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ANTECEDENTS OF END-USER SATISFACTION WITH AN ERP SYSTEM IN A TRANSNATIONAL BANK: EVALUATION OF USER SATISFACTION WITH INFORMATION SYSTEMS

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ABSTRACT

The main objective of this study is to identify the antecedents of end-user satisfaction with an Enterprise Resource Planning (ERP) system, in the context of a transnational Bank. The Information System (IS) success theory is applied for the end-user computing satisfaction (EUCS) assessment. Quantitative data is analyzed through multivariate statistical techniques whereas qualitative data is analyzed through content analysis technique. The results indicate that the EUCS model is pertinent to the context of ERP systems for a fast data collection and overall perception of user satisfaction; nevertheless it is suggested the continuity of its evaluation in other research contexts and additional categories should be considered as antecedents to IS end-user satisfaction.

Keywords: ERP system, information system success, end-user satisfaction, system quality, information quality.

1. INTRODUCTION

ERP is a kind of information technology (IT) outsourcing (Aalders, 2001, Lacity, & Willcocks, 2004) and its concept originated from MRP (Material Requirements Planning) in manufacturing firms implementing IS in stock control, supply chain management and co-ordination between finance, sales and manufacturing operations (Trott & Hoecht, 2004). Therefore, ERP is viewed as a "broad set of activities supported by multi-module application software [IS] that help a manufacturer or other business manage the important parts of its business…" (Free On Line Dictionary of Computing, 2009). Today, Customer Relationship Management (CRM), Enterprise Asset Management (EAM), Product Lifecycle Management (PLM), Supply

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Chain Management (SCM), and Supplier Relationship Management (SRM) are among the ERP solutions offered by software suppliers.

According to Arc Advisory (2009), the worldwide market for enterprise applications is expected to grow US$43 billion by 2011, what represents a compounded annual growth rate of 8.3 percent over the next five years. The ERP market is worth US$18 billion and is expected to reach US$25 billion by 2011 at a compounded annual growth rate of 6.7 percent. These numbers reflect the need of enterprises to reengineer their processes through the adoption of an ERP, integrating them, as well as becoming more business focused and competitive. Supporting the adoption of an ERP, the market (ERP suppliers) is assumed to have competence in offering the appropriate technology for the main organization processes. Diverse sectors like health, tourism, transport, education, government, banking, etc., are users of ERP solutions.

Despite the significance of the business opportunities that these data suggest, the ERP client-supplier relationship is not always an easy and simple task. According to Rockford Consulting Group (2009), more than 60% ERP implementations historically fail. While most studies have focused on the factors related to the adoption, unsuccessful implementations, or even in identifying approaches for a better ERP implementation (Huang, Chen, Hung, & Ku, 2004; Ioannou & Papadoyiann, 2004), few have been dedicated to evaluate the perception of its users (Yang, Ting, & Wei, 2006).

In this sense, this study explores the end-user satisfaction with an ERP, in the context of six European branches of a South American transnational bank, with the purpose to answer the following question: *What are the antecedents of end-user satisfaction with a bank ERP?* For this, the main objective of this work was to assess the end-user satisfaction regarding a strategic ERP system, which has been used for more than eight years by those branches. The Doll, Deng, Raghunathan, Torkzadeh and Xia (2004) End-User Computing Satisfaction (EUCS) model was adopted. The validity of EUCS model was tested as a secondary objective of this study, along with the identification of opportunities for its improvement.

2. END-USER SATISFACTION IN ERP SUCCESS

Looking for the dependent variable of IS success, DeLone and McLean (1992) identified six categories: **system quality**, **information quality**, **information use**, **user satisfaction**, **individual impact**, and **organizational impact**. Through these categories, they proposed a model for IS success with a process type approach, as illustrated in Figure 1, instead of treating them independently. According to the model, **system quality** and **information quality**, singularly or jointly, affect positively or negatively **information use** and **user satisfaction**. Moreover, the amount of **information use** can affect **user satisfaction**, as well as the contrary, the latter affecting the former. They also posited that **information use** and **user satisfaction** are direct antecedents of **individual impact**, which would suggest some **organizational impact**.

In fact, the measurement of IS success is multidimensional and the research focus will indicate which categories will be more appropriate. Several researchers have

used this perspective to some extent to assess IS success based on the DeLone and McLean model (Zviran, Pliskin, & Levin, 2005; Nelson & Wixom, 2005), where **user satisfaction** category was reported as the one of the most researched (Ives, Olson, & Baroudi, 1983; Baroudi & Orlikowski, 1988; Chang & King, 2000; Adamson & Shine, 2003; Doll *et al*., 2004; Wixom & Todd, 2005). Chin and Lee (2000, p. 554) define **end-user satisfaction** with an IS as an "overall affective evaluation an end-user has regarding his or her experience related with the information system [IS]", being both IS use and other activities related (e.g., training, participation or involvement in development or selection) "of value in predicting subsequent behavior (e.g., utilization) or performance".

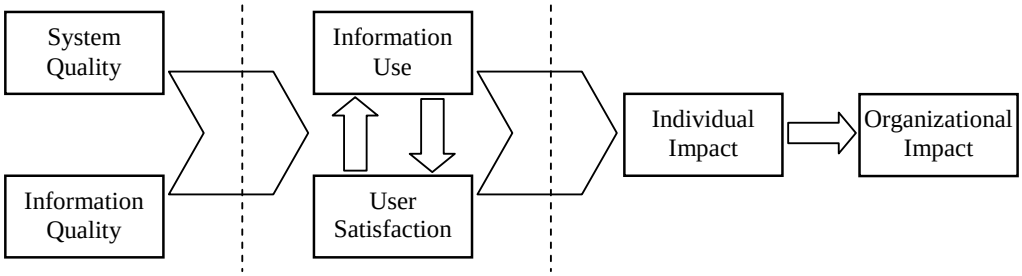

Figure 1 – IS Success Model

Source – DeLone and McLean (1992)

The real-time environment of current IS applications is characterized by end-users interacting with them directly to input data as well as making queries (search for data) for specific decision making purposes. In this environment, end-users assume more responsibility in operating these applications and, as a consequence, they obtain an adequate perception about how they are served by them. This perception is extended to management level personnel who do not necessarily interact directly with the applications, but are mainly end-users of the information produced by them to run the business. The first kind of user would be characterized by Doll and Torkzadeh (1988) as a **computing user**, while the latter an **information user**. They also defined **end-user computing satisfaction** (EUCS) as an "affective attitude towards a specific computer application by someone who interacts with the application directly" (p. 260), definition that can be adapted to **information user** regarding the information they receive from the application.

The **Information quality** category is associated with the output of an IS (Yang *et al*., 2006), be the data on paper, electronic file or even on a monitor screen; while **system quality** category refers to the system that processes the information required to output, which represents user perceptions about his or her interaction with the system during the tasks performed (Nelson & Wixom, 2005). **Individual impact** category is the effectiveness of the IS in decision making by users, helping their understanding, problem identification, learning, etc., predicting the **organizational impact** category in terms of cost reductions, productivity gains, increased market share, return on investment or assets, staff reduction, etc. (DeLone & McLean, 1992).

For the six categories presented in the IS Success Model, DeLone and McLean (1992, p. 88) recommended "further development and validation before it could serve as a basis for the selection of appropriate I/S [IS] measures. In the meantime, it suggests that careful attention must be given to the development of I/S [IS] success installments". That's what this study is all about as it evaluates end-user computing satisfaction with an ERP system.

3. METHODOLOGY

The descriptive-exploratory survey strategy was developed with the objective to investigate a contemporary organizational phenomenon, which is complex and non dissociable from its real-life context. The site was six European branches of a large retail South American bank whereas the unit of analysis was the end-user satisfaction with an ERP system adopted for process automation of these branches.

The selection of the bank (assets over US$500 billion and among the 10 largest American banks) in the context of the ERP used by its European branches resulted from: a) the ERP is viewed as a strategic tool in the management of internal processes and business performance of the branches; b) the license contract with the ERP supplier being more than US$2 million; c) the same ERP automates the six branches in six different countries, which creates an opportunity for a wider perception of the system; d) ERP is a market leader; e) ERP has been used by the branches for more than eight years, a situation which allows for a deeper perception of the end-users; and f) authorization of the bank to develop this research.

3.1 DATA COLLECTION AND INSTRUMENT

Data collection process took place in the period between December 8th 2005 and January 20th 2006. The survey used the EUCS instrument from Doll *et al*. (2004), which has 12 items distributed in five dimensions (see Table 1), where the corresponding variables treated in this study were also associated. **Content**, **accuracy**, and **format** can be considered constructs (or dimensions) of **information quality**, as they refer to the output of the IS; while **timeliness** and **easy use** to **system quality**, **timeliness** being partially related to **information quality** as it evaluates the currency of information (if it is up-to-date).

The Doll *et al*. (2004) model seems to be very appropriate for the objectives of this study as it has been "widely used and cross validated to measure a user's satisfaction with a specific application", evaluating in few items aspects of information and system quality dimensions shared by other models that use more extensive items (Rivard, Poirier, Raymond, & Bergeron, 1997; Nelson & Wixom, 2005). In this sense, the model facilitates data collection for a fast overall perception, besides being considered a "surrogate for system success" (p. 229) from the user satisfaction standpoint, which is the focus of this paper.

A seven point Likert scale (1 for strongly disagree and 7 for strongly agree) was used in these 12 items, instead of the Doll *et al*. (2004) scale of five points. According

to Hair, Anderson, Tatham, & Black (1998, p. 186-187), “the more points you use, the higher the precision you will obtain with regards to the intensity with which the person agrees or disagrees with the statement". The results of Cronbach's Alpha (see Table 4) show that the internal consistency of the scale was maintained, which assured the reliability of the instrument.

The instrument also aggregate an item (variable **satisf**) to evaluate the overall satisfaction of the respondent with the ERP system (“You are satisfied with the system”), using the same scale interval as the prior 12 items, besides an open-ended question (“Below, feel at ease to write any commentaries you’d like to do regarding your use of the system”), aiming to obtain general perceptions of the respondent about the ERP system. For Patton (2002, p. 21), the purpose of this question is to “enable the researcher to understand and capture the points of view of other people without predetermining those points of view through prior selection of questionnaire categories”. In this sense, the open-ended question provided flexibility and openness to respondent exposure about his or her points of view relating to the ERP system, which enhanced the richness of the research.

Table 1 – The Five Dimensions of End-User Computing Satisfaction

Dimension	Items	Variables
Content	1. The system provides the precise information you need	cont_1
	2. The information content of the system meets your needs	cont_2
	3. The system provides reports that seem to be just about exactly what you need	cont_3
	4. The system provides sufficient information	cont_4
Accuracy	5. The system is accurate	acc_1
	6. You are satisfied with the accuracy of the system	acc_2
Format	7. The output of the system is presented in a useful format	form_1
	8. The system information is clear	form_2
Timeliness	9. You get the information you need from the system at a suitable time	time_1
	10 The system provides up-to-date information .	time_2
Easy Use	11 The system is user friendly .	easy_1
	12 The system is easy to use .	easy_2

Source – Adapted from Doll *et al*. (2004)

Closing the instrument, a demographic item (variable **demogr**) asked about the length of time the respondent had interacted with the system (less than 1 year, between 1 and 3 years, between 3 and 5 years, and more than 5 years). The instrument was pre-tested respecting the content of the 12 EUCS items, even in relation to the English language, which is considered a common language in the six branches. No difficulty or suggestion for modification was reported, which can be viewed as a result of past validation of the EUCS instrument.

3.2 SAMPLE AND DEMOGRAPHIC PROFILE

The sample was formed by the end-user computing employees of the branches, whose tasks are executed in direct interaction with the ERP system. The survey instrument was sent by e-mail to the branch executive managers who asked the employees to respond. A total of 63 responded instruments distributed in the six branches were collected electronically and returned by e-mail.

The demographic profile of the respondents is showed in Table 2, where the quantity (Qty) per branch is also shown. Only one respondent from the BRAN-5 branch participated in the survey, while BRAN-2 branch had the most participants (20). Moreover, there is a major concentration of respondents with more than five years' experience (58.5%) in using the ERP system. Considering a population of around 100 respondents in the branches researched, the sample was considered representative as it reached 63% of the total, showing characteristics of independence and randomness in their selection from the researcher standpoint.

Table 2 – Time of the end-user with the IS

Branch	**< 1 year**		**1 - 3 years**		**3 – 5 years**		**> 5 years**		**Total**	
	Qty	**%**	**Qty**	**%**	**Qty**	**%**	**Qty**	**%**	**Qty**	**%**
BRAN-1	-	-	1	11.1	-	-	8	88.9	9	100
BRAN-2	2	10.0	7	35.0	4	20.0	7	35.0	20	100
BRAN-3	2	15.4	2	15.4	1	7.7	8	61.5	13	100
BRAN-4	-	-	-	-	-	-	9	100.0	9	100
BRAN-5	-	-	-	-	1	100.0	-	-	1	100
BRAN-6	2	18.2	2	18.2	2	18.2	5	45.5	11	100
Total	**6**	**9.5**	**12**	**19.1**	**8**	**12.7**	**37**	**58.7**	**63**	**100**

4. RESULTS AND ANALYSIS

Two main methods of analysis were applied to the data collected: structural equation modeling (SEM) and content analysis (CA). The first, a second generation statistical technique, was used with the purpose of confirmatory factor analysis (CFA) of the EUCS model. The second was applied to qualitative data (text) from the open-ended question.

4.1 STRUCTURAL EQUATION MODELING

SEM is a technique to examine a series of dependence relationships at the same time, which is attractive for two main reasons (Hair *et al*., 1998): a) it deals with multiple relationships simultaneously while providing statistical significance; and b) it assesses the relationships comprehensively and provides a transition from exploratory to confirmatory analysis. This study intends to present the confirmatory analysis as it works with a validated model (Doll & Torkzadeh, 1988). Before this, it was analyzed the quality of the data.

4.1.1 DATA QUALITY ANALYSIS

As recommended before, the application of any multivariate data analysis technique aiming at a better prediction and more accurate dimensionality measuring (Kline, 1998), the quality assessment of the data collected was evaluated in terms of missing data, outliers, and assumptions of multivariate analysis. The SPSS™ software was used in the analysis of data quality.

Missing data per variable stayed below the conservative limit of 5% (Tabachnik & Fidell, 2001), one being identified as missing in **time_2** and in **demogr** variables, which were estimated by the **expectation-maximization** method. No outlier with either a univariate, bivariate, or multivariate perspectives was identified. From a univariate perspective, the cases remained outside the limit of 2.5 standard deviations, considering a sample of fewer than 80 cases (Hair *et al*., 1998). From a bivariate perspective, when the combinations of two variables were analyzed through scatterplots (dispersion graphics), there was no observation that could be considered for deletion. Nor from a multivariate perspective, as the Mahalanobis distance (D^2) didn't indicate any case with a D^2 value larger than twice the next highest value (Hair *et al*., 1998).

Tests for the assumptions of multivariate analysis considered the requirements of normality, linearity, and homoscedasticity. Normality was assured through the examination of statistic values (z) of skewness and kurtosis of each variable, which remained within the acceptable range of -1.96 to +1.96 for p=0.05 (Hair *et al*., 1998). Linearity was observed with a scatterplot between the most distant variable from normality characteristics (**time_1**) and the closest (**time_2**), considering z values of skewness and kurtosis. An ellipse was formed with an oval shape; there was no curvilinear relationship (Tabachnik & Fidell, 2001). Finally, homoscedasticity was a consequence of normal data distribution of each variable, besides the distribution of

time_1 and **time_2** (more discrepancy between each other than in relation to normality) exposing proportional variability (Tabachnik & Fidell, 2001).

Indeed, the quality of the data was considered appropriate for the CFA application, mainly because of the sample size, which reached slightly more than the minimum recommended of five observations per item (Hair *et al*., 1998), being in fact 5.25 (63 observations per 12 items).

4.1.2 CONFIRMATORY FACTOR ANALYSIS

CFA measured the fitness between the model and observations collected through statistic significance, generated by the AMOS™ software (see Figure 2). Once the fitness of the model to data researched was assured, the next step was to evaluate reliability (composite reliability and extracted variance) and construct validity (convergent and discriminant).

The estimation technique defined was **maximum likelihood estimation** (MLE), since it is the most common and has provided valid results for small samples like 50 observations (Hair *et al*., 1998). The estimation process was **direct estimation**, when the model is directly estimated from the chosen estimation technique (MLE). Therefore, each parameter is estimated with its confidence interval, which is originated from the sampling error. This process is executed just one time over the study sample.

The next steps were an initial evaluation of unreasonable estimations and the analysis of model fitness. In relation to the initial estimation, high correlation was perceived between the following pairs of constructs: **format** and **content** (0.738), **format** and **accuracy** (0.852), **format** and **timeliness** (0.922), **format** and **easy use** (0.818), **timeliness** and **accuracy** (0.764), and **timeliness** and **easy use** (0.762). Furthermore, the error variance **er_6** of variable **acc_2** had a negative value, besides a standardized coefficient slightly superior to 1.0 (1.029, in fact). A lower variance of 0.007 (Dillon, Kumar, & Mulani, 1987) to **er_6** was established, producing the value 0.998 to that standardized coefficient (p<0.001). Once these adjustments were implemented for acceptable estimations of the overall model, its fit was assessed with goodness-of-fit measures.

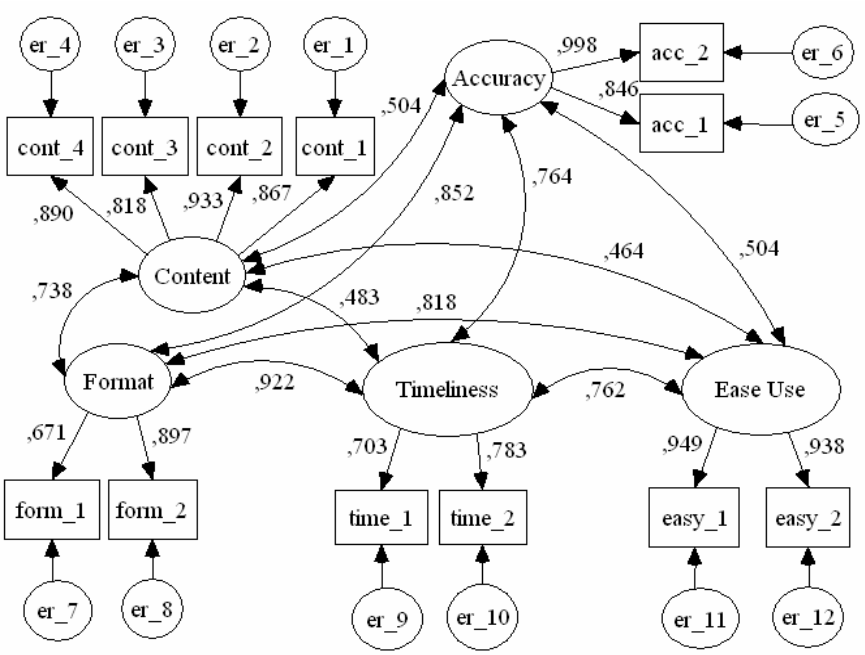

Figure 2 – Results of Confirmatory Factor Analysis (factor loadings)

In CFA, the fit of the generic model shows the degree to which the indicators represent their constructs, being evaluated through three measure sets (goodness-of-fit measures) of observed variance matrix and that previewed from the proposed model (Hair *et al*., 1998): a) **absolute fit measures**, that assess only the overall model fit (structural and measurement, collectively) with **normed chi-square** (ratio chi-square over degree of freedom or χ^2/ DF), **goodness-of-fitness index** (GFI), **root mean square residual** (RMSR), and **root mean square error of approximation** (RMSEA); b) **incremental fit measures**, which compare the proposed model to a null model, using **Tucker-Lewis Index** (TLI) and **normed fit index** (NFI); and c) **parsimonious fit measures**, that measures the fit of the model per estimated parameter with **goodness-of-fit index** (GFI), **normed-chi-square**, and **comparative fit index** (CFI).

The application of multiple measures provides greater consensus regarding the acceptability of the model. These measures are presented in Table 3 and their overall values are within the minimum limits recommended for overall model acceptance, suggesting the model is an acceptable representation of the established constructs.

Since the overall model EUCS was accepted for measuring the ERP end-user satisfaction, the next step assessed the measurement and structural models. This step analyzed the measurement model fit, when each construct was assessed separately for the examination of indicators weights (loadings) in terms of statistical significance, as well as for the examination of composite reliability and extracted variance. All loadings (arrows linking constructs to their indicators in Figure 2) were superior to 0.50 (Hair *et al*., 1998) for $p<0.001$.

Table 3 – Indexes of measurement model fit

Indexes	**Recommended Values** (Kline, 1998; Hair *et al*., 1998)	**Values**
χ^2	-	64.216
DF	-	45
X^2/ DF	< 3 and preferable between 1 and 2 ($p < 0.05$)	1.427 ($p = 0.031$)
GFI	High values (~1) indicate model goodness-of-fit	0.872
RMSR	Next to zero	0.097
RMSEA	< 0.10	0.083
NFI	> 0.90	0.906
TLI	> 0.90	0.955
CFI	> 0.90	0.955

Table 4 shows the values of the composite reliability, through Cronbach's Alpha, and extracted variance. All constructs had composite reliability superior to the minimum recommended of 0.70 (Nunnally, 1978), being impressive in the constructs **content**, **accuracy**, and **easy use**, which presented values superior to 0.90. Regarding extracted variance, all the constructs had values above the acceptable minimum of 0.50 (Fornell & Larcker, 1981). Then, based on the examination of the indicator weights, composite reliability, and extracted variance, the convergent validity was observed. So, the measurement model was accepted.

Table 4 – Composite reliability and extracted variance per construct

	Composite Reliability	**Extracted Variance**
Content	0.928	0.789
Accuracy	0.914	0.946
Format	0.751	0.805
Timeliness	0.709	0.775
Easy Use	0.942	0.827

The analysis of the structural model involves the inspection of a matrix with construct correlations, where high correlations (>0.90 or >0.80, if more conservative criteria) suggest corrective action like the deletion of one of the constructs or modification in the causal relationships (Hair *et al*., 1998). According to Table 5, the correlations can be marked between the constructs **format** and **timeliness** (0.922);

format and **accuracy** (0.852), and **format** and **easy use** (0.818). Another criteria is the squared multiple correlations (R^2), or covariance, having the indicators **form_1** and **time_1** obtained less than 50% of explained variance (Kline, 1998), or R^2 x 100, by their respective factors **format** and **timeliness** (see Table 6), for p<0,001. As a result, the discriminant validity wasn't confirmed and the structural model couldn't be considered accepted. Kline (1998, p. 198) suggests that "no single method provides a definitive test of whether the researcher's specifications about measurement are correct. Also, construct validity in not typically established in a single study".

Table 5 – Matrix of construct correlations

	Content	**Accuracy**	**Format**	**Timeliness**	**Easy Use**
Content	1.000	0.504	0.738	0.483	0.464
Accuracy	0.504	1.000	0.852	0.764	0.504
Format	0.738	0.852	1.000	0.922	0.818
Timeliness	0.483	0.764	0.922	1.000	0.762
Easy Use	0.464	0.504	0.818	0.762	1.000

Table 6 – Squared multiple correlations (R^2)

Fator	**Content**				**Format**		**Accuracy**		**Timeliness**		**Easy Use**	
Indic.	cont_1	cont_2	cont_3	cont_4	form_1	form_2	acc_1	acc_2	time_1	time_2	easy_1	easy_2
R^2	0.752	0.870	0.669	0.792	0.450	0.805	0.715	0.998	0.494	0.613	0.900	0.880

Table 7 exposes the respondent perceptions regarding each the EUCS item through median values per item, in which an interval was considered between 1 (not satisfied at all) and 7 (totally satisfied), according to the interval scale adopted. The overall impression is that the 12 **system** and **information quality** attributes were not a cause of a remarkable dissatisfaction nor satisfaction related to the ERP system, even though there was a slight dissatisfaction in item 11 ("The system is user friendly"). The item used to obtain an overall satisfaction perception of the respondent (variable **satisf**) corroborated this finding as it reached a median value of 4. This situation gives importance to the open-ended question, aiming at practical considerations for both the constructs used as for the causes of the neutral overall perception.

Table 7 – End-user satisfaction with the ERP system

Construct	**Content**				**Format**		**Accuracy**		**Timeliness**		**Easy Use**	
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Median	4	4	4	4	4	4	4	4	4	4	3	4

4.2 CONTENT ANALYSIS

CA was the method adopted to investigate the textual answers from the open-ended question of the survey. On analysis of the data collected from the documents, interviews and researcher observation, the technique of qualitative content analysis was applied through categorical analysis (Bardin, 1977, p. 153). The unit of significance, or register, was *themes* (thematic analysis). In this way, the categorization criteria were semantic and non syntactic (aggregating verbs, adjectives, pronouns, etc.) or lexical (aggregating by the sense of the words) (p. 118).

The themes are clippings of units with variable length extensions, including several sentences. For the categorization of the themes a category system was designed based on the target of the open question - user satisfaction. Nevertheless, the category system was not sufficiently exhaustive to restrict the analysis with the **tunnel vision** effect (Miles and Huberman, 1994, p. 85), which would jeopardize the perception of unusual data having important significance to the research (Marshall and Rossman, 1995).

This prior category system took into account the constructs of the Doll *et al*. (2004) EUCS model as well as from other variant end-user satisfaction models (Rivard, Poirier, Raymond, & Bergeron, 1997; Nelson & Wixom, 2005; Wixom & Todd, 2005) that were based on DeLone and McLean (1992) IS Success Model. These categories were segmented in **system quality** and **information quality**, referring to the first as "perceptions of the system itself and the way it delivers information", and to the second as "dimensions that determine the user's perception of the quality of the information included in the system" (Wixom & Todd, 2005, p. 91). The categories were illustrated with a respondent citation in quotation marks between parentheses (e.g., "My limited exposure [to the system] has not been a positive experience…").

System quality defined categories were: a) **timeliness** or the degree to which the system offers timely responses to requests for information or action ("The system is sometimes quite slow…"); b) **flexibility** or the versatility of the system to be adapted to changing or new demands of the end-user ("As requirements for central banks and for branch administration change a lot, the system is not flexible to meet these new requirements…"); c) **ease of use** or how easy the system is to operate for accessing or extracting information ("I find it difficult to get what I want…"); d) **integration** or the way the system allows data to be integrated from various sources or different areas of the business ("Other systems are needed to find and feed information of input…"); and e) **reliability** or the dependability of system operation or trustworthiness of its

continued performance ("Would it be useful to have an option which could prevent us from paying the same invoice twice…").

Information quality defined categories were: a) **accuracy** or the user's perception that the information is correct ("The profit figures produced by the system in 2000 were completely incorrect …"); b) **currency** or the user's perception of the degree to which the information is up to date ("General ledger [monetary transactions in the form of debits and credits] is not real time…"); c) **content** or the degree to which the system provides all necessary information ("The system doesn't provide us with all the information we need for our control…", "The available information does not quite meet our requirements…"); and d) **format** or the user's perception of how well the information is presented ("There are a lot of reports for each [system] module but none for an overall view…").

Even though the category system proved its adequacy according to respondent´s answers, other categories were needed to support a broader view for the assessment of **system** and **information quality**. One of them was **functionality**, conceptualized in this study as being the degree to which the system functionalities provided satisfaction to end-user needs ("As we are in Administration and Accounts, payable is one of our functions which [the system] doesn't support…"), being linked to **system quality**. Two more categories were also identified for the context of supplier **service quality**, defined as an attitude or global judgment of how superior the service is (Robinson, 1999) if compared to prior expectations (Parasuraman, Zeithaml, & Berry, 1988): a) **dependability** (Russell & Chatterjee, 2003), a synonym for **reliability** in SERVQUAL model (Berry, Zeithaml, & Parasuraman, 1990) meaning the supplier's ability to meet schedule and provide a reliable and accurate service ("Any new product [feature of the system] is always delivered late…"); and b) **support** or supplier providing easy access for clients questions related to system problems ("We can not ask the system supplier directly to solve problems or user-questions...").

The claim for the **service quality** category was already identified by DeLone and McLean (2003) when they discussed the utility of IS Success Model updated with this category for measuring the e-commerce system success, category that was confirmed in the model by Petter and McLean (2010) in a meta-analysis assessment. De Lone and McLean (2003) argued for **service quality** category "as a consequence of the changes in the role of IS over the last decade" (p. 18) and made reference to SERVQUAL model. Even though this model has its origin in marketing discipline and has been applied to different services areas (Prayag, 2007; Kumar, Kee, & Charles, 2010) it has been a reference to evaluate IT services (Landrun, Prybutok, & Zhang, 2010).

The categories list was completed with two more ones, both related to **knowledge quality** of the employees to permit a better interaction with the ERP system (Bailey & Pearson, 1983; Baroudi & Orlikowski, 1988): a) **training level** or training received by the user for using the system ("The branch needs special trained staff which we do not have…"); and b) **system understanding** or how well the user knows the system ("We don't know its [the system] maximum potential…"). Other categories could already be added to the list, but this study was interested in end-user satisfaction antecedents and the new potential ones were related to the impacts caused by user

satisfaction, both in an individual sense ("A number of manual adjustments are necessary to obtain information [as needed]…"), producing **task overload**, as in an organizational one ("For more efficient and better software services the market presents better products and the Bank is able to save a lot of money…"), associate with the **benefit- cost ratio**.

Analyzing the categories and respective respondent citations, it can be considered that an instrument for end-user satisfaction assessment needs a broader range of items to obtain a more precise picture of the respondent´s perceptions. In this sense, the categories of **system** and **information quality** must have their constructs incremented, according to the category system defined. Other categories must also be taken into account, mainly in relation to **service quality**, as the differentiation between product (ERP system) and corresponding services becomes even more blurred for a quality perspective (Parasuraman *et al*., 1988), giving importance to the client-supplier relationship (Gronroos, 1988). The process defined for this relationship must guarantee the appropriate knowledge for using the product (i.e., ERP system) by end-users. If the end-users don't know the system very well, it's difficult for them to express a suitable perception.

Indeed, as there is an extensive use of alternative ways for an ERP system to perform the tasks in the branches ("Our reporting requirements may be obtained by queries and a special module [local applications]…", "We use lots of queries and excel sheets to prepare the reports…"), which compensate the lack of information or functionalities in the system, it seems that the day-to-day tasks of the branches don't suffer from the risk of discontinuity. Nevertheless, this surely impacts their efficiency, be it from an individual (**work overload**) or organizational (**benefit-cost ratio**) standpoint, which points to more two DeLone and McLean (1992) categories – **individual** and **organizational** impacts.

5. FINAL CONSIDERATIONS

This study explored the antecedents of end-user satisfaction related to a specific ERP system used by a bank using the Doll *et al*. (2004) EUCS model as an empirical reference. The results obtained demonstrated the need for a broader range of constructs so as to have a more precise assessment of that satisfaction, like those of **service** (**dependability** and **support**) and **knowledge quality** (**training level** and **system understanding**) categories. Variant end-user satisfaction models helped in the identification of these two categories, which were not part of the original DeLone and McLean (1992) IS Success Model, even though **service quality** was included in the model revision (DeLone and McLean, 2003; Petter and McLean, 2010).

It is not possible to disqualify the appropriateness of Doll *et al*. (2004) instrument, as it facilitates data collection (only 12 items) and covers both **system** and **information quality** categories as antecedents of **end-user satisfaction**. It can be very suitable for collecting overall perceptions with a high rate of respondents in a short research period, besides being recommended for a broad range of system applications and respective comparability of results (Doll & Torkzadeh, 1988). Anyways, following

DeLone and McLean (1992, p. 88) suggestion "…careful attention must be given to the development of I/S [IS] success installments".

Among the identified limitations of this research are (a) the lack of discriminant validity of the EUCS model did not permit construct validity, even though the convergent validity was confirmed; (b) with the exception of the **content** construct of this model, all others have only just two indicators, limiting the effect of indicator exclusion as a corrective action in confirmatory factor analysis; (c) the limited possibility of generalization of the findings, as the study was restricted to a specific bank with a specific ERP system; and (d) the new categories identified through content analysis technique may be subject to question, since the content, as a whole, is not exhaustively treated (Bardin, p. 115). Regarding this last item, Bardin (1977, p. 115) emphasizes the fact that, although valid in the making of specific deductions on a precise inference category, it is not valid in general inferences. But its potential remains precise in exploring the reduced *corpus* of data and establishing more discriminating categories. So, it is suggested the continuity of assessing the EUCS model fit.

As practical contributions, the present study applied an end-user computing satisfaction model to an ERP solution, whose projections for increased adoption by enterprises imposes a close examination of how well it is perceived by end-users. As an assessment model, end-user satisfaction helps the management of ERP client-supplier relationship. Moreover, the suggested improvement of antecedent categories, along with their respective constructs, has a practical effect in IS managerial practices for business success from an end-user satisfaction perspective. Finally, future research is expected to integrate **system, information**, and **service quality** in the assessment of end-user satisfaction, in which the perception of information user will also be considered.

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