba they provide full information about the suitable operating systems and browsers, while in Riyadh bank and alajhi bank they provide general information, but they do not require a specific operating system

except it has to be up-to-date. For NCB Alahli, they advise the users to keep their systems up to date with security patches, use anti-virus software, disable the "auto complete" function in the browsers, and other general information. SABB bank The search feature in NCB and Al Rajhi is in use and can return similar results, unlike SABB search feature that does not return any results and need to be enhanced. In contrast, Riyadh bank and Samba have no search feature at all; users will lack the ease to find information quicker. Most of the pages in the five banks' websites use frames including the home page.

First subcategory, Online Banking Information: Content has shown an excellent rate in providing information about the charges, however not all the five bank's has a full description about each service like samba. Terms and conditions are easily accessed in all the five banks except the NCB Al ahli, it seems more difficult to reach. Technical requirement information varies from one bank to another bank. For example, in Samba they provide full information about the suitable operating systems and bowsers, while in Riyadh bank and alajhi bank they provide general information, but they do not require a specific operating system except it has to be up-to-date. For NCB Alahli, they advise the users to keep their systems up to date with security patches, use anti-virus software, disable the "auto complete" function in the browsers, and other general information. SABB bank suggests some versions of browsers to use such as, internet explorer version 8 (on windows) or safari version 5 (on Macintosh), also they state that it is better for your operating system to be up-to-date. All the five banks provide a demo of internet services that shows how to use the bank's site. However, the user must go through various documents to get all these information from the banks websites.

Second subcategories, bank information and communication: revealed full information about the five banks and flexible way of communication. All the five banks has multi way in order to communicate with the bank including employee, website, Telephone number, fax number, postal and physical addresses are available. These ways of communication are convenient to ordinary user. **Third subcategory, Advertisement** of the bank's services is shown in some pages in the website, all of the five banks have controlled amount of advertisement of other companies beside of careful use of advertisement and applied effective advertisement techniques. **Forth subcategory, website user's support** listed the amount of help and support could be conducted online. Most of the five banks have feedback forms available where users can report a problem or submit a request except Al-Rajhi bank. In addition, most of the five banks have the round the clock support where the user can call anytime during the day, this feature is very important specially for emergency case, un fortunately round the clock feature is not available in Riyadh bank. Most of the banks offer their customers toll free telephone assistance except NCB Alahli and Al-Rajhi bank. What worth to mention that in Samba phone it's not that easy to reach the appropriate employee to solve your issue or case. **Fifth subcategory is Competency of the Provided Assistance** evaluated the detailed information about every step. However, it provide descriptive heading. In addition, Samba does not provide full transaction guide while SABB does. Riyadh bank provides a comprehensive PDF document and a video explaining how to register to the Riyadonline step-by-step and how to use its services. Alrajhi bank provides full information about what users will need to register and detailed information about every step. In NCB Alahli, they have a demo center (youtube channel) where they provide videos explaining how to register and use Alahli online services. Most of the banks show good rate of easily understandable assistance for amateur users.

Forth category, Services Offered: is provided services have discovered number of online services. All of the five banks have an excellent profile\account management. Users can change settings like username, password, email and mobile number. In addition, all the five bank has evaluated the ease of use of the provided services. All of the five banks provide helpful tools such as calculator and organizer. Beside they offer some extra services like booking, shop-online and charity to meet users' demands. All the five banks provide loan, credit card and check information. Users can request loan online through defined processes in most of the five banks except NCB Al-Ahli and Riyadh bank. Also, users can pay bills online through defining a beneficiary. There is no information regarding to cancelling online accounts.

Fifth categoryis Reliability: has specified the registration and transaction procedure.

First subcategory, registration where the most of the banks use easy steps to complete successful registration. Samba registration steps as shown below:

1. Enter your ATM card number or your Credit Card number.
2. Enter your ATM or credit card PIN.
3. Authenticate your registration by entering the registration password that will be sent to your mobile number available in our records.
4. Read the Samba online agreement and click "I Agree".
5. Choose your Samba online username and password.

Where Riyadh bank registration steps require the user to visit an ATM machine or visit one of Riyadh bank branches to ensure the user's Identity, which decreases the usability and increases the security of the registration process in Riyadh Bank unlike the other four banks. After the registration process is complete, the user can logon and modify his/her profile easily in all the five banks.**Second subcategory, Transaction procedure** shows that all the five banks support foreign language and disconnection management except Samba. Action history is available in all the five banks where customer can view all the transactions and incomes in his account.

Sixth category is Technical aspects: identify the fast loading speed of the entire website in all the five banks.

Seventh category is Multi-factor Authentication Methods: is used to provide a double secure on customers login and transactions. Multi factor methods vary in use from bank to bank. The most common multi-factors are tokens, mobile SMS and site key.

First subcategory is Tokens, Token is a small hardware device that the owner carries to authorize access to a network service. The device may be in the form of a smart card or may be embedded in a commonly used object such as a key fob. The user has a personal identification number (PIN), which authorizes them as the owner of that particular device; the device then displays a number, which uniquely identifies the user to the service, allowing them to log in. The identification number for each user is changed frequently. Riyad, Samba and SAAB offer hardware tokens where NCB Al-Ahli and Al-Rajhi offers software tokens. These tokens ensure security and stability. Based on our evaluation, user adoption for using the tokens ranked in a low rate. Surprisingly, SAAB offers their customers a free tokens where Al-Rajhi , Riyad and Samba charge their customers with annual fee 50 SR, NCB Al-Ahli offers the tokens with 25 SR every 5 years. In case of defect or issue on the tokens, All the five banks guarantee the replacement of the tokens in a certain event. Second multi-factor is Mobile SMS. The user will receive a unique password via SMS to complete his order; most of the five banks allow only one Mobile number except Riyadbank, which allowed for two Mobile numbers. Third and last subcategory is SiteKey. SiteKey is a web-based security system that provide authentication between end-users and websites. Its primary purpose is to deter phishing. Based on our evaluation, only NCB Al-Ahli use SiteKey, SiteKey in other banks are not applicable.

VI. CONCLUSION

Usability of online banking is evolving very fast in the field of the banking industry in Saudi Arabia. Saudi banks claim that users can use online banking in a secure and usable manner. Security and usability trade-off in online banking systems is challenging, because users focus on their primary goal of accomplishing their financial transactions, while they dismiss the security to be the primary production task. The banks in Saudi Arabia expect the normal user to be aware and to read all the documents about the security order to be safe in online banking, but even if the normal user have read all the security-related information there is no guarantee that the customers will understand all of it or even any of it which raises a critical issue. On the other hand, most users are only able to complete installation of the security requirements in online banking systems by having an adequate technical background and computer skills. Nevertheless, the adoptability and trust of using online banking safely in the five studied banks are low-to-medium for the normal Saudi user.

The applied evaluation method the Evaluation Framework used in this paper were developed through an extensive use of the related work to establish usability evaluation framework. Furthermore, the comparative analysis demonstrate the actual evaluation and comparison of the five studied Saudi Banks websites (NCB (Alahli), Alrajhi Bank, Riyad Bank, SABB Bank, and Samba Bank) using several novel evaluation metrics suited for the Saudi banking market in particular.

VII. FUTURE WORK

Developing an authentication pilot portal to meet security and usability requirements and to enhance the security-usability trade-off by using a graphical password authentication instead of text password authentication.

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