END-USER SATISFACTION WITH THE INTEGRATED SYSTEM OF THE FEDERAL GOVERNMENT FINANCIAL ADMINISTRATION (SIAFI): A CASE STUDY
AVALIANDO O NÍVEL DE SATISFAÇÃO DOS USUÁRIOS FINAIS DO SISTEMA INTEGRADO DE ADMINISTRAÇÃO FINANCEIRA DO GOVERNO FEDERAL (SIAFI): UM ESTUDO DE CASO.

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ABSTRACT

Evaluating the impact of technology investments is a complex task. I examine whether the end-user satisfaction is a valid measurement of technology performance in the public sector. I evaluated information system users in the Integrated System of the Federal Government Financial Administration (SIAFI). The Siafi system supports Brazilian federal government entities. Using a survey, I collected data from 77 users. I used the model and the instrument developed by Doll and Torkzadeh (1988). I used confirmatory factor analysis to evaluate the data. The survey results validated the model used for technology employed in the public sector.

Keywords: Evaluation of ICT investments, SIAFI, End-Users satisfaction

RESUMO

Avaliar o impacto de investimentos em tecnologia é uma tarefa complexa. Esta pesquisa analisa se a mensuração do nível de satisfação dos usuários é válida para compreender o desempenho de uma tecnologia utilizada no setor público. O objeto de estudo escolhido foi o Sistema Integrado de Administração Financeira do Governo Federal - SIAFI. O desenvolvimento da pesquisa foi realizado através de uma survey da qual participaram 77 usuários. Para isto, foram utilizados o modelo e o instrumento desenvolvidos por Doll e Torkzadeh (1988). A técnica estatística empregada foi a análise fatorial confirmatória. Os resultados da pesquisa validaram o modelo utilizado para uma tecnologia empregada no setor público.

Palavras-Chave: Avaliação de investimento em TI, SIAFI, Satisfação do usuário

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1. INTRODUCTION

In recent years, technology in processing and sharing of information has evolved, allowing the use of large volumes of information. Nevertheless, investment in an information system (IS) is still very expensive. The information needs of an organization strongly influence its decision to invest in an IS. Additionally, before implementing an IS, the organization must evaluate its necessity. After deciding to purchase or develop an IS, the organization must also prepare to evaluate the operational performance of the system. Finally, after installing the IS, the organization needs tools to measure its performance. The success of the IS corresponds to the ratio between the expected result and the result reached by the system.

Research conducted over the past decades shows that IS users have different perceptions, priorities, and cultural habits. These variables influence user perceptions about the success of these systems. Fewer studies evaluate what makes a system successful or how to evaluate this success. Bokhari (2005, p. 211) suggests that an IS can be considered successful if it satisfies its users' needs and achieves the objectives and goals of the organization. However, measuring IS success is complex, because numerous factors affect its development and operation. The literature shows that this complexity leads to the development of measurement instruments that evaluate indirectly related variables, such as user satisfaction, system use, service quality, and information quality (Li, 1997; McHaney & Cronan, 1998; Doll & Torkzadeh, 1989; Ives, Olson, & Baroudi, 1983).

As noted above, user satisfaction is a measurement of IS success, but there is little research on the use of this variable to evaluate technologies in the public sector. In the Brazilian literature, two papers investigate this issue: Maçada and Borenstein (2000) and Oliveira Neto and Riccio (2003). Maçada and Borenstein (2000) conducted a case study to evaluate IS performance by measuring user satisfaction. They evaluated users in the Department of Finance of the State of Rio Grande do South (in Portuguese, *Secretaria da Fazenda do Estado do Rio Grande do Sul)*, which is a public-sector organization. The authors adapted the instrument developed by Doll and Torkzadeh (1988) to measure IS satisfaction levels. The adapted questionnaire was administered to 30 officials, who were IS users supporting budget management. The authors emphasized that the instrument was satisfactory; however, they noted that measuring the characteristics of a public entity might require alternative methods and techniques. Oliveira Neto and Riccio (2003) also aimed to develop an instrument to measure user satisfaction with an IS. They studied a sample of 143 graduate students, including users of management and financial systems, and identified four factors related to user satisfaction: feasibility, accuracy, availability, and information adequacy.

Considering this context, I propose the following question: is the end-user satisfaction level a valid measurement to understand the performance of a technology used in the public sector? To answer this question, I chose the Integrated System of the Federal Government Financial Administration (in Portuguese, *Sistema Integrado de Administração Financeira do Governo Federal,* or the Siafi) as the object of study. I seek to understand in detail how end-users satisfaction with IS performance affects organizational decisions to invest in these systems. Thus, the main objective of this research is to determine if end-user satisfaction is a valid measurement for evaluating performance of the Siafi. This research also has three secondary objectives: to determine the level of end-users satisfaction with the Siafi, according to the instrument developed by Doll and Torkzadeh (1988); to identify the main factors responsible for

the calculated index of user satisfaction; and to describe the instrument developed by Doll and Torkzadeh (1988).

This paper is organized as follows: Introduction, Theoretical Platform, Methodology, Analysis of Results, and Conclusion.

2. THEORETICAL PLATFORM

2.1 Users and end-users

The digital world that pervades our daily lives today began in the 1960s and 1970s, mostly in Western countries. Digital information (i.e., stored information) is processed and shared by using information and communication technology (ICT). A notable development of ICT is the emergence of the World Wide Web, or Internet. New digital information formats and computer network systems have since been introduced. Gradually, people have gained access to education on how to use this technology. They have developed varying degrees of skills and became users of digital information.

In the early years of IS, few people used digital information, mainly because of the expense of machinery and systems development. As prices decreased and computer networks improved, these technologies became available to more users. Thus, previous concepts of the term 'user' have been quite broad, encompassing anyone who makes or uses digital information. For example, Buntrock and Valicenti (1985, p. 203) note that the literature defines 'user' generally as a recipient of digital information and the term 'end-user' as a professional who has experience in a technical area and who uses digital information.

Farber and Shoham (2002, p. 92) find that the concepts of users and end-users has been discussed among professionals in information technology over the past three decades. They add that the concept of end-user has changed over time. They categorize the term according to the chronological stages of the digital information age: the 1970s, which represents the emergence of the IS and online information industry and a focus on the processing and distribution of information; the 1980s, which represent the expansion into menu-based systems; and the 1990s, which represent improvement in storage and distribution of information.

The first stage, which began in the 1970s, is characterized by the development of the digital IS and the first online systems. Ojala (1986, p. 197) points out that the first definition of end-user appeared during this time in a technical glossary of the International Business Machines Corporation (IBM). Ojala (1986) defines end-user as "a person accessing online databases and performing search operations for the purpose of finding information to be used by that same person rather than another." Arnold (1984, p. 71) defines end-users as those who use an IS, internet-based or not, to seek specific information.

The second stage, which began in the 1980s, is characterized by the widespread use of menu-based systems. Menu-based systems use text commands with few graphics (e.g., images, vectors, animations). Another feature of this stage, according to Farber and Shoham (2002, p. 93), is that many felt that information 'consumption' would be performed only by professionals. During this period, Bourne and Robinson (1980, p. 25) do not consider all users of digital information systems to be end-users. Rather, they define an end-user as someone who performs searches in an IS to fulfill a specific

informational need for others, such as researchers, teachers, and students. During this stage, this concept of end-user narrows further, so that it is limited to research-specialized generalists. This narrow definition is strongly influenced by academic organizations, which developed databases of books and periodicals during the 1980s (Ojala, 1986; Bourne & Robinson, 1980).

The last stage, which began in the 1990s, is characterized by the rapid advancement of technology and the evolution of digital information storage and distribution media. During this stage, the internet is the main source of digital-information sharing. According to Farber and Shoham (2002, p. 93), the digital-information industry begins to change its concepts of systems and users during this stage. The more conservative perspectives of the previous two decades do not favor these companies in the new informational market. During this stage, Brakel (1989, p. 52) defines end-users as any professionals who use updated information to assist in their activities. Similarly, Farber and Shoham (2002, p. 94) describe these professionals (e.g., researchers, teachers) as IS users who become end-users. At this stage, the end-user is a professional who seeks specific digital information to improve their performance.

My research considers the current state of the evolutionary stage of information technology and communication. To that end, I adopted the concept of end-user from the third stage, which incorporates features of the earlier stages. Figure 1 shows an analytical summary of these stages and the evolution of the concept of end-user.

Stage	Definition of end-user	Key features of the stage
1970s	Any user who uses an IS to search for information for others.	Users search for information on online systems.
1980s	Any user who uses an IS to seek specific information for personal use or for others' use.	Users need specific information extracted from an IS.
1990s	Any professional who uses an IS to seek specific information for use in his or her activities.	Professionals require specific information.

Figure 1. Evolution of the concept of end-user.

2.2 Measuring the success of an information system.

As noted in the previous section, the technologies employed in the processing and sharing of information have evolved significantly in recent years, allowing the use of large volumes of information. However, investing in an IS continues to be expensive. The informational needs of an organization strongly influence its decision to invest in an IS. According to Ives, Olson, and Baroudi (1983, p. 785), when an organization chooses to implement an IS, it needs mechanisms to evaluate the necessity of the system. After deciding on the purchase or development of a system, the organization must prepare to evaluate the operational performance of the system. Finally, after implementation, the organization also needs mechanisms to evaluate system performance. The success of this IS can be measured as the ratio between the expected result and the actual result. According to Bhimani (2003, p. 523), research conducted in the last decade shows that IS users have perceptions, priorities, and different cultural

habits. These variables influence users' perceptions about the success of information systems. This author adds another variable that influences users' perceptions of system success: the level of users' involvement in system development.

Gelderman (1998, p. 11) points out that defining IS success factors has been the main goal of research in ICT since the 1980s. A measure of this success has been converted into an object in this controversial area of study. Bokhari (2005, p. 211) posits that an IS can be considered successful if it satisfies users' needs and achieves the objectives and goals of the organization. However, measuring the success of a system is complex, because numerous factors affect system development and operation.

McHaney and Cronan (1998, p. 526) point out that, although many studies identify variables related to the success of a system, none identify precise tools to measure this success. Furthermore, Ilias, Suki, Yasoa, and Razak (2008, p. 3) state that, because of the difficulty of directly measuring qualitative aspects of an IS, researchers have opted for indirect measurement instruments. These indirect measurement instruments evaluate variables related to system users, including user satisfaction, system use, service quality, and information quality (Li, 1997; McHaney & Cronan, 1998, Doll & Torkzadeh, 1989; Ives, Olson, & Baroudi, 1983). Thus, measurement of user satisfaction is a tool that evaluates the level of success of an IS. According to Bailey and Pearson (1983):

While seeking a model of user satisfaction, it was natural to turn to efforts of psychologists who study satisfaction in its larger sense. […] The literature generally agreed that satisfaction in a given situation is the sum of one's feelings or attitudes toward a variety of factors affecting that situation.

Ives, Olson, and Baroudi (1983, p. 785) state that if a system provides the necessary information, its users will be satisfied. Otherwise, these users will be dissatisfied and will seek other means to obtain information. Thus, user satisfaction is a measure that reflects the extent to which users believe that the information provided by the system meets their needs. Previous approaches show that users' satisfaction with an IS represents a percentage, or a subjective measure, of the success of this system. Thus, satisfaction is an indirect measurement that indicates if the system is successful.

Bailey and Pearson (1983, p. 530) suggest that user satisfaction level is also a measure of IS productivity. Since IS productivity involves efficient and effective provision of information, user satisfaction can be an indicator of system performance. If users perceive a better provision of information, then the system is considered successful. Likewise, the more the information system is used, the more users believe that the system meets their demands.

2.3 The Doll and Torkzadeh model

In the 1980s, the growth of computing focused on end-users, according to Benson (as cited in Doll & Torkzadeh, 1988, p. 259) and Lefkovits (as cited in Doll & Torkzadeh, 1988, p . 259). In the traditional IS model (see Figure 2), users make information requests to the ICT team and receive information indirectly. This method requires the intermediation of ICT professionals.
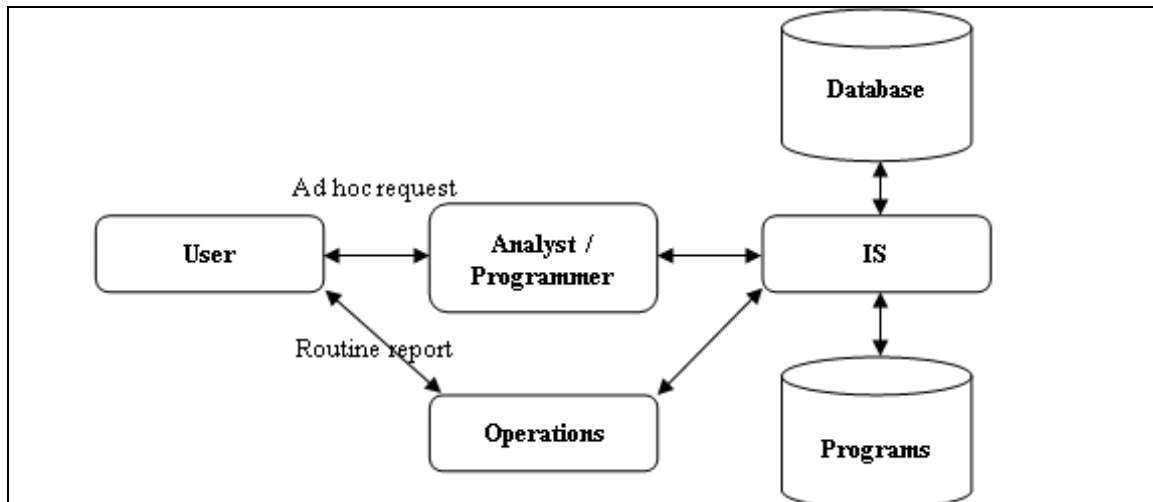
Figure 2. Traditional computing environment.

Source: Adapted from Doll and Torkzadeh (1988, p. 261).

In the end-user computing model (see Figure 3), users interact directly with IS to obtain information. The IS provides certain information that can be selected, in whole or in part, by system users.
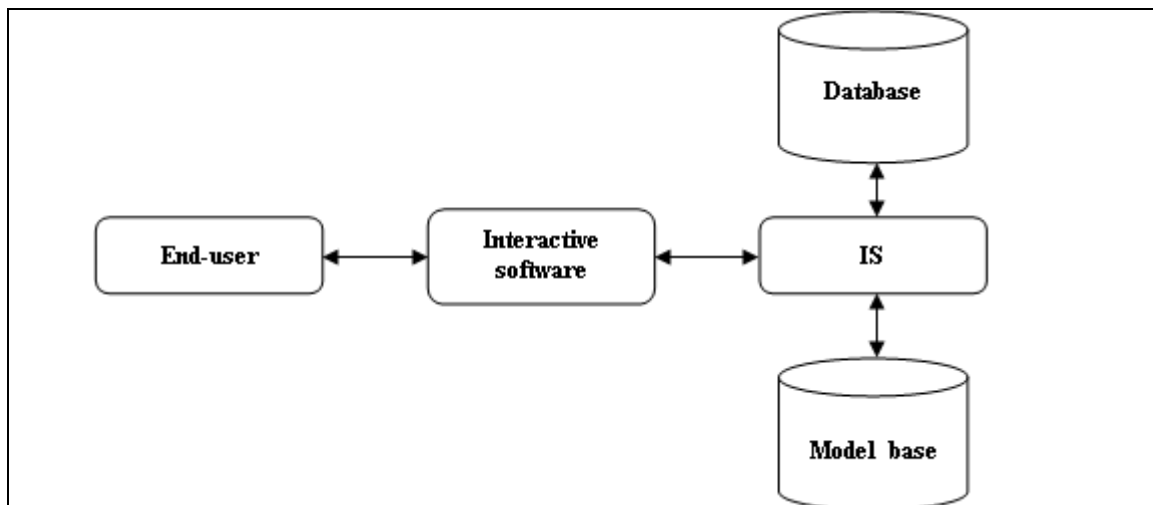
Figure 3. End-users computing environment.

Source: Adapted from Doll and Torkzadeh (1988, p. 261).

According to Davis and Olson (as cited in Doll & Torkzadeh, 1988, p. 261), two roles help differentiate between users and end-users. The first role is the decision-maker, who uses the information gathered by the system. This is the traditional model of the end-user. The second role is the IS user, who enters information or prepares reports without directly using information. In this model, information is obtained through an intermediary. In the end-user computing model, the user assumes both roles.

User satisfaction is critical to the success of an IS (Bailey & Pearson, 1983; Ives, Olson, & Baroudi, 1983). However, according to Doll and Torkzadeh (1988, p. 260),

existing measurements of user satisfaction, which are based on the traditional computing model, are unsuitable for measuring end-user satisfaction. Therefore, their study measures end-user satisfaction by using an instrument that meets the following criteria:

a. It measures satisfaction with regard to the information provided by a specific IS.

b. It includes items to evaluate the ease of use of an IS.

c. It implements a Likert scale, instead of a semantic differential scale.

d. It is short, easy to use, and suitable for both academic and practical research.

e. It is reliable and valid, and it can be used in several systems.

f. It explores the relationship between the satisfaction of end-users and other independent variables.

Doll and Torkzadeh first review the literature on user satisfaction to obtain a list of items for measuring end-user perceptions. Then they define relationships by using 40 items: 31 items are obtained from the literature review, seven items are related to ease of use, and two items are related to overall satisfaction (Doll and Torkzadeh, 1988, p. 263). Each item is categorized by a Likert scale with five items: almost never, some of the time, about half of the time, most of the time, and almost always. The questionnaire also contains open questions designed to describe the IS, including the most and least satisfying aspects. Doll and Torkzadeh then conduct a pilot study of the questionnaire in five institutions, with a sample of 96 end-users. To ensure the measurement validity of of each item, they evaluate correlations between total and individual scores. After analysis, the number of items is reduced to 18, with reliability (Cronbach's alpha) of 0.94 and a correlation of 0.81 (Doll & Torkzadeh, 1988, p. 263–264).

Doll and Torkzadeh then administer the questionnaire at 44 companies, resulting in a sample of 618 respondents. The collected data are subjected to exploratory factor analysis, using the principal components and varimax rotation extraction methods. Using a multivariate statistical technique, they obtain five factors (see Figure 4) to explain 78% of variation: content, accuracy, format, ease of use, and timeliness. Consequently, the instrument is reduced to 12 items, with reliability of 0.92 and a validity of 0.76.
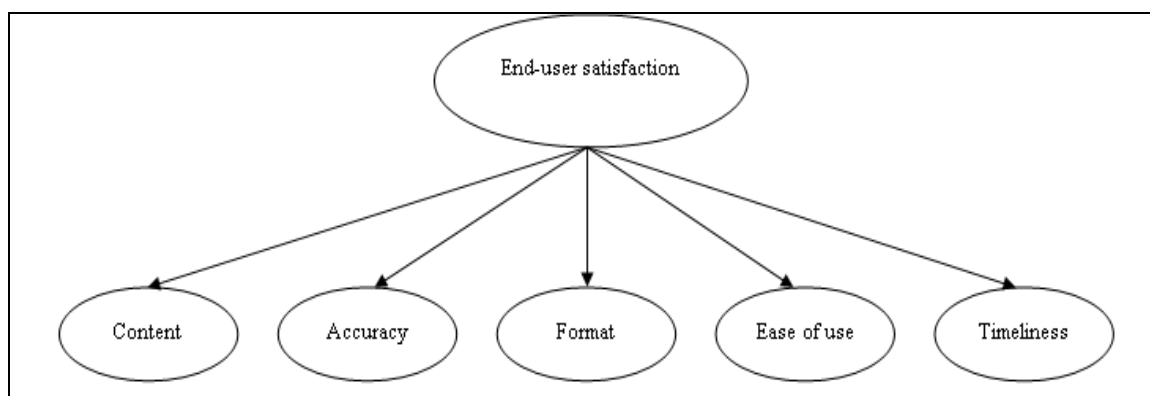

Figure 4. The end-user satisfaction model of an IS.

Source: Adapted from Doll and Torkzadeh (1988, p. 268).

Doll and Torkzadeh's evaluates the following context items:

• C1: Does the system provide the precise information you need?

• C2: Does the information content meet your needs?

• C3: Does the system provide reports that seem to be about exactly what you need?

• C4: Does the system provide sufficient information?

It evaluates the following accuracy items:

• A1: Is the system accurate?

• A2: Are you satisfied with the accuracy of the system?

It evaluates the following format items:

• F1: Do you think the output is presented in a useful format?

• F2: Is the information clear?

It evaluates the following ease-of-use items:

• E1: Is the system user friendly?

• E2: Is the system easy to use?

Finally, it evaluates the following timeliness items:

• T1: Do you get the information you need in time?

• T2: Does the system provide up-to-date information?

Doll and Torkzadeh (1988, p. 272) conclude that this 12-item instrument has adequate reliability and validity, and it can be applied to the evaluation of various systems. They also conclude that it is easy to use, because it combines distinct factors. They also point out that, although end-user satisfaction is a convenient measure to evaluate the efficiency and effectiveness of an IS, efforts are needed to develop measurement tools that evaluate the extent and degree of end-users' skills in an organization.

This instrument has received some criticism. For example, Etezadi-Amoli and Farhoomand (1991, p. 1–4) offer several criticisms. First, they claim that some of the items are not attitudinal measures (i.e., they do not measure the amount of user affection or disaffection in relation to an IS). Second, the 12 variables (items) of the instrument should have different weights, according to the scale of responses. Third, some variables do not correspond to a frequency scale that measures satisfaction. Finally, satisfaction levels in this instrument are related to a frequency, which is not always the most appropriate measurement. Roy and Bouchard (1999, p. 51) note that the instrument does not address more specific IS issues, such as support systems for executives or group systems.

Doll and Torkzadeh (1991) respond to these criticisms by noting that the instrument is intended to evaluate the level of end-user satisfaction as a dependent variable of user perception on the successful development and implementation of an IS. The instrument is not intended to predict the psychological behavior of end-users, but rather to contribute to research in the field of management information systems. The

Likert scale is suitable to measure end-user perceptions, and it makes the questionnaire easier to administer. Because of the high correlations among variables, the effects of weighting variables are barely noticeable and do not affect the proposed model. As for reducing the number of variables, the authors explain that, besides being natural in the beginning of any search, the withdrawal of variables shows low correlation and is necessary to reduce interference in the instrument. Despite these criticisms, the Doll and Torkzadeh model has been widely used and validated, as exemplified in Figure 5.

Author(s)	Sample Characteristics
Gelderman (1998)	180 technology managers
Chen, Soliman, Mao and Frolick (2000)	42 database users
Somers, Nelson and Karimi (2003)	407 IS management users
Pikkarainen, Pikkarainen, Karjaluoto and Pahnila (2006)	268 internet banking IS users
Ilias, Razak and Yasoa (2009)	90 accounting IS users
Mohamed, Hussin and Hussein (2009)	130 government sites users
Seyal and Rahim (2011)	360 internet banking IS users
Aggelidis and Chatzoglou (2012)	283 hospital IS users

Figure 5. Research using the Doll and Torkzadeh model, with and without adjustments.

For exemple, Aggelidis and Chatzoglou (2012) expanded the Doll and Torkzadeh (1988) model by adding the following attributes: system speed, interface, training, documentation, support insourcing, and support outsourcing.

3. METHODOLOGY

In this research, I used a survey technique. According to Cooper and Schindler (2003, p. 248), the survey is a technique for primary data collection that aims to identify attitudes, motivations, intentions, and expectations. I sought to determine the level of satisfaction of the Siafi end-users. For this, I applied a self-administered questionnaire composed of two parts. The first part contained 11 closed questions intended to characterize users' responses. The second part contained 12 closed questions based on the model of Doll and Torkzadeh (1988) and was intended to measure the level of satisfaction. Each question allowed responses that were organized on a qualitative and quantitative mixed scale with five options: 1 – no, 2 – little, 3 – indifferent, 4 – moderately, and 5 – completely.

This questionnaire was administered over the internet during the months of May and June 2009. Siafi end-users (i.e., federal agents seeking information to use in their activities) were invited to participate. Invitations were delivered to the e-mail addresses of the users listed in the database system. The data collected were organized and statistically analyzed. I used confirmatory factor analysis with principal components and the varimax rotation extraction methods. Factor analysis, according Bezerra (2007, p.

74), is a multivariate statistical technique that identifies variables (factors) within a group that are not directly observable. The primary goals of this technique are to reduce and summarize data. The secondary goal is to analyze the relationships among the observed variables. I used confirmatory factor analysis, because the five factors of user satisfaction are already known, according to the model proposed by Doll and Torkzadeh (1988). I used the extraction method of principal components to generate observable factors that were not correlated with each other. I used the varimax rotation extraction method to minimize the number of variables in each factor.

The sample consisted of 77 Siafi end-users, mostly male (58.4%) and between 31 and 50 years of age (63.6%). The sample was distributed geographically as follows: 26.0% in the Midwest Region (in Portuguese, *Região Centro-Oeste*); 10.4% in the North Region (in Portuguese, *Região Norte*); 18.2% in the Northeast Region (in Portuguese, *Região Nordeste*); 15.6% in the South Region (in Portuguese, *Região Sul*); and 29.8% in the Southeast Region (in Portuguese, *Região Sudeste*). Most attained a higher education level (75.3%), and 53.2% were accounting graduates. Among the accountants, 56.1% completed lato sensu postgraduate courses (see Table 1). Most users were public servants (77.9%), and most worked in Accounting Management (50.6%), Financial Management (31.2%), and Authorizing Expenditures (5.2%). Only 1.3% did not work in the budgetary, financial, or accounting areas.

Table 1 Sample – Classification according to educational level.

	Education level				
Position	**High School**	**Graduate**	**Lato sensu postgraduate**	**Stricto sensu postgraduate**	**Total**
High School – Accounting	5	-	2	-	7
High School – Others	5	6	2	-	13
Graduate – Administration	-	3	-	-	3
Graduate – Accounting	-	16	23	2	41
Graduate – Economy	-	4	-	-	4
Graduate – Others	-	4	5	-	9
Total	**10**	**33**	**32**	**2**	**77**

Source: Research data, 2009.

4. ANALYSIS OF RESULTS

The first analysis identifies the number of factors that should be retained. According Mingoti (2007, p. 105) there are some criteria to determine this quantity. The most used criteria are:

a. Criterion 1 (analysis of the proportion of the total variance): The number of factors to be retained is determined according to the percentage of variance in the original data.

b. Criterion 2 (comparison of eigenvalues): The eigenvalue is the variance of a factor. Factors are retained only if they have an eigenvalue equal to or greater than one.

c. Criterion 3 (graphical analysis of the scree-plot): The eigenvalues are ordered decreasingly and arranged graphically in relation to the number of factors to be retained. The number of factors to be retained is represented by a point of abrupt change in the graph.

I used Criterion 3 to retain five factors, the same amount as described in the original model (Doll & Torkzadeh, 1988). Thus, the model was able to explain 82.4% of the variance in the initial data (i.e., the five factors obtained explained 82.4% of the changes in the distribution of the 12 original variables.)

Figure 6 shows the scree-plot graph. The slopes of the curve indicate that the points (5, 0.587) and (9; 0.277) contain sudden changes. The most abrupt change occurs at the first point on the graph, with a change in inclination from 11.6° to 17.4°. Thus, as Criterion 3 specifies, this point indicates the number of factors to be retained. I interpreted sudden change as the change in trend function, which originally had a decreasing tendency.
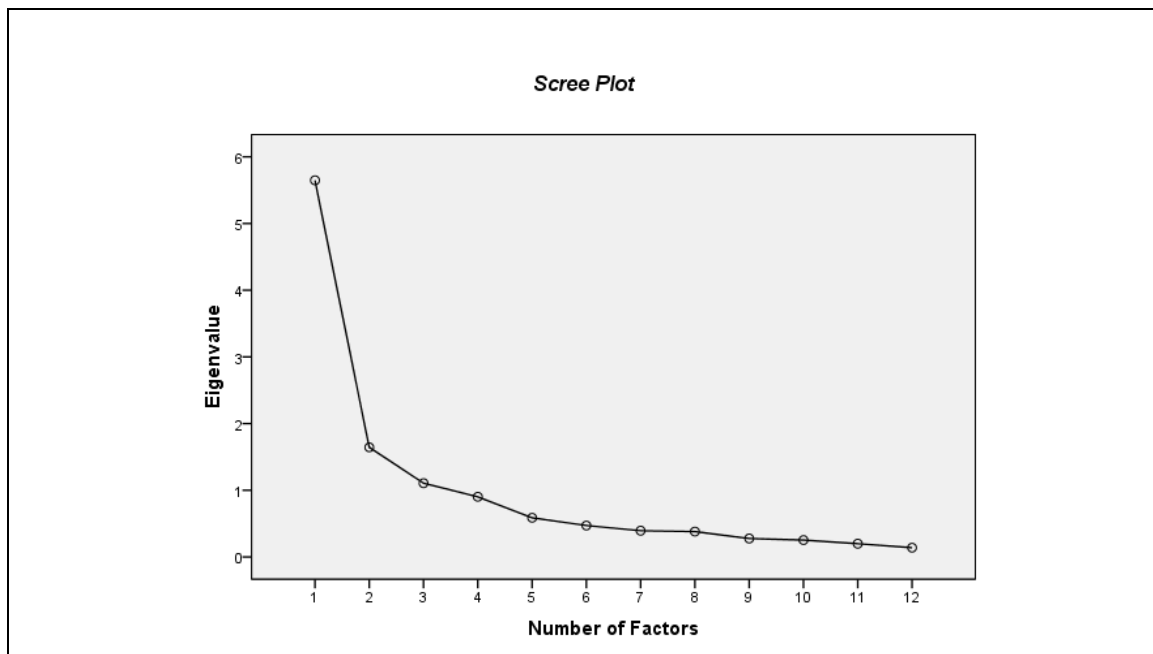

Figure 6. Screen-plot graph.

The commonality, according to Cooper and Schindler (2003, p. 467), is the variance estimate for each variable that is explained by the factors. All values were above 70%, which indicated good capacity for an explanatory model. I evaluated the adequacy of the model by using Barlett's sphericity test and Kaiser-Meyer-Oklin (KMO). Table 2 shows the values of commonalities.

Table 2: Commonalities.

	Commonalities	
Question	**Before extraction**	**After extraction**
1	1.000	0.819
2	1.000	0.832
3	1.000	0.701
4	1.000	0.749
5	1.000	0.873
6	1.000	0.873
7	1.000	0.855
8	1.000	0.701
9	1.000	0.763
10	1.000	0.808
11	1.000	0.941
12	1.000	0.970

Source: Research data, 2009.

Table 3: Tests on the suitability of the model.

Indicator	**Value**
KMO	0.836
Barlett's sphericity	0.000

Source: Research data, 2009.

The value obtained for the Kaiser-Meyer-Oklin indicator was above 0.8, which, according to the classification presented by Maroco (2007, p. 368), meant that the factor model presented a good fit. In turn, the Bartlett sphericity test showed a probability of less than 0.001, which, according Mingoti (2007, p. 138th), showed that the variables were correlated, thus validating the factor analysis.

Table 4 shows the values of the test model consistency using Cronbach's alpha. This statistical indicator assesses the internal consistency of the model (i.e., whether the issues are homogeneous and whether they allow the identification of factors implied.) The Cronbach's alpha value for the complete instrument was 0.89, a value considered suitable, since it was above 0.7 (Hair, Tatham, Anderson, & Black, 2005, p. 112). Except for the "timeliness" factor, all other factors had alpha values above 0.7 and very close to the values found by Doll and Torkzadeh (1988, p. 266–267).

Table 4: Tests on model consistency.

Factor	Cronbach's Alpha	
	This Research	**Doll; Torkzadeh**
Context	0.87	0.89
Accuracy	0.87	0.91
Format	0.76	0.78
Ease of use	0.80	0.85
Timeliness	0.53	0.82
End-user satisfaction	**0.89**	**-**

Source: Research data, 2009.

After the formation of the equations factor, the estimators of the factors were calculated. Table 5 provides a statistical summary.

Table 5: Estimation of factors.

Factor	Theoretical values			Calculated values			
	Minimum	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	**Standard deviation**
Context	-2.051	6.593	2.271	0.544	3.638	2.368	0.733
Accuracy	-2.498	6.926	2.214	-0.427	3.747	1.878	0.108
Format	-1.087	5.629	2.271	0.198	3.819	2.826	0.797
Ease of use	-3.591	6.477	1.443	-1.331	2.776	1.459	0.962
Timeliness	-2.071	6.109	2.019	1.063	3.583	2.531	0.681
End-user satisfaction	**-2.260**	**6.347**	**2.044**	**1.436**	**2.725**	**2.212**	**0.382**

Source: Research data, 2009.

The 'content' factor, which relates to the information that can be extracted from the system, indicated that users were indifferent (i.e., the factor caused neither satisfaction nor dissatisfaction.) The 'accuracy' factor, which relates to the accuracy of information produced by the system, indicated that respondents had some dissatisfaction. The 'format' factor, which relates to the provision of information provided or accessed, indicated that users had some satisfaction. The 'ease of use' factor, which relates to aspects of system operation, indicated some dissatisfaction from users. The 'timeliness' factor, which relates to availability and updating of system information, indicated that respondents were indifferent. Overall, the average level of satisfaction was statistically much higher than three and less than four, which means that Siafi users were only slightly satisfied with the Siafi IS.

5. CONCLUSIONS

Considering the role of the Siafi as a tool for recording and controlling budgetary, financial, and accounting activities of the Brazilian federal government, I sought to examine whether user satisfaction is a valid measurement of IS performance in the public sector. I analyzed responses from Siafi end-users, who were professionals working in the budgetary, financial, and accounting areas and who sought specific information in this IS for use in the performance of their organizational activities. Satisfaction levels were measured using the model and instrument proposed by Doll and Torkzadeh (1988). This model consisted of a questionnaire with 12 items. It showed that the level of user satisfaction was a second order factor composed of five primary factors: content, accuracy, format, ease of use, and timeliness.

The survey results validated the model. I used factor analysis with multivariate statistical technique to obtain a model with an explanatory power of 82.4%. Moreover, the model achieved good levels of fitness and consistency. According to these results, Siafi end-users showed little satisfaction with this IS. Users showed some satisfaction only for the 'format' factor, dissatisfaction for the 'precision' and 'ease of use' factors, and indifference to the other factors. Thus, the measurement of user satisfaction with public-sector information systems was validated. This measurement may be considered for use as a tool for evaluating ICT performance.

There were some limitations in this research. For example, sample size was limited. Although the results of auxiliary tests validated the sample size in this study, an increase in the number of respondents may reduce margins of errors and foster the discovery of new relationships between variables. Also, the use of a single tool for users of ICT does not allow research findings to be generalized. Thus, the findings and conclusions reached were, in principle, valid only for the Siafi. Future research should include increased sample sizes and the use of other tools to assess the level of user satisfaction.

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