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Evaluating Mobile Banking Portals

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Abstract: Mobile banking is becoming widespread worldwide. Designing effective mobile banking services is of vital importance. This paper attempts to address this need by providing a comprehensive Mobile Banking Evaluation Framework (MoBEF). This framework consists of 164 criteria categorized into six categories: Interface, Navigation, Content, Offered Services, Reliability, and Technical Aspects. MoBEF would be useful both for customers to evaluate the mobile banking services of candidate banks, and for bank managers to improve their mobile banking services. Furthermore, the paper evaluates the mobile banking portals of thirty (30) major banks from all over the world using MoBEF. Strengths and inefficiencies are identified. The major problem is the inadequacy of their offered services. Guidelines and proposals for improvement are given.

Key words: E-Banking; Evaluation; Internet Banking; Online Banking; M-Banking; Mobile Banking; Mobile Commerce; Mobile Communications; Security; Usability.

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1. Introduction

Many banks have established presence on the Internet and many others are in the process of doing so. Using telecommunication systems and networks, a bank can reach out to customers and provide them with not only general information about its services but also the opportunity of performing interactive banking transactions. In electronic banking, bank customers can request information and carry out most banking services (e.g. balance reporting, inter-account transfers, and bill payment) via a telecommunication network without the need to go at the bank's branch offices. Electronic banking comprises all electronic channels customers use to access their accounts, including the Internet and recently mobile phones (WAP- Wireless Application protocol, SMS- Short Message Service, SIM Toolkit, PDAs-Personal Digital Assistants). The cell phone handset can be used as a terminal in much the same way as an ATM (Automatic Teller Machine). Currently, almost everyone in the developed countries carries a mobile phone

(Economides and Nikolaou, 2008; Economides and Grousopoulou, in press). So, customers can access their bank accounts through the bank's website using not only a computer but also mobile devices. M-banking is not only another channel for banking services, but there is the possibility for becoming the primary channel (Barnes and Corbitt, 2003).

Previous studies on online banking can be categorized into four categories. The papers in the first category examine factors that influence customers' adoption of online banking (Aladwani, 2001; Karjaluoto et al., 2003; Liao et al., 1999; Nielsen, 2002). They focus on the influences of demographic variables and psychological beliefs about the positive attributes possessed by online banking. They usually focus on a specific country or market. The papers in the second category examine how banks enhance their banking services through Internet (Chung and Paynter, 2002). They investigate factors that are used to judge the performance of Internet banking services. The papers in the third category present the benefits of online banking either from the bank's or the customer's point of view (Aladwani, 2001). In some cases they present benefits in perspective with risks. Additionally, they make suggestions to improve the available services. Finally, the papers in the fourth category analyze a specific group of factors such as providing security or help to the customer (Al-Taitoon and Sorensen, 2004; Wenham and Zaphiris, 2003).

Despite the plethora of research regarding online banking, there is a shortage of studies on mobile banking. Previous studies on mobile banking can be classified into five categories. The first category includes papers on customers' adoption of mobile banking (Borreguero et al., 2005; Brown et al., 2003; Laukkanen and Lauronen, 2005; Laukkanen, 2007; Luarn and Lin, 2003). The papers in the second category investigate mobile financial applications, including both mobile payments and banking services, showing how the new financial services can be deployed in mobile networks (Mallat et al., 2004; Mcom, 2007). The papers in the third category introduce and analyze the players in the mobile financing value chain (Hyvärinen et al., 2005; Sivanand and Suleep, 2004). They develop the structure of the mobile commerce business environment caused by multiple players, which are Internet companies, content providers, and new m-commerce start-up companies. The papers in the fourth category analyze the channels

regarding mobile banking (Hyvärinen et al., 2005; Mcom, 2007; Pousttchi and Schurig, 2004). They provide information about their characteristics and compare them among themselves. Finally, the papers in the fifth category investigate the mobile services offered by banks in specific countries, like Japan (Scornavacca and Barnes, 2004) and Germany (Scornavacca and Hoehle, 2007). Yang et al. (2007) found that e-banking operation is still in its infant stage for most of small and local community banks in rural areas. Furthermore, these banks do not effectively promote e-banking to their customers. Thus, the percentage of their customers who use e-banking is lower than that of banks in large cities. Scornavacca and Hoehle (2007) argued that reduction in the "mobile flat-rates" offered by the wireless telecommunication providers may cause an increase in demand of mobile banking services.

Online and mobile banking are challenging issues for banks. They need to get to the market rapidly. Factors that drive the introduction of these channels are enhancing the competitive position, meeting consumer demands, creating new distribution channels, improving business image, and reducing costs (Aladwani, 2001). Deploying mobile banking services quickly and effectively will enable a bank to improve the acquisition and retention of customers (Mcom, 2007). They will create profitable new revenue opportunities for banks, including the opportunity to: a) Increase the number of banking transactions carried out by customers, due to the convenience of the mobile channel, and b) Charge customers for services that they do not currently pay for through the other channels (e.g. balance inquiry through the Internet channel). Mobile banking services offer convenience to the customers. Customers consider that convenience and the ability to save time during banking transactions and services are important values in their relationship with their bank. Koivumaki et al. (2006) showed that usefulness, user guidance and support, and user skills are significant factors in consumer acceptance of mobile services. Furthermore, usefulness and user-satisfaction are significant predictors of the willingness to recommend the services to others. Similarly, Park and Chen (2007) showed that perceived usefulness and ease of use positively influence the intention to use smart phones. Also, customers' satisfaction and loyalty should be seriously considered by companies in the mobile phone sector (Turkyilmaz and Ozkan, 2007). Liang et al. (2007) examined factors that

affect the successful adoption of mobile technology by organizations. Mobile banking enables customers to save time and not carry TAN (Transaction Authentication Number) lists with them. Laukkanen and Lauronen (2005) interviewed customers and found that customers perceive location-free access and the ability to react immediately to the service need as valuable for the creation of convenience and efficiency in service consumption. Laukkanen (2006) interviewed customers and found that perceived convenience and efficiency are the influential factors for using electronic fund transfer service and internet brokerage service. Furthermore, privacy, preciseness/control and safety-related factors are also important in the consumption of the internet fund transfer service. Security and privacy are the most important concerns for customers dealing with mobile banking (Chung and Paynter, 2002). Users tend to have negative management attitudes towards adoption and do not trust financial transactions made via these channels (Sivanand and Suleep, 2004). Security concerns and user distrust in mobile applications transmitted over wireless networks may delay the adoption of mobile banking (Siau and Shen, 2003). Security practices should be established and enhanced, especially when banks offer transaction-oriented services. While accumulating personal data, a bank should not underestimate private issues. Furthermore, mobile device limitations such as small screen size and key pads; limited computational power, memory, and disk capacity; shorter battery life; complicated text input; higher risk of data storage and transaction errors; lower display resolution; unfriendly and cumbersome user interfaces; and graphical limitations are obstacles in using mobile banking (Siau and Shen, 2003). Furthrmore, Laukkanen (2007) surveyed mobile banking customers. The respondents were clustered into two groups: customers who request account balances and customers who pay bills via their mobile devices. He found differences in their preferences for the channel attribute. Consequently, mobile device manufacturers should develop different kinds of devices for different market segments. Thus, there are several issues to consider for effective mobile banking services.

Evaluation is an important phase in the design and redesign of effective systems. By evaluating a bank's web site, the web designers and developers would identify the shortages and inefficiencies of their design. They would also persuade the bank's administrators to

finance the web sites' upgrade in order to keep up with technological advances and customers' expectations. The evaluation would fuel the web site's continuous development and improvement.

In order to perform an evaluation, it is needed a comprehensive evaluation framework containing quality criteria. These quality criteria should satisfy the customers' needs and demands. For example, is it easy to use the web site? Does the web site offer useful services? Can a customer easily perform any transaction?

Previous studies on web sites evaluation (Loiacono et al., 2002; van der Merwe and Bekker, 2003) used criteria classified in categories such as Interface, Navigation, Content, Reliability, and Technical. Self-efficacy, financial cost, credibility, ease of use and usefulness were also proposed as criteria (Luarn and Lin, 2003). Chung and Paynter (2002) evaluated 7 New Zealand banks using 32 criteria. Also, Pousttchi and Schurig (2004) presented the services provided by 4 banks.

Despite its significance, available research suffers from at least 3 deficiencies. First, past research has a rather narrow focus in terms of issues discussed. Only few criteria were considered for the evaluation of a bank's portal. Second, previous research usually focuses only on simple users. However, not only simple users are interested in mobile banking services but also business customers, bank officials, other banks, other financial institutes, government officials, etc. Finally, there is not any previous study that examines the worldwide situation. Previous studies concerned with a specific market or country examining one or few banks. The aim of this paper is to provide a holistic evaluation framework for mobile banking and to investigate the worldwide situation of mobile banking. The proposed MoBEF (Mobile Banking Evaluation Framework) may help banks to focus services on different target segments separating the offered services according to the channel, the type of the service (e.g. banking, investment, insurance, alerts), and the type of customers. Furthermore, this paper presents the state of mobile banking services all over the world. Strengths and inefficiencies are identified and suggestions for improvement are made. So, this paper may also help banks' officials to increase market presence by radically improving their mobile banking services.

In the next Section 2, we present the MoBEF. In Section 3, we present the Evaluation Method. In Section 4, we present the Evaluation Results. Finally, in Section 5, we conclude and suggest directions for future research.

2. Mobile Banking Evaluation Framework (MoBEF)

In this section we present the MoBEF (Mobile Banking Evaluation Framework) which can be used for design, development and evaluation of mobile banking portals. Based on our previous research and experience, on related literature analysis, and on bank sites investigation worldwide, we developed MoBEF that captures the most important factors for effective mobile banking. It considers all important factors from the first visit to the site, to the registration process and up to the completion of the transaction.

MoBEF consists of six categories of criteria: 1) Interface, 2) Navigation, 3) Content, 4) Services Offered, 5) Reliability, and 6) Technical Aspects (Tables 1 to 6). Although Tables 1 to 6 are self-explanatory, we briefly describe each one.

The Interface category consists of four subcategories containing 19 criteria: 1) Design Principles, 2) Graphics & Multimedia, 3) Style & Text and 4) Flexibility & Compatibility (Table 1). 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.

Table 1: Interface criteria

1. INTERFACE
1.1 Design Principles
1.1.1 Home page is concise and clear
1.1.2 Effective use of white space
1.1.3 Effective and consistent use of color, color combination and backgrounds

1.1.4 Effective graphics

1.2 Graphics & Multimedia

1.2.1 Site is visually attractive

1.2.2 Graphics and multimedia help the navigation

1.2.3 Icons are easy to understand

1.2.4 Not excessively used

1.2.5 No negative impact on loading times

1.3 Style & Text

1.3.1 Consistent use of pages' style and format

1.3.2 Consistent use and easy to read fonts

1.3.3 Correct spelling and grammar

1.3.4 Text is concise and relevant

1.3.5 Purpose of site is made clear on home page

1.4 Flexibility & Compatibility

1.4.1 Pages sized to fit in browser window

1.4.2 Printable versions of pages are available

1.4.3 Text-only version is available

1.4.4 Options of many available languages

1.4.5 Accommodation made for users with special needs

The Navigation category consists of five subcategories containing 24 criteria: 1) Logical Structure, 2) Ease of Site's Use, 3) Ease of Mobile Banking Pages Use, 4) Search Engine, and 5) Navigational Necessities (Table 2). Navigation examines the easiness of navigating the mobile 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”.

Table 2: Navigation criteria

2. NAVIGATION
2.1 Logical Structure
2.1.1 Intuitively progressing (proceeding)
2.1.2 Rational design of the content
2.1.3 Menus are understandable and straightforward
2.1.4 Sitemap is available
2.1.5 Consistent navigation throughout the site
2.1.6 Navigation bar is available
2.1.7 Table of contents is available
2.2 Ease Use of the Site
2.2.1 Easy to find the site
2.2.2 Easy to learn and navigate the site
2.2.3 Easy to return to main page
2.2.4 Easy to modify user’s settings
2.3 Ease Use of the Mobile Banking Pages
2.3.1 Easy to access complete mobile banking range
2.3.2 Separation of mobile banking pages from the rest pages
2.3.3 Separation between individual and business customers, as well among various channels
2.4 Search Engine
2.4.1 Easy to use search engine
2.4.2 Search engine provides accurate and useful results

2.4.3 Good description of search engine findings

2.4.4 No search engine errors

2.5 Navigational Necessities

2.5.1 No broken links

2.5.2 No “under-construction” pages

2.5.3 Links are clearly discernible, well labeled and defined

2.5.4 Clear label of current position on the site

2.5.5 Effective use of frames, non-frames version is available

2.5.6 No pages in separate window

The Content category consists of six subcategories containing 30 criteria: 1) Mobile Banking Information, 2) Company Information & Communications, 3) Advertisement, 4) Web Site Users’ Support, 5) Information Quality, and 6) Competency of the Provided Assistance (Table 3). 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.

Table 3: Content criteria

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3. CONTENT

3.1 Mobile Banking Information

3.1.1 Full information about the purpose of each service

3.1.2 Full information about the charges

3.1.3 Full information about national and foreign network providers

3.1.4 Full information about the mobile devices which support the services

3.1.5 Full information about contract conditions (with network providers)

3.1.6 Terms and conditions are easily accessed

3.1.7 Full information about the security for both transactions and devices

3.1.8 Full information about Technical Requirements

3.1.9 Familiarity programs and demo are available

3.2 Company Information & Communications

3.2.1 Full company information is available

3.2.2 Different ways for communication with the bank's employees are available

3.2.3 Telephone and fax numbers are available

3.2.4 Postal and physical addresses are available

3.3 Advertisement

3.3.1 Adequate advertisement of bank's services

3.3.2 Controlled amount of advertisements by other companies

3.3.3 Careful advertisement use

3.3.4 Effective use of advertisement techniques

3.4 Web Site User's Support

3.4.1 Feedback forms are available

3.4.2 Telephone and e-mail numbers for providing help

3.4.3 Round the clock support

3.4.4 Free or toll free telephone assistance

3.5 Information Quality

3.5.1 Content is current and update

3.5.2 Content is relevant to purpose of the site

3.5.3 Content is concise and non-repetitive

3.5.4 Visible (evident) quality

3.6 Competency of the Provided Assistance

3.6.1 Detailed information about every step

3.6.2 Easily understandable assistance for amateur users

3.6.3 Assistance regarding mobile settings is provided

3.6.4 Assistance regarding various mobile devices is provided

3.6.5 Transaction guide is provided

The Services Offered category consists of four subcategories containing 49 criteria: 1) Provided Services, 2) Provided Transactions, 3) Mobile Banking Charges, and 4) Special Offers and Economical Benefits using Mobile Banking (Table 4). It is important that the portal provides multiple services such as Balance Inquiries and Alerts that can be easily used. The Provided Services are classified into General, Financial, Investment, Insurance and Alert Services. Similarly, the portal should provide multiple transactions types such as Account Transfers and Bill Payments. The Provided Transactions are classified into Financial, Investment, Insurance and Business Transactions. The first two subcategories are evaluated for all possible channels (SMS, SIM Toolkit, WAP and PDA). It is examined whether the bank offers its Provided Services and Provided Transactions via every alternative channel. The last two subcategories examine the charges and the benefits of using these services.

Table 4: Services Offered criteria

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4. SERVICES OFFERED

4.1 Provided Services

GENERAL

4.1.1 Information about bank's announcements

4.1.2 Profile/ username/ password management

4.1.3 Cancellation ability

4.1.4 Ease use of services

4.1.5 Assistance via the mobile device is available

4.1.6 Tools such as organizer and calculator are available

4.1.7 Necessary software and updates are offered by the site

4.1.8 Extra services such as ticket booking, shop on line, charity

FINANCIAL

4.1.9 Account and loan information

4.1.10 Credit card and check information

4.1.11 Cheque book order and management

4.1.12 Loan request

4.1.13 Fixed payments at a specific times and automatic repeated payments

INVESTMENT

4.1.14 Daily stock market detailed information

4.1.15 Mutual funds and international bonds information

4.1.16 Stocks and index information

4.1.17 Currency prices information

INSURANCE

4.1.18 Insurance products information

4.1.19 Insurance contract application

4.1.20 Accident or disadvantage reference

ALERTS

4.1.21 Reminders, e.g. instalment

4.1.22 Transaction confirmation

4.1.23 Critical account, investment, credit card level

4.1.24 Bank announcements

4.2 Provided Transactions

FINANCIAL

4.2.1 Deposit management

4.2.2 Funds transfer

4.2.3 Bill payments

4.2.4 Mobile phone bill or card recharge

4.2.5 Credit card or loan installment payment

INVESTMENT

4.2.6 Portfolio management

4.2.7 International stock markets, exchange transactions

4.2.8 Bonds transaction

INSURANCE

4.2.9 Insurance payment

4.2.10 Contract modification

BUSINESS

4.2.11 Government and state payments

4.2.12 Payrolls

4.2.13 Transfers inland and abroad

4.2.14 Remitment

4.2.15 Personnel's medical care payments

4.2.16 Extra businesses services

4.3 Mobile Banking Charges

4.3.1 Bank's charge equals to mobile network provider's charge

4.3.2 Mobile network provider's charges are clear and known

4.3.3 Small amount of transferred data via the network

4.4 Special Offers and Economical Benefits using Mobile Banking

4.4.1 Without or small charge for transferring funds

4.4.2 Without or small charge for paying cards

4.4.3 Without or small charge for business services

4.4.4 Without or small charge for payments

4.4.5 Order cheque discount

4.4.6 Extra discounts

The Reliability category consists of three subcategories containing 24 criteria: 1) Registration, 2) Transaction Procedure, and 3) Services Quality (Table 5). This category examines the reliability of the registration process and the transaction procedure. It also examines the continuous availability of the mobile banking services anywhere.

Table 5: Reliability criteria

5. RELIABILITY

5.1 Registration

5.1.1 Easy to register

5.1.2 Easy to adjust the mobile device to display the site's pages

5.1.3 Clear (evident) benefits of registration

5.1.4 Easy to log on to the site

5.1.5 Adjustable customer profile is stored

5.1.6 Registration in the web site by phone or at the branch

5.1.7 E-mail request for receiving offers or information

5.1.8 Guided ordering using customer profile is available

5.1.9 Easy to go back or exit from the registration procedure

5.1.10 Easy modification of user's profile

5.2 Transaction Procedure

5.2.1 Foreign language support is available

5.2.2 Channels' variety (SMS, SIM Toolkit, WAP)

5.2.3 Menu personalization to the user's profile

5.2.4 Disconnection management

5.2.5 Actions' history is available

5.2.6 Round the clock availability

5.3 Services quality

5.3.1 The services are available anywhere in the country and abroad

5.3.2 Quick and effective services

5.3.3 All the provided services work properly

5.3.4 Constantly service update

5.3.5 Constantly information update

5.3.6 Quick reply to e-mail enquires

5.3.7 Information and transactions are trustworthy

5.3.8 All the available channels are equally trustworthy

Finally, the Technical Aspects category consists of four subcategories containing 18 criteria: 1) Loading Speed, 2) Privacy, 3) Security, and 4) Browser Compatibility (Table 6). The proper operation of the portal with respect to the loading speed, the security, privacy and compatibility is also important.

Table 6: Technical Aspects criteria

6. TECHNICAL ASPECTS

6.1 Loading Speed

6.1.1 Fast loading speed of the home page as well the rest pages

6.1.2 Effective use of caching

6.1.3 Consideration of non-broadband users

6.2 Privacy

6.2.1 Full privacy policy information is available

6.2.2 No personal information is forwarded to third parties

6.3 Security

6.3.1 Encrypted data during transmission (WTLS, SSL/128 bit)

6.3.2 Bank site firewall is available

6.3.3 Security certificates

6.3.4 Mobile device recognition before the transaction

6.3.5 Multiple ways of user's identification (password, username)

6.3.6 Code abolition after too many wrong login attempts

6.3.7 Process Timeout

6.3.8 Idle Timeout

6.3.9 Service deactivation ability

6.3.10 High safety level using Transaction Authorization Number, digital certificate

6.3.11 Bank SMS gateway

6.4 Browser Compatibility

6.4.1 Cross-browser capability

6.4.2 Users advised on ideal browser (open source preferred)

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3. Evaluation Method

Our second aim was to find out the current state of mobile banking all over the world. During Spring 2006, we extensively searched the Internet for banks offering mobile services. We looked at hundreds of banks worldwide. We were interested to identify the most mature of them with respect to their offered mobile banking services. Strange enough, big banks in highly developed countries did not provided high quality mobile banking services. We were also restricted by the language. However, many banks provided services in only one language (e.g.

French). This was a strong inefficiency of these banks. So, we compounded to evaluate 30 Banks' Web Sites (Table 7).

Table 7: Evaluated Web Sites

ABN- Ambro Bank (India) http://www.abnabro.com	Illinois Nat. Bank (USA) http://www.illinoisnationalbank.com	Oceanic Bank (Nigeria) http://www.oceanicbanknigeria.com
Access Bank (Nigeria) http://www.accessbankpls.com	Icici Bank (India) http://www.icicibank.com	OTP Bank (Hungary) http://www.otpbank.hu
Alpha Bank (Greece) http://www.alphabank.com	Industrial Bank (China) http://www.icbc.com	Piraeus Bank (Greece) http://www.piraeusbank.gr
ASB Bank (New Zealand) http://www.asb.co.nz	Istrobanka (Slovakia) http://www.istrobanka.sk	Popular Bank (Puerto Rico) http://www.bppr.com
Bank of China (China) http://www.bochk.com	Kiwi Bank (New Zealand) http://www.co.nz	Security Bank (Philipines) http://www.securitybank.com
Bank of East Asia (China) http://www.hkbea.com	Krung Bank (Thailand) http://www.ktb.co.th	Sporitelna (Czech) http://www.csas.cz
CIBC Bank (Canada) http://www.cibc.com	Maybank (Singapore) http://www.maybank2y.com	Standard Bank (South Africa) http://www.standardbank.co.za
Erste Bank (Slovenia) http://www.slsp.sk	Nanyang Bank (China) http://www.ncb.com.hk	TD Bank (Canada) http://www.td.com
Habib Bank AG (England) http://www.habibbank.com	Ned Bank (South Africa) http://www.nedbank.co.za	UBS Bank (Switzerland) http://www.ubs.com
HDFC Bank (India) http://www.hdfcbank.com	Nordea Bank (Finland) http://www.nordea.fi	Zachodni Bank (Poland) http://www.bzwbk.pl

Next, we evaluated these thirty (30) Banks' portals using MoBEF. MoBEF consists of 6 categories. Each category contains several subcategories (total: 26 subcategories). Finally, each subcategory consists of several specific criteria (total: 164 criteria). Evaluating a specific

Bank's portal, we assigned a score for each criterion. This score was from one (worst) to five (ideal) depending on the degree that the criterion in the specific bank portal was satisfied. Portals that did not satisfy at all a specific criterion were scored with (-) for that criterion. Criteria in 4.1 and 4.2 subcategories were evaluated separately for each specific channel (SMS, SIM Toolkit, WAP, PDA). Twenty one of the thirty evaluated banks offered SMS services, nine offered SIM Toolkit services, fifteen offered WAP services and all of them offered PDA services. They were also categorized with respect to their offered services, such as financial, investing, insurance, business and alert services. All these specifications help the reader to focus on the aspect he is interested in.

4. Evaluation Results

In this section, we analyze the evaluation results and draw some conclusions which would be useful to both customers and banks' officials. The vertical axes of the Figures show the number of bank sites and the horizontal axes show the scores.

Regarding the Interface category (Figure 1), the maximum score that a bank site can achieve is 95 (19 criteria times 5). Most banks scored well (between 57 and 76). Three Asian Banks clearly failed in every subcategory and scored lower than the rest. Oceanic Bank, Habib Bank AG, Access Bank, Sporitelna, CIBC Bank, Piraeus Bank, Maybank, Alpha Bank, and UBS Bank were better designed as well as more flexible and compatible than the rest. Additionally, they had a slight advantage with respect to Design Principles, Graphics & Multimedia. Regarding the Flexibility & Compatibility subcategory, all evaluated banks fell short from the ideal. Therefore, more steps need to be taken in this direction.

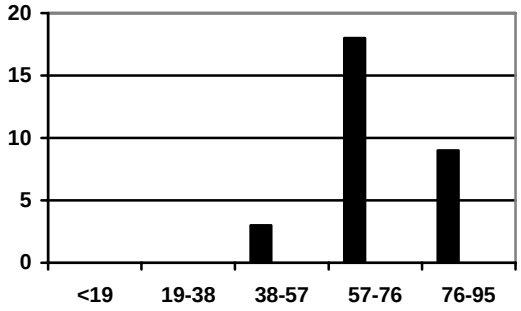


Figure 1: Scores distribution for Interface.

Regarding the Navigation category (Figure 2), the maximum score that a bank site can achieve is 120 (24 criteria times 5). Most banks scored well (between 72 and 96). Kiwi Bank, Illinois National Bank, ASB Bank, Access Bank, Sporitelna, CIBC Bank, Piraeus Bank, Maybank, and UBS Bank achieved scores over 96. These best banks provided effective Search Engine and navigation tools. Regarding the other subcategories, all banks ranked at the same level. However, five banks were a little more complex and difficult to use than the rest due to their overloaded menus, and the lack of sitemaps or tables of contents. Additionally, some of these banks did not classify properly their provided services. So, the user would be confused.

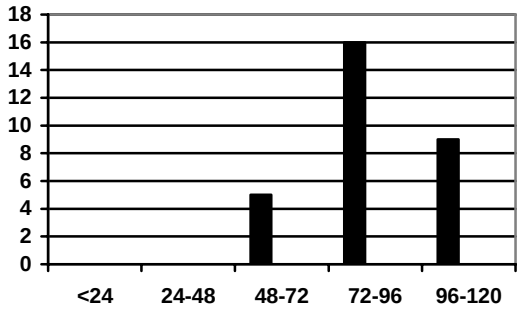


Figure 2: Scores distribution for Navigation.

Regarding the Content category (Figure 3), the maximum score that a bank site can achieve is 150 (30 criteria times 5). Most banks scored well (between 90 and 120). ASB Bank, Nordea

Bank, Popular Bank, Standard Bank, Alpha Bank, Sporitelna, UBS Bank, and Bank of East Asia achieved scores over 120. In both the Company Information & Communications and the Web site user's support subcategories, we examined the available information about the bank and the different ways the user can communicate with it. It is useful for the user to be able to be informed about the bank's history and profile or that he can communicate with the bank directly, quickly and easily. This makes the user feel secure and satisfied. Most banks met these requirements. However, two banks should provide to their users more ways to communicate with them, such as e- mail, phone and by mail, as well as 24 hour response in certain services.

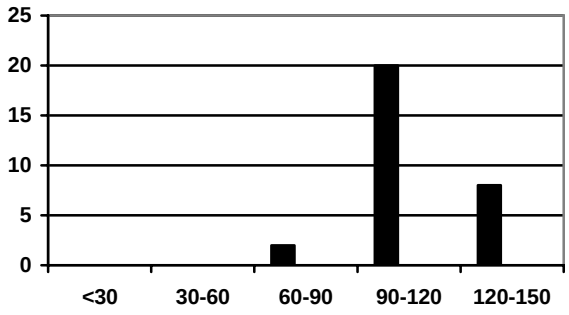


Figure 3: Scores distribution for Content.

Most bank sites lacked any Advertisements about both the bank itself and other institutions. Customers need reliable information about every interaction that they have with the bank. These issues are examined in 3.1, 3.5 and 3.6 subcategories. The scores in these subcategories were not high enough because the bank sites did not provide enough information to answer all possible questions a user may have. The user and potential customer must be completely aware of all the following: 1) charges, 2) technical requirements, 3) security, 4) mobile devices that support the services, 5) help to adjust them, 6) national and foreign mobile networks that support the services. It is very useful that the bank site offers a well designed demo and FAQs (Frequently Asked Questions) for mobile banking. In this way, the user may be

effectively informed about all these issues. There were hardly four or five banks that provide all these information in a convenient way.

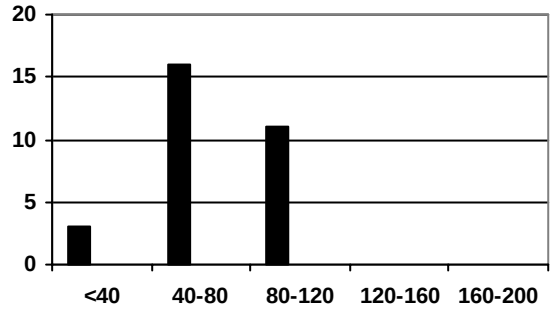
Regarding the Services Offered category (Figure 4), we present the scores in each Service type (Financial, Investment, Insurance, Alerts and Business) separately. For each Service type, we consider all possible channels (SMS, SIM Toolkit, WAP, and PDA). The maximum score that a bank site can achieve in Financial Services and Transactions is 200 (10 criteria times 4 channels times 5). Most banks scored low (between 40 and 80) and average (between 80 and 120).

The maximum score that a bank site can achieve in Investment Services and Transactions is 140 (7 criteria times 4 channels times 5). Here, the situation was even worst. Most banks scored extremely low (less than 32) and low (between 32 and 64). The maximum score that a bank site can achieve in Insurance Services and Transactions is 100 (5 criteria times 4 channels times 5). Here, the situation deteriorated. Most banks scored extremely low (less than 20). Almost all bank sites did not offer any Insurance Services to the users. The maximum score that a bank site can achieve in Business Transactions is 120 (6 criteria times 4 channels times 5). Similarly, the situation was disappointing. Most banks scored extremely low (less than 28). Almost all bank sites did not offer any Business Transactions to their business customers.

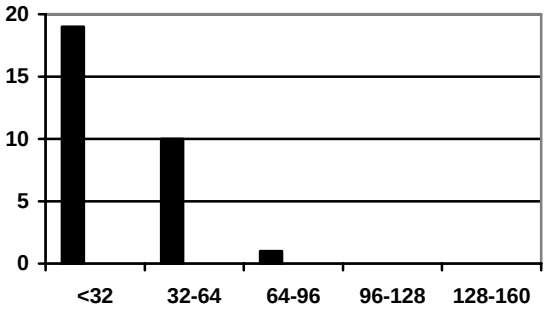
The maximum score that a bank site can achieve in Alert Services is 80 (4 criteria times 4 channels times 5). Most banks scored extremely low (less than 16) and low (between 16 and 32. Although Alerts is an extremely useful service and many users would like to have it, most banks do not support it. Finally, the maximum score that a Bank site can achieve in all Services and Transactions is 800 (40 criteria times 4 channels times 5). Most banks scored very low (between 80 and 240).

It is clearly that much work is needed to be done by all banks in order to provide to the users useful Services. The situation was worst with respect to the Investment, Insurance and Business Services and Transactions. The best banks in this category were Maybank,

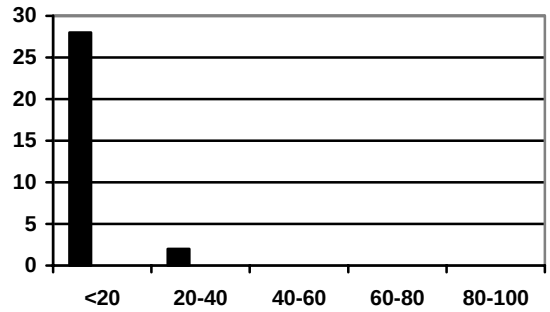
Istrobanka, Bank of East Asia, Piraeus Bank and Zachodni Bank. The rest 25 banks scored far below than these 5 Banks. They have a lot of space to cover in order to offer useful services.



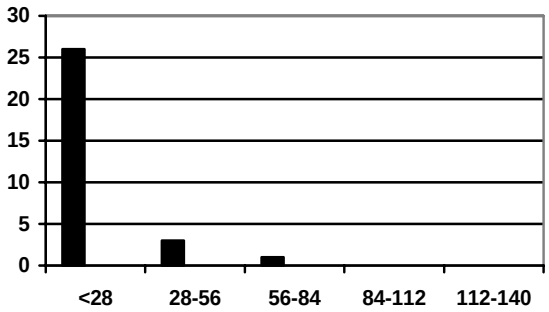
Financial



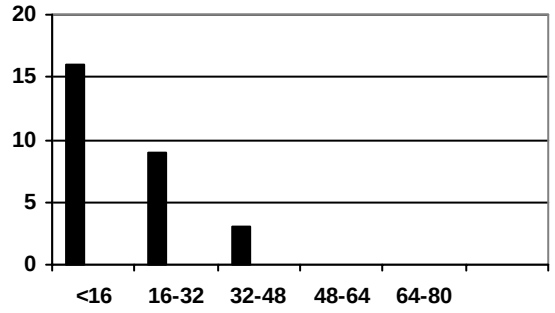
Investment



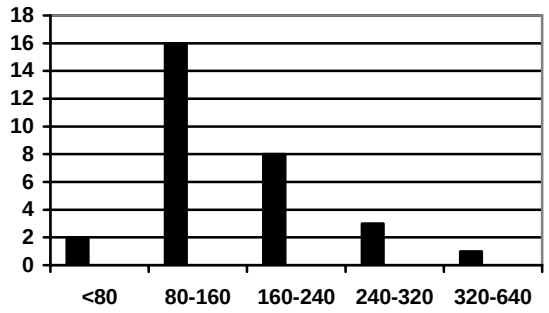
Insurance



Business



Alerts

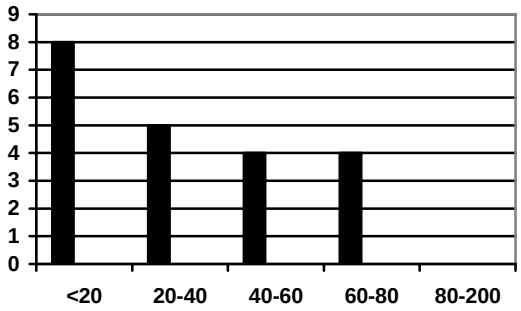


Overall

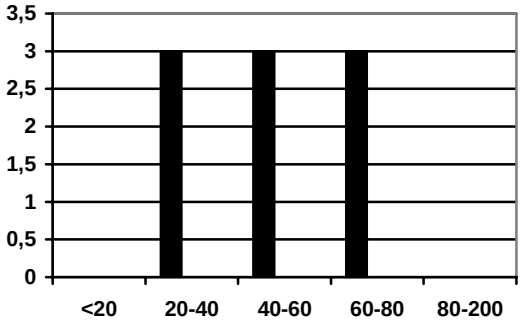
Figure 4: Scores distribution for Services Offered.

One reason that these 5 banks offered many advanced services may be that they took more restrict securities measures than most of the others (as we shall show later). Therefore, they could provide many services. However, we noticed that each one of these 5 banks did not offer all Services but it specialized in some particular Services. So, Piraeus Bank was specialized in Investments, while Bank of East Asia in Insurance. Also, Piraeus Bank, Istrobanca and Zachodni Bank offered Alerts' services. Finally, Piraeus Bank, Bank of East Asia, Istrobanca, and Maybank provided better Business banking services such as mass payment collection, tools for institutions to acquire e-payments, shop on line, ticket booking, and charity services. We also noticed that banks were more interested in providing Financial services than Insurance and Business services.

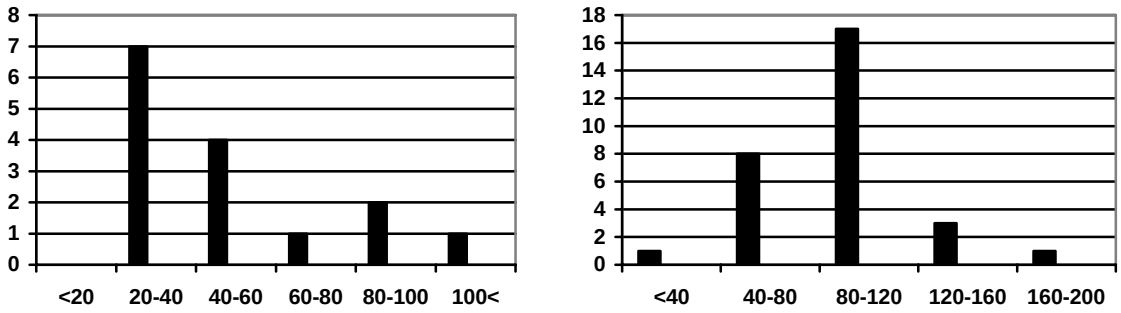
Examining the Channels through which the banks offered their Services (Figure 5), we noticed that all banks provided many services via PDAs, while only 9 banks provided SIM Toolkit services. Progress has to be made in that direction in order that a bank becomes competitive. Nanyang Bank, Bank of China, Industrial Bank, and Istrobanka scored higher than the others in SMS banking. Maybank and Istrobanka had an advantage with respect to SIM Toolkit. Zachodni Bank, Istrobanka, Piraeus Bank, and Bank of East Asia provided better WAP banking. Finally, Maybank, Piraeus Bank, Bank of East Asia, and Zachodni Bank provided better PDA services. Nordea Bank offered extra Internet banking services for palmtops.



SMS



SIM Toolkit



WAP PDA

Figure 5: Scores distribution for Provided Services through Each Channel

Regarding the Charges and Economical Benefits (Figure 6), the maximum score that a bank site can achieve is 45 (9 criteria times 5). Most banks scored low (between 9 and 18) and average (between 18 and 27). In the Charges subcategory, the lower the charges are the higher the score is. Few banks applied Charges for using their mobile banking services, so far. Moreover, there is an unchallengeable financial advantage arisen by the use of mobile banking. Transaction supplies are less or even completely absent in mobile banking. However, banks scored low in the Economical Benefits subcategory because they did not offered their services totally free. In order to speed up the mobile banking development, banks would offer all these services for free, at least in the beginning.

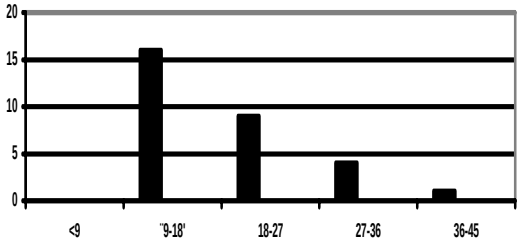


Figure 6: Scores distribution for Charges and Economical Benefit using Mobile Banking

In the Reliability category (Figure 7), we examined if the user can trust the bank site regarding the offered information and services, and if he can eagerly register. The maximum score that a bank site can achieve is 120 (24 criteria times 5). Most banks scored well (between 75 and 100). Nordea Bank, TD Bank, and Maybank achieved the highest scores. The rest banks did not fell short too much. However, all banks did not score high with respect to Registration because they did not offer to their customers the choice to register in many alternative ways. Additionally, they did not offer to their customers the opportunity to create a profile, which would automatically provide him with many personalized facilities. Similarly, they did not score high with respect to Transaction Procedure because the banks did not offer to the user a diversity of channels and the ability for the user to personalize the channel's menu according to his needs.

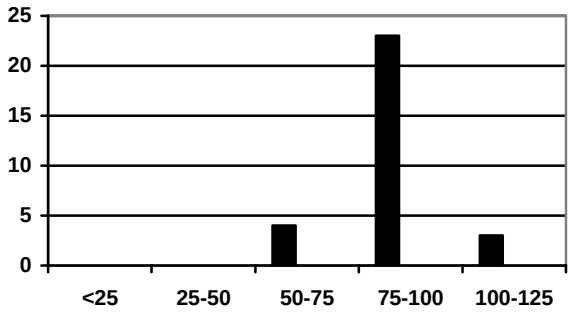


Figure 7: Scores distribution for Reliability.

In the last category of the Technical Aspects (Figure 8), we evaluated factors such as loading speed, privacy and browser's settings. The maximum score that a bank site can achieve is 90 (18 criteria times 5). Most banks scored well (between 54 and 72). They provided information on privacy and restrictions, as well alerts regarding which browsers they support. Most of them supported all major browsers (e.g. Internet Explorer, Mozilla Firefox, Netscape Navigator). Security is of vital importance. We examined which systems were used by the banks to secure the stored or transmitted data, the transactions and payments. We noticed that many banks used non-standard security systems. It was usual that a bank employed different security systems than any of the others. Standards and certified security tools should be used by the

banks. Banks would increase their security using process and idle timeout services, firewalls, higher safety levels with Transaction Authorization Number (TAN) and digital certificate, SMS Gateways, among others.

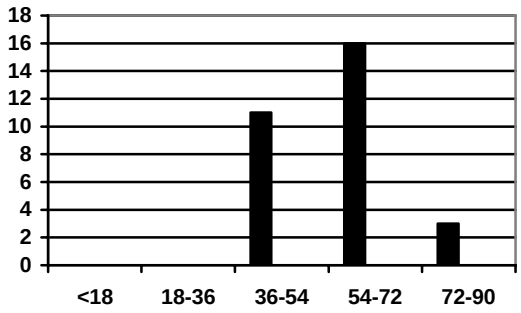


Figure 8: Scores distribution for Technical Aspects.

5. Discussion

In this paper, we presented MoBEF, a self-explanatory and comprehensive framework that can be used as guidelines for design and evaluation of bank sites which offer mobile banking services. MoBEF considers the interests of a simple customer, a business customer, and the bank itself. We classified the evaluation criteria into six major categories: Interface, Navigation, Content, Offered Services, Reliability, and Technical Aspects. Furthermore, we divided each category into subcategories (total: 26 subcategories). Each subcategory contains many criteria (total: 164 criteria). Then, we evaluated 30 bank sites using MoBEF. Figure 9 presents the overall scores distribution. Few banks exceled. Piraeus Bank, Istrobanka, Maybank, Zachodni Bank, ASB Bank, and Bank of East Asia would be considered as best cases. Other banks would take ideas from these bank sites for mobile banking development.

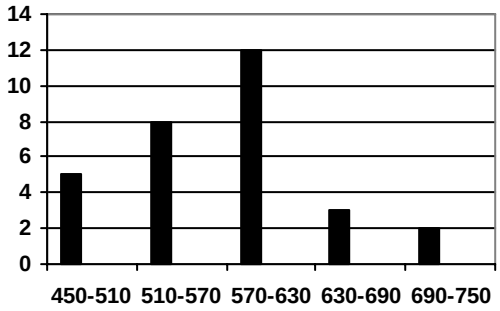


Figure 9: Overall scores distribution

Most bank sites performed well at most of the evaluation criteria. However, they failed with respect to the Offered Services. Also, more steps are needed to be taken to enhance their Interface. For example, they would offer the following: 1) printable versions of pages, 2) resizable fonts, 3) text-only version available, and 4) accommodation made for disabled users (e.g. text-to-voice and voice-to-text conversion).

In addition, it would be easy to incorporate widely available Navigation tools such as site map, search engines and table of contents. However, simplicity should be embedded in these tools so that a non experienced user is not overloaded.

Banks would improve Content by providing detailed information about the following: 1) the charges, 2) technical requirements, 3) security, 4) mobile devices that support the services, 5) help to adjust them, and 6) national and foreign mobile networks that support the services providing well designed demo and FAQs.

Regarding Reliability, most bank sites presented inefficiencies. They would offer to their customers the choice to register using as many as possible ways (e.g. via the web site, via the phone, at the branch). Also, they would offer to the customer the opportunity to create a profile. Moreover, the services would be offered through all channels (SMS, SIM Toolkit, WAP, PDA) and the user should be able to personalize the channel's menu.

Finally, banks tried to maximize the Security by using proprietary security systems. However, most of them did not use security services such as Transaction Authorization Number (TAN), SMS Gateway or a third access number, apart from username and password, provided by

phone, SMS or a special device offered by the bank. Bank sites should be accommodated with such security tools. This would enable the development and offer of more mobile banking services than currently. In order to provide more, better and advanced services, it is essential to enhance security.

Regarding the offered mobile banking Services and the mobile banking Channels, banks scored low. If banks want to replace branches with mobile banking and give to their customers the opportunity to be informed and make transactions exclusively from their mobile devices, they should add many extra services. Banks should follow the Internet banking services paradigm as a guide to offer many more mobile banking services.

6. Policy Implications on Mobile Communications

The development of effective mobile banking services would have an impact on the evolution of the mobile communications as well the banking sector. Mobile banking is both an alternative and a complement channel for conducting banking transactions.

Government would facilitate banks, businesses and citizens in using mobile services. It should ensure the accessibility to mobile banking by all people. No person should be excluded due to falling short with regards to socioeconomics, gender, age, education, remote location, abilities, etc. An open and all-inclusive society should accommodate all people irrespectively of abilities. Consideration to the support (e.g. accessibility) of persons with special abilities should be given. Furthermore, government would foster mobile communications by providing various mobile government services. For example, deadlines and notifications of tax obligations would be sent to citizens' mobile phones. Also, a citizen would be able to pay fines and permits via his mobile device. Government should also modernize the legislation regarding mobile financial transactions. It would support open source software as well standards in the development of mobile services. It would foster competition among banks as well among mobile operators. It

would also try to ensure low cost mobile communications and banking services. Banks, mobile operators (telecommunication providers, carriers) and others may try to take advantage of the mobile customers. Government should safeguard the citizens. Also, it would educate people on the mobile communications' usage, benefits and risks (e.g. security, health). Finally, precaution should be taken to assure the citizens' safety (economical, personal, etc.), privacy and security. Government would require the security and protection of all mobile communications and stored data (e.g. SSL, encryption, firewalls, VPNs) as well their proper use. Similarly, administrators of the mobile bank portals should ensure the security of all transactions and stored data.

Finally, bank associations would regularly perform evaluations of the mobile bank portals in order to identify their status. They would also design campaigns in order to raise customers' awareness on mobile banking.

7. Managerial Implications for Mobile Communications

Managers in the mobile communications as well as in the banking sector may consider the findings of this study into their strategies. Managers would continuously evaluate their offered services in order to satisfy the customers' demands and expectations.

The results of this study have implications for managers of banks, administrators of mobile banking portals, and managers of mobile operators, providers and carriers. Using MoBEF, banks' managers and mobile banking portals' administrators would identify the strengths and weaknesses of their mobile banking portal. Then, they would try to advertise their competitive advantages and correct their drawbacks. Most mobile banking portals have inefficiencies with regards to Services and Channels, Reliability, Customer Assistance and Interface Flexibility. So, managers would consider enhancing these factors. Furthermore, they would increase the customer support by providing personal guidance and assistance at bank offices, toll-free telephone numbers, online help, demos, frequently asked questions and other assistance.

Banks would be interested in increasing the number of their regular customers as well as the number of their mobile customers. Offering multiple channels would attract new regular customers. Customers would have the flexibility to use any available alternative channel. Offering easy to use, secure and reliable mobile banking would attract mobile customers. Managers would also consider offering free trials of the mobile banking services for a period of time. They would also launch training programs to educate people on using the mobile banking services. They would also make group offers to organizations' employees. Early adopters and well-known people would influence customers towards increasing the desire for and usage of mobile banking services. Furthermore, they would try to increase the usage per customer by offering many simple mobile banking services. In the beginning, they would offer these services for free. After achieving a critical mass of loyal customers, they would start charging their services. However, the pricing should be cheap, simple and clear. Otherwise, they may loose their customers. A flat rate pricing policy seems attractive.

Managers of mobile operators, providers and carriers would consider heavily safeguarding the mobile transactions against tapping. Mobile communications would be a target of illegal actions. Mobile operators would gain money both from the banks and the mobile customers. They would charge banks for offering the mobile banking services over their networks. They would also charge mobile customers for using their network. Offering many mobile services via their network, the customers would use their network many times. Regarding pricing, they would consider offering cheap and simple pricing policies in order to foster network usage (Sismanidis and Economides, 2007).

8. Conclusions and Future Research

This study presented MoBEF, a self-explanatory and comprehensive framework useful for design and evaluation of a bank's portal that provide mobile banking services. A common user,

a professional or a business would use it to evaluate mobile banking services of various candidate banks. Furthermore, bank officials and web portal designers may use it as a guide in order to improve their services. Piraeus Bank, Istrobanka, Maybank, Zachodni Bank, ASB Bank, and Bank of East Asia would be considered as state of the art cases to consider.

The major contributions of this study are the following. 1) This is the first study that evaluates mobile banking portals. 2) In contrast to previous evaluation studies of bank's web site that used few criteria, this study took into consideration a large number of quality criteria to holistically evaluate a mobile banking portal. Most of these criteria were used for first time. It also covered many different dimensions of the portal. For example, it is not enough to present a lot of information and services on the portal. It is also important that a customer easily explores and utilizes it. 3) In contrast to previous studies that evaluated the bank's web site from the point of view of an individual customer, this study evaluated the mobile banking portal from the point of view of both the individual and the business customers. 4) In contrast to previous studies that evaluated few Internet banking sites, this study evaluated 30 mobile banking portals. 5) In contrast to previous studies that concentrated on a specific country, this study evaluated a large number of mobile banking portals from around the world. So, it identified the global situation. Most bank portals did not offered many mobile services and channels. There were also reliability and interface flexibility inefficiencies. Guidelines and proposals for improvement were made.

Future research would compare mobile banking services among different countries using MoBEF. Also, the mobile banking services of a single bank may be evaluated by many users using a simplified version of MoBEF. The strengths and shortcomings of that particular bank would be identified. Then, the managers may take appropriate actions. Furthermore, repeated evaluation over time would be performed in order to investigate the mobile banking progress. Evaluation is a continuous process. Bank officials would consider to continuously evaluating their mobile banking portals in order to attract new customers and satisfy their current customer's expectations.

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