

Quantitative Evaluation of e-Banking Web Sites: an Empirical Study of Spanish Banks

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Abstract Online banking research to date is to a large extent anecdotal. Only a very limited number of studies have explored Electronic Banking in recent years. In this work an objective investigation of the issue has been conducted by manually accessing and evaluating the web sites of Spanish private and saving banks. Quality of web home pages was determined using an original Web Assessment Index, which focuses on four categories: accessibility, speed, navigability and content. A detailed report of the results arising from this investigation is presented and systematically analyzed. These findings will be useful for both researchers and practitioners who seek to understand the issues relevant to electronic banking.

Keywords: World Wide Web, Electronic Banking, Content analysis, Web design, Internet, Research paper.

1. Introduction

Web technology is transforming all business into information-based activities. The rate of technological change is so high that emerging electronic commerce is already making fundamental changes in the economic landscape, affecting every aspect of how business is and will be conducted. Many organizations have jumped on the dot-com bandwagon and implemented online systems. There is substantial evidence to suggest that e-banking is being embraced by financial institutions in developed and emerging markets to the extent that explosive growth is almost at hand. There are two different strategies for Internet banking: First, an existing bank with physical offices can establish a web site and offer Internet banking to its customer as an additional delivery channel. A second alternative is to establish an Internet-only bank or virtual bank, almost without physical offices. Recent years have seen the industry rapidly moving towards a "click and bricks" strategy that emphasizes an online supplement to the conventional banking services. Banking institutions are using their web sites not only to provide classical operations such as fund transfer or accounts information, but also to provide stock trading, bill payments, credit card request and investment advice. The purpose of this paper is to develop a web site assessment index that can be employed to compare the current usage of the Internet by Spanish banks. We begin by identifying the main factors considered as determinants of web site quality, as outlined in previous studies. Secondly we discuss the design of the web assessment index. Then, the web sites of Spanish banks are subsequently analysed using this index. Finally, the main results of this analysis are discussed and future research directions are outlined.

2. Web sites assessment tools

Evaluating the performance of business web sites has been a constant concern of researchers in different fields. A review of the recent literature on web site assessment reveals some attempts to measure web site quality (Selz and Schubert, 1997; Liu, et al, 1997; Ho, 1997; Evans and King, 1999; Simeon, 1999; Huizingh, 2000; Young and Benamati, 2000; Bauer and Scharl, 2000; Palmer, 2002). Although some researchers have tried to provide ways of evaluating business web sites specifically (Boyd, 2002; Merwe and Bekker, 2003), the selection of evaluation criteria still requires more theoretical justification. Most of the previous approaches have focused either on basic content management or a specific set of web site outcomes. The web site quality evaluation method (QEM) proposed by Olsina et al. (1999) can be considered as one of the main approaches. Amongst the main factors analysed in this study we can find: functionality (global search, navigability and content relevancy), usability (site map, addresses directory), efficiency and site reliability. However the excessive number of attributes employed raises some subtle problems of computational nature (Bauer and Scharl, 2000). The desired assessment can often be better achieved using only a few, but highly relevant features of the sample to be analysed. Most previous assessment models employ subjective factors, such as easy-access, text clearness, presentation quality, attractiveness of colours, sounds, etc. To minimize this subjectivity site evaluators should be given precise guidelines to rate each factor and a large group of evaluators is needed (Evans and King, 1999).

Trying to avoid the main weaknesses of previous models, Buenadicha et al. (2001) developed a new web site assessment index that can be employed to compare the current use of the Internet by different organizations. This model, which is shown in Figure1, has been previously employed to compare the Internet usage from the 200 largest Spanish companies (Miranda and Bañegil, 2004). According to Evans and King (1999), a web assessment tool must have five main components: categories, factors, weights, ratings and total score. The first step is to choose the categories and factors that are critical to web site effectiveness. The index used in this paper (Web Assessment Index or WAI) selects four broad categories as the basis for a quality web site: accessibility, speed, navigability and site content.

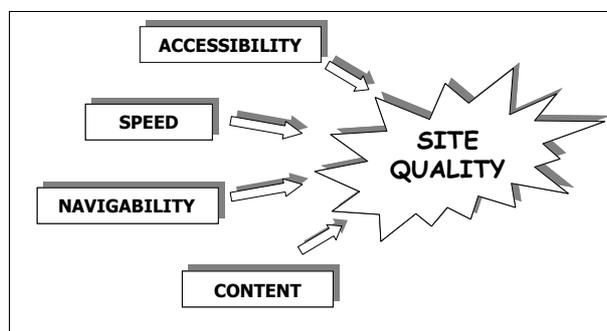


Figure 1: Web site quality assessment model.

The key factors within each category are chosen based on the literature and the researchers' experience, and must reflect what are generally considered to be important components and features of web sites by users. The first category in the Web Assessment Index (WAI) is accessibility. It is clear that the quality of a web site is increased if the site is easily identifiable and accessible to the users. However, merely counting "hits" on a page is not an accurate measurement of quality or success of a web site (Murray, 1997). To actually evaluate the accessibility of a web site, objectively measurable quantities need to be defined. Therefore, we have employed two indicators to measure this category: search engines presence and link popularity. Higher search engines rankings translate into greater traffic to the site and therefore, increase its degree of accessibility. In the present work, to evaluate this factor we have chosen Google, because this search engine is the most frequently used by Spanish Internet users.

The second indicator used to measure accessibility is the site-popularity. The most common measure of web performance is the number of "hits" a site generates. However, there are accuracy problems associated with this type of measurement, because if the page contains graphics, each graphic is counted as a new hit and because there are some methods to

artificially increase the number of hits. Therefore, the total number of hits does not necessarily correspond to the actual number of visits to the site. Taking this into account, we decided to employ a different kind of measurement: we defined link popularity as the number of external links on the web that point to the web site being analysed. The advantages of a large number of links to a site are evident: firstly, the more sites that link to you, the more traffic you can expect to receive, and secondly, major search engines will rank your pages higher when you have more links to your web site (Miranda and Bañegil, 2004). Although banking is clearly a directed and intentional activity where attracting customers with external links is not so important as in others businesses, we consider that external links could be a valid indicator of web accessibility. In this study we have used the Market position Web Service to check the link popularity of each site.

Access speed and response time are obviously very significant, because time is always a critical factor. Some studies have revealed that there is a significant correlation between web site download speed and web user satisfaction (Muyille et al., 1998; Hoffman and Novak, 1996). The access speed has been measured with a chronometer, but this recording is influenced by a great number of factors such as hardware employed, connection hour, web traffic etc. In order to minimize these sources of error, the tests were carried at the same hour with the same computer (AMD-K6 processor, with 64MB of RAM, 4 MB graphics card) equipped with a 56kbps modem connected by an ordinary phone land line (Telefonica). Internet access was gained through an independent Internet service provider (ISP). Web browsing was undertaken using the most popular browser, Internet Explorer 6.0. The sites were repeatedly accessed on consecutive days to obtain more representative averaged speed measurements. The third category in our index is what we have called navigability. Poor web design will result in a loss of potential sales due to users being unable to find what they want, and a loss of potential repeated visits due to an initial negative experience. Given that users should never feel lost, each page should be self-sufficient and provide links to the main contents. The hallmark of a good site is that the site index should always be in display, thereby making it very easy for someone to arrive at the desired location fast. So, following the research of Miranda and Bañegil (2004), the factors used to assess this category are the following:

- Permanent site menu allowing a rapid access to the different sections from every page.

- Keyword search function, for users to locate available interesting items within the company home page.

The content quality of the web site will be measured assessing the presence of information relevant to the users. A site must have content that satisfies users' needs and it should be frequently updated. Banks web sites can contain various features, including product information, contact information to enable customer feedback, general company information, etc. Important information should be immediately accessible. If 80% of your users are seeking 20% of your information, then that information should be the most visible and the easiest to access. Basic contact information of the organization should be on the main menu page and related information should be grouped together rather than scattered in different sections of the site. The factors selected to quantify content quality were based on site contents identified in previous studies (Young and Benamati, 2000; Huzingh, 2000; Buenadicha et al., 2001; Miranda and Bañegil, 2004), practitioner journals and the researchers' experience. Diniz (1998) reported that banks use the web to achieve three main objectives: to market information, to deliver banking products and services and finally as a tool to improve customer relationship. Based on the extent to which the banks have exploited these three functional opportunities in their web sites, they can be described as informational, transactional, or beyond transactional. So, we have considered three sets of factors to assess the content of a web site using a binary no/yes scale:

Informational factors: Web sites are largely informational, providing commercial and non commercial information about the bank. They can provide insight into the background of the company, partners, important customers and social policies. Another important content is the product/service description, including price, specifications, photographs, etc. Also, more recently, companies have started to use their web sites to provide information that is useful to its stakeholders, especially financial information. Therefore, we have considered the following five informational factors:

- General company information.
- Product/services information.
- Price information.
- Automatic Teller Machines (ATM) and branch information.
- Financial information.

Transactional factors: With the widespread use and adoption of the Internet, the possibility for financial institutions to provide their products and services over the Internet has become a reality.

The first distinction that we have made within this category is between those institutions that provide products over the Internet and those that only use Internet as an informational channel. The transactional contents that are found in each of the searched web sites can be included in the following categories: online communications, general inquiries (check statements and account balances), specific inquiries, funds transfers, brokerage, investment and saving services, accounts and pay cards, credit applications, tax payment and cell phone recharges.

Communicational factors: Given that web sites are often entry points to a company and visitors typically want to access information about the bank, contact information for the organization should be on the main menu page and therefore easily accessible. In order to evaluate the communicational capacity of each web site we identified whether the site contains the following items:

- Contact e-mail;
- Contact telephone;
- Contact address;
- Users feedback tools.

After defining them, all the categories and factors were weighted (based on a total of 100 points¹). Given that the site content is the most critical aspect, as it is the very reason why the site is created—to deliver and give access to certain information and services—we have assigned 55 points to this category and 15 points to each of the three remaining categories. These weightings have been assigned from the analysis of previous studies (Evans and King, 1999; Bauer and Scharl, 2000; Buenadicha et al., 2001; Miranda and Bañegil, 2004) and take into account the views of different e-banking experts. Moreover, to ensure the reliability of this assignment, 5 web sites users were recruited as evaluators. Each web site user provides the relative importance of the different categories in the instrument. First, users distribute 100 points across the 4 major categories and then further subdivide category allocations among the different subcategories. A Delphi analysis allowed us to establish the final list of items and their weights. The use of these subjective weightings may be considered as the main limitation of our study; however, many recent studies (Olsina et al., 1999; Bauer and Scharl, 2000; Buenadicha et al., 2001; Miranda and Bañegil, 2004) have employed similar weightings. Mean values of the weights obtained for the different categories and subcategories of Internet banking web sites are shown in table 1.

¹ The greater the number of points, the more important the factor is.

Table 1:-Web assessment index.

CATEGORIES	Weights	CATEGORIES	Weights
ACCESSIBILITY	15	NAVIGABILITY	15
Presence in search engines	5	Site map	10
Popularity	10	Keyword search function	5
SPEED	15		
Access speed (in seconds)	15		
CONTENTS QUALITY	55		
Informational content	20	Transactional content	20
General company information.	4	Online banking	10
Product/services information.	4	Online communications.	1
Price information.	4	General inquiries.	1
ATM and branches information.	4	Specific inquiries.	1
Financial information.	4	Funds transfers.	1
Communicational content	15	Brokerage.	1
Users feedback	6	Investments and saving services.	1
Contact telephone	3	Accounts and pay cards.	1
Contact address	3	Credit applications.	1
Contact e-mail	3	Tax payment.	1
		Cell phone recharging.	1
		TOTAL	100

Spanish banks and saving banks web sites assessment

Internet banking in European Union has evolved very fast, either in number of on-line banks or services offered through the web. The concern about the quality of this electronic banking environment raises the question on how to evaluate these on-line services. Several authors (e.g. Diniz, 1998; Jasimuddin, 2001; Vijayan and Shanmugam, 2003; Diniz, 2005) have carried out research on the evaluation of bank web sites in different countries (USA, Saudi Arabia, Malaysia, Brasil, etc.), but these studies have some limitations and none have been developed in the European Union. Our study tries to fill these gaps in the literature. One of the most relevant aspects of the Spanish financial system is the ongoing concentration process that it has gone through during the last decade. The combined number of

deposit institutions (banks, saving banks² and co-operative savings banks) has decreased in the last years, mostly by mergers. Private and savings banks are important because of their volume of business and because their activities cover all segments of the economy. The Bank of Spain's register, as of June 2002, shows 89 private banks, 47 savings banks, 88 credit unions, 84 finance houses and 49 branches of foreign banks headquartered in non-EU countries. These banks have about 17,500 branch offices, although downsizing processes in some institutions are reducing this figure. Many Spanish banks have merged to improve, in part, their position in view of the EU single market for banking services

² The Savings Banks were born with a clear regional vocation with the objective of attending to the needs of the families and businesses within their territories. At the present there are forty-six Savings Banks in Spain covering the entire national territory.

Table 2: Spanish financial system. Source: Bank of Spain

	Average 1992/2003	2004	2005	June 2006
Branches/Organization	127,42	151,24	154,64	156,32
Banks	112,46	104,18	104,55	105,25
Saving banks	343,2	457,81	476,81	484,11
Co-operative savings banks	37,92	54,93	56,1	56,84
Deposits/Branch (thousands euros)	8832,97	15470,23	17565,25	19196,10
Banks	8361,84	15424,97	17764,34	19638,92
Saving banks	9912,92	16485,3	18581,09	20184,65
Co-operative savings banks	6228,09	10823,21	12054,47	13045,76

If we take the ratio assets/branch as a measure of productivity, commercial banks generally find themselves in a better situation than saving and co-operative saving banks. Private and savings banks are of particular importance for the banking industry in Spain, because of the volume of their business and because they are active in all sectors of the economy. The number of banks with transactional websites is growing every year. There are only 5 banks that conduct business almost entirely via the Internet but approximately 92% of all commercial banks offer transactional online banking. All Spanish banks and saving banks web sites (a total of 98 sites) were visited and assessed using the WAI between April and May 2004. The ranking published in the Spanish Bank Association (AEB) and Spanish Confederation of Savings Banks (CECA) and the search engine Google were used to locate the URL for each organisation. Most Spanish banking institutions (61,9%) have a public web site in Spanish and the number increase further if we do not consider foreign banks (76,6%). Saving banks show a greater Internet presence with 93,5% of entities having a web page. Figure 2 shows the banks and savings banks on the Internet.

According to the WAI, the best web sites correspond to La Caixa and Banco Español de Crédito (Banesto). However, the most valuable output from our study is not the ability to identify the best sites, but to see how each firm site is

compared to related sites and to spot ideas and practices that can improve firm sites. Our results show a high correlation (Significant at 95% two-tailed) (0,436) between WAI and bank size, measured by amount of deposit in Euros.

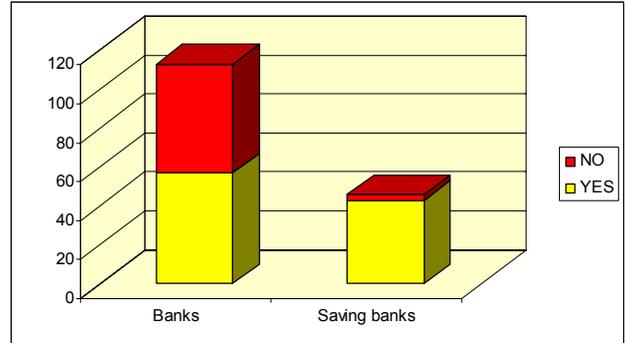


Figure 2: Banks and saving banks on the Internet

Larger banks present higher values in the WAI. The results reported in this paper present a snapshot of Internet banking providers and the services they offer as of April 2004. Figure 3 shows an outline of the results derived from the study for the top 20 institutions (according to WAI). The overall results, grouped by categories (accessibility, speed, navigability and site content), are summarized and discussed in the following sections.

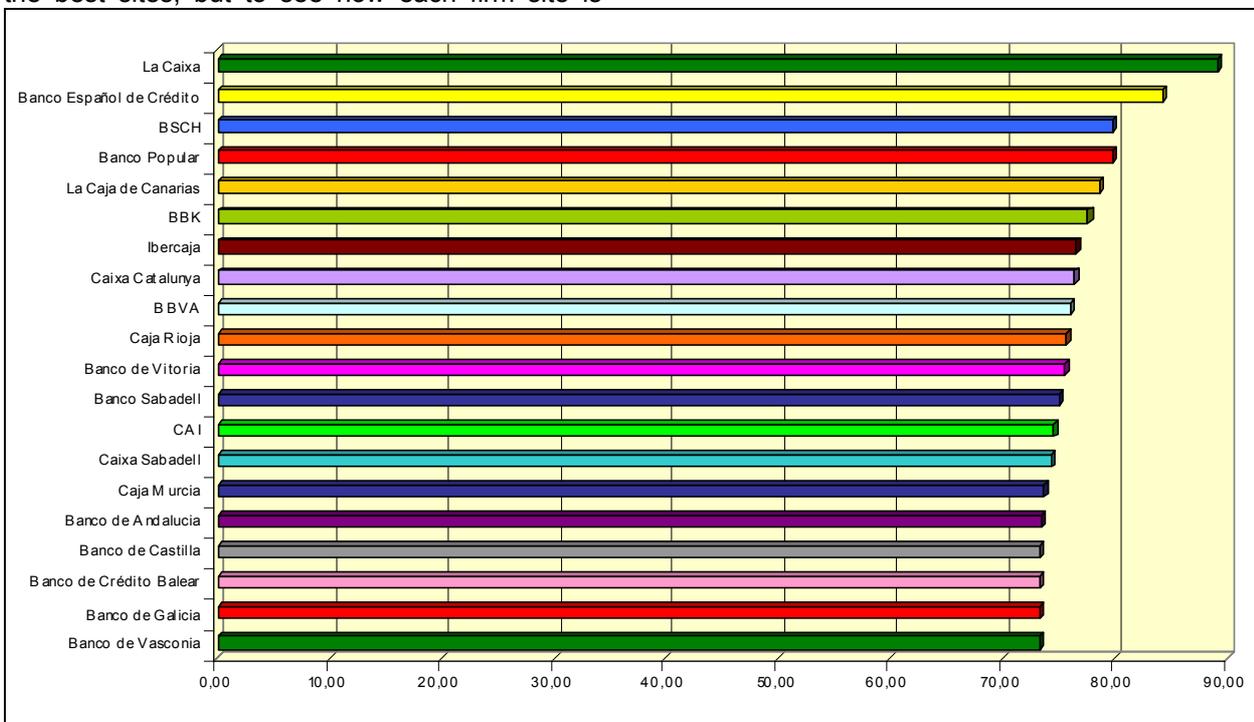


Figure 3: WAI values for the Top Spanish banks and saving banks (Each factor was measured on a 1-100 scale.)

Accessibility: La Caixa y BSCH show the greater values in this category, especially in the popularity index. In spite of that, these values are far from

those obtained by leading international firms (cf. La Caixa (9.093) vs. Microsoft with 14.261.108). Our results show a high correlation (Significant at

99% two-tailed) between accessibility and size measurements such as number of employees (0,64), number of branches (0,68) or deposit accounts (0,66). This result was expected, because larger institutions have more resources to invest in the promotion of their web sites, which implies that they are the most popular and accessible. The average accessibility of saving banks (28) was higher than for private banks (14).

Speed: Typically, those sites whose whole pages loaded quickly were also easily navigable. For users with a typical modem connection, waiting several seconds for a single page to appear is common and although telecommunications firms are researching and enacting bandwidth-boosting options like ISDN, DSL and cable modems to improve web speed and performance, transmission speed is one of the main obstacles for Internet operability. All available tools must be used to improve the speed of downloading web pages: adding servers and links, upgrading Java, using the latest releases of Real Player and Shockwave, include self-content features, etc. Banco de Depósitos and Popular Banca Privada were the sites that received the highest possible rating in this area. The range of values measured varied from 7 seconds to almost 2 minutes and there is a high inverse correlation between speed and site content as it was expected. Navigability: We assessed how easy it was to navigate around the site, to return to the home page or to find relevant information. Links to components within the site should be available from every page and

the security must be appropriate for the interactions conducted at the site (Evans and King, 1999). Almost 65% of sites provided a permanent menu or site map to aid navigation through the site. This figure was higher in private banks (81.5%) than in saving banks (44.2%). The presence of this menu is essential to avoid users from getting lost, informing them of where they are on the site and how to find the information they want. When a visitor accesses the firm site, he is usually looking for some specific information. In order to find this information quickly, the presence of a keyword search function is extremely useful. If users can access the information they seek quickly (in a few clicks) their satisfaction will be augmented and the site will probably increase the number of visitors. However, this function appears only in 36.1% of the sites analysed (48.1% of the private banks and 20.9% of saving banks sites), which indicates that the navigability of Spanish banks web sites is definitely improvable.

Site content: Site content has been assessed by considering the relevant information that must appear in a bank web site according to the needs of potential users. 12 of the site assessed achieved the highest mark in this category. Private banks must be highlighted for their high informational content. The kind of information that is most often available on the web site is ATM and branches information (95.92%) (see figure 4). Besides, information about products and services is available on 93.88% of the sites and price information in 86.73% of them.

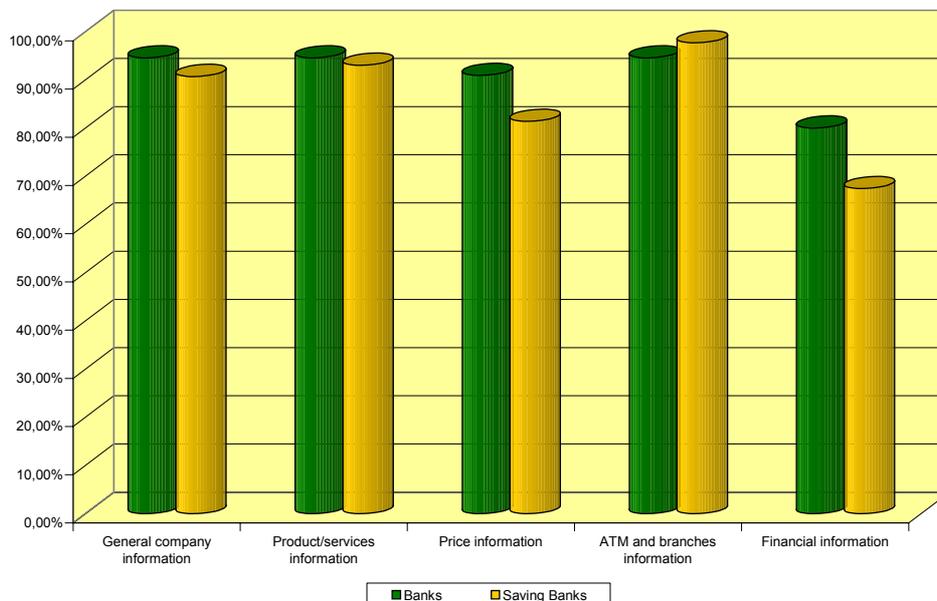


Figure 4: Informational Content

Only 89.8% of the sites analyzed in the study were transactional³, though private banks

³ In this study, a transactional site refers to a site where customers can, at least, access their accounts online.

(92.73%) have a higher percentage of transactional web sites than saving banks (86.05%). The results show that the era of electronic commerce has arrived to Spain and most institutions were motivated by Internet

business to establish a presence on the web. Most transactional Internet banks offered services of balance inquiry and other general inquiries (84,69%). Funds transfer between accounts and brokerage are also very usual, with more than 70% of institutions offering these services. Other services available include: investments and

saving counsel (59,18%), specific inquiries (57,14%), opening accounts and management of pay cards (50%), cell phone recharging (50%), tax payment (45,92%), online communications (31,63%) and credit applications (31,63%). Figure 5 shows the transactional content.

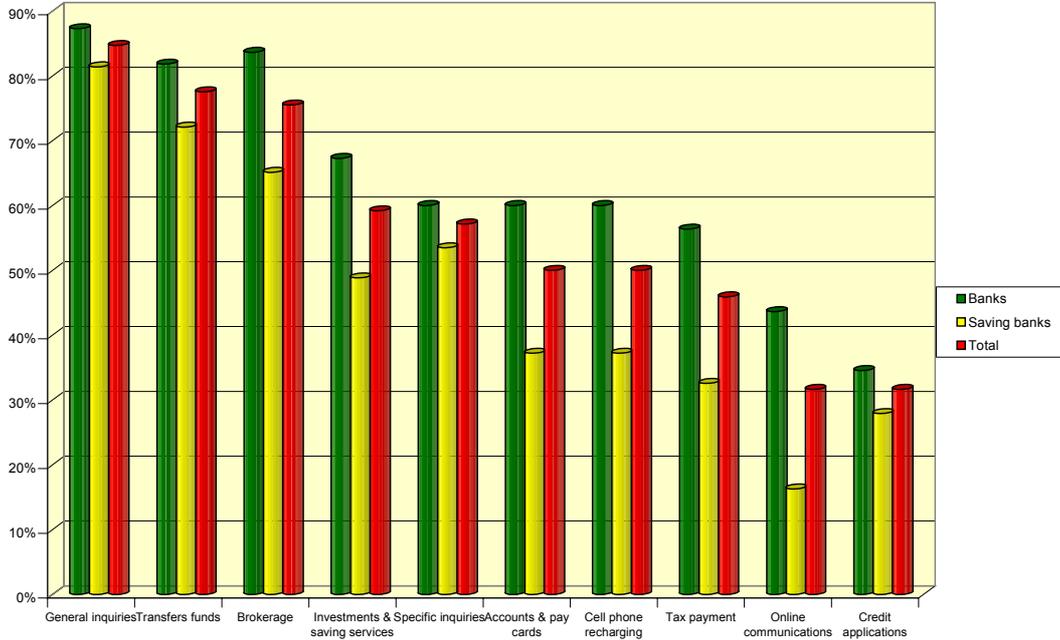


Figure 5: Transactional content

The extent of Internet banking services offered is again correlated with bank size. Larger banks offer a larger number of services as they have more available resources to invest in their web sites. Just 80.1% of the sites reviewed in the study offered users feedback tools, though once again the percentage is higher among private

banks (87.27% compared to 72.09% for saving banks). A contact e-mail address was found only in 63.27% of the web sites assessed. Most sites provide an alternate means of contacting them, with only about 85.71% of them providing a phone number and 88.78% a mailing address. Figure 6 shows the methods of communications.

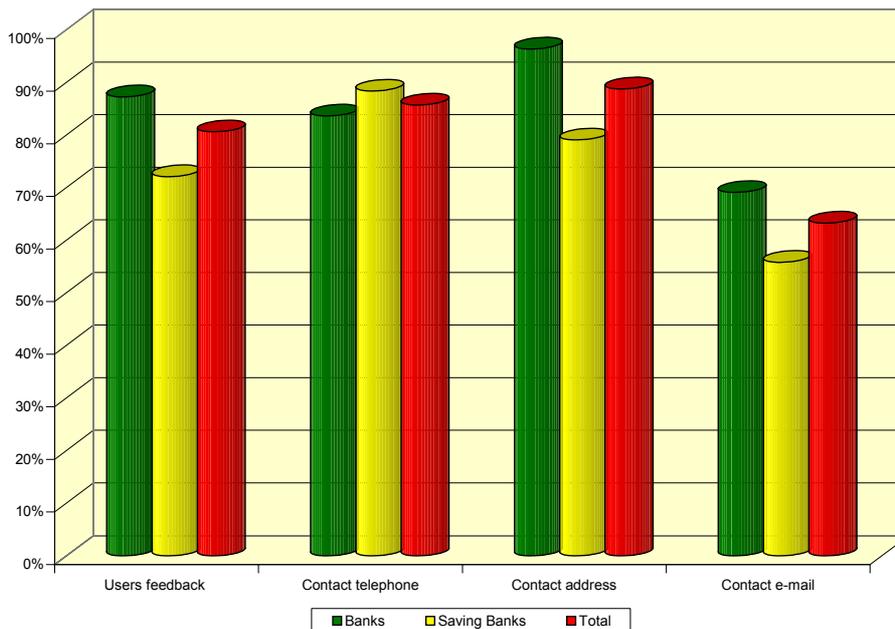


Figure 6: Communicational contents

Finally, we analyzed the number of languages versions available in each site. Only 37 per cent of the sites are translated into English, which represent a serious obstacle to the internationalization of Spanish banks and saving banks, because English is the “official” language of the Internet.

In order to complete our study we have analysed the correlation between the different constitutive factors of our index, we measured the degree of relationship between the four categories used: speed, accessibility, navigability and content. Figure 7 shows the remarkable correlations identified. Site content is significantly related with accessibility and navigability. Both correlations suggest that best designed sites are richer in content, easily accessible and navigable. It is interesting to note that navigability is also related with accessibility, and therefore easily accessible sites are also easily navigable.

The negative relationship between speed and content was also expected. More complex sites, with more informational, communicational and transactional elements, are usually slower. However, this situation can be easily avoided by distributing the content in different pages and keeping the home page as simple as possible. One way to handle this trade-off (speed versus content) is to plan intra-site links so that certain features are self-contained. Thus, a user interested in a virtual visit to the bank could click onto a specific link, learn how long the download will take and do not be slowed down if he/she is not interested in this feature. On the other hand, there is no significant relationship between speed and accessibility or between speed and navigability ($\alpha = 0.05$).

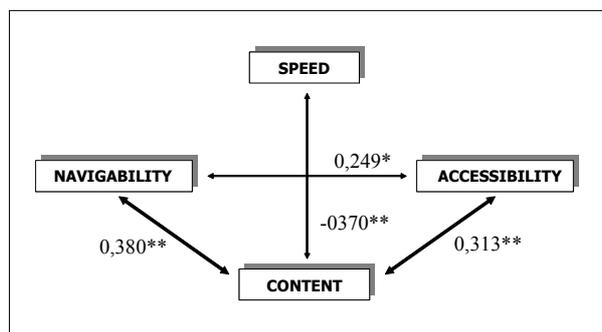


Figure 7: Bivariate correlations between factors (*Significant at 95% and ** Significant at 99%)

3. Discussion and conclusion

This paper proposes and tests a model, the Web Assessment Index (WAI), for evaluating the potential of e-banking web sites, allowing

researchers and managers to compare attributes and components of Internet sites, in order to determine the drawbacks and opportunities. The main challenge in the elaboration of the index was to avoid subjective factors, which have been predominant in previous assessment tools. Our index is based on four broad categories: site content, speed, accessibility and navigability, which are quantified in an objective and logical way. The results of the application of this index to the analysis of Spanish banks sites have demonstrated the high flexibility of the WAI and have detected the main weaknesses of the web pages assessed. We noticed that Spanish banks and saving banks sites are only in the beginning in terms of functionality. Besides, significant differences between private banks and saving banks have been highlighted. Finally, the statistical correlations among web page quality factors have been identified, in order to help firms of each industry to decide the features they should invest upon.

It is worth noting that there are several limitations for this analysis. Firstly, all the data in the survey was collected from a limited number of visits to each site at a certain time, despite the fact that the web is a highly dynamic and changeable medium. Similar studies at different times are likely to show different results. Such an evaluation over time will also shed some light on whether there is a divergence or convergence of web activities. Second concern was the subjective nature of factors weightings, which although are based on the results of previous studies and personal interviews with Internet experts, introduces subjectivity into our analysis. Nevertheless, the strength of this study lies in its foundation for future research: Having identified the critical categories and factors in the WAI, the next stage is to test this tool in different countries and measure the relationship between the index value and online banking success. Further research in this important area is currently under way. Evaluators can use this instrument easily without specific training or knowledge and, besides, the evaluation time is lower than in other assessment models (Merwe and Bekker, 2003). As further information on web design and usability methods becomes available, the assessment index presented here can be refined into an empirically validated toolkit for the design of functional corporate sites. The proposed index constitutes a suitable method for evaluating web sites and making a comprehensive analysis of the usage of the new medium.

References

- AECE (2000): "Tercer estudio sobre Comercio Electrónico en España". <http://www.aece.es>
- Bauer, C. and Scharl, A. (2000): "Quantitative evaluation of web site content and structure". *Internet Research: Electronic Networking Applications and Policy*, vol 10, nº 1, pp 31-43.
- Boyd, A. (2002) "The goals, questions, indicators, measures (GQIM) approach to the measurement of customer satisfaction with e-commerce Web sites" *Aslib Proceedings*, vol 54, nº 3, pp 177-187.
- Buenadicha, M, Chamorro, A., Miranda, F. J. y González, O. R. (2001): "A new Web Assessment Index: Spanish Universities analysis". *Internet Research: Electronic Networking Applications and Policy*, vol 11, nº 3.
- Cheung, W. M. y Huang, W. (2002): "An investigation of commercial usage of the World Wide Web: a picture from Singapore". *International Journal of Information Management*, vol 22, pp 377-388.
- Christopher, D. (1997): "Sites lacking good information design", www.netb2b.com, article 1, Sept. 14, pp 1-3.
- Diniz, E. (1998): "Web banking in USA" *Journal of Internet Banking and Commerce*, Vol.3, No.2, June.
- Diniz, E., Morena, R. and Adachi, T. (2005): "Internet Banking in Brazil: Evaluation of Functionality, Reliability and Usability". *Electronic Journal of Information Systems Evaluations*, vol 8, nº 1, pp 41-50.
- Evans, J. R. and King, V. E. (1999): "Business-to-business marketing and the World Wide Web: Planning, managing and assessing web sites". *Industrial Marketing Management*, vol 28, pp. 343-358.
- Fink, D and Laupase, R.(2000): "Perceptions of web site design characteristics: a Malasyan/Australian comparison". *Internet Research: Electronic Networking Applications and Policy*, vol 10, nº 41 pp 44-55.
- Gromov, G. R. (2000). <http://www.internetvalley.com/intvalstat.html>.
- Hoffman, D.L. and Novak, T. P. (1996): "Marketing in hypermedia computer mediated environments: conceptual foundations". *Journal of Marketing*, vol. 60, July, pp. 50-68.
- Huizingh, E. (2000): "The content and design of web sites: an empirical study". *Information & Management*, 37, pp. 123-134.
- Ho, J. (1997): "Evaluating the World Wide Web: A global study of commercial sites". *Journal of Computer Mediated Communication*, nº 3, vol 1.
- Jasimuddin, Sajjad M. (2001): "Saudi Arabian Banks on the Web". *Journal of Internet Banking and Commerce*, Vol.6, No.1, May.
- Ligos, M. (1998): "Getting real world results in cyberspace: can you measure the effects of a web site?". *Sales and Marketing Management*, vol 150, p. 71.
- Liu, C., Arnett, K., Capella, L. and Beatty, R. (1997): "Web sites of the Fortune 500 Companies: Facing customers through home pages". *Information and Management*, 31, pp. 335-345.
- Merwe, R. v. d. and Bekker, J. (2003) "A framework and methodology for evaluating e-commerce Web sites". *Internet Research: Electronic Networking Applications and Policy*, vol 13, nº 5, pp 330-341.
- Miranda, F. J. and Bañegil, T. M. (2004): "Quantitative evaluation of commercial web sites: An empirical study of Spanish firms". *International Journal of Information Management*, vol 24, nº 4, August, pp. 313-318.
- Misic, M. and Johnson, K. L. (1999): "Benchmarking: a tool for Web site evaluation and improvement". *Internet Research: Electronic Networking Applications and Policy*, vol 9, nº 5, pp 383-392.
- Murray, M. (1997): "Evaluating web impact-the death of the highway metaphor". *Direct Marketing*, vol 59, pp. 36-39.
- Muyile, S., Moenaert, R. and Despontin, M. (1998): "Introducing Web site user satisfaction: an integration of a qualitative pilot study with related MIS research", Working paper, Owen Graduate School of Management, Vanderbilt University, Nashville.
- OCLC Research Project: Measures Scope of the Web (1999). <http://www.oclc.org>
- Olsina, L., Godoy, D., Lafuente, G. J. and Rossi, G. (1999): "Specifying quality characteristics and attributes for websites". First ICSE Workshop on Web Engineering, Los Angeles, USA.
- Palmer, J. W. (2002): "Web Site Usability, Design, and Performance Metrics". *Information Systems Research*, vol 13, nº 2, pp. 151-167.
- Selz, D. and Schubert, P. (1997): "Web assessment: A model for the evaluation and the assessment of successful electronic commerce applications". *Electronic Markets*, vol 7, nº 3, pp.46-48.
- Simeon, R. (1999): "Evaluating domestic and international web-site strategies". *Internet Research: Electronic Networking Applications and Policy*, vol 9, nº 4, pp 297-308.
- Vijayan, P. and Shanmugam, Bala (2003): " Service Quality Evaluation of Internet Banking in Malaysia". *Journal of Internet Banking and Commerce*, Vol.8, No.1, June.
- Young, D. and Benamati, J. (2000): "Difference in public web sites: The current state of large U.S. firms". *Journal of Electronic Commerce Research*, vol 1, nº 3.

