Analysing the impact of a business intelligence system and new conceptualizations of system use

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Abstract

Purpose – In this study, three models were empirically compared, the DeLone and McLean model, the Seddon model and the Modified Seddon model, by measuring the impact of a business intelligence system (BIS) in companies in Peru. After that, the mediators and dependent constructs were analysed to determine if they were behaving properly (a good level of variance explanation and significant relations with others constructs). The study used a sample of 104 users of the BIS, from companies in several important economic sectors, in a quasi-voluntary context and with six constructs: information quality, system quality, service quality, system dependence (system use), user satisfaction and perceived usefulness (individual impact).

Design/methodology/approach – To interpret the results, the authors used structural equations. The idea was to look for the best fit and explanations for the outcomes. The main difference in these models is that the DeLone and McLean model considers system dependence (system use) as a part of information system success, but in the Seddon model, it is a consequence of it.

Findings – The Seddon model seems to show the best fit and explanation for the outcomes. After that, a review of the system use construct was realised, because of its limited variance explained and the few significant relations with other constructs, to improve its explanation power in future research.

Research limitations/implications – It is estimated that the sample includes more than 15 per cent of all the companies that use a BISs in Peru, so the size of the sample is adequate, but it is not entirely random and therefore limits the generalizability of outcomes. Besides that, a sample size that is bigger could be better for the sake of making a more detailed analysis, permitting the use of some items with less power, or the use of another statistical procedure for structural equations such as the Asymptotical Distribution Free, permitting a more detailed analysis (Hair *et al.*, 2006).

Originality/value – Business intelligence (BI), one of the most important components of information systems (IS), is playing a very relevant role in business in this time of high competition, high amounts of data and new technology. Currently, companies feel pressured to respond quickly to change and complicated conditions in the market, needing to make the correct tactical, operational and strategic decisions (Chugh and

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Grandhi, 2013). BI is one of the most important drivers of the decade (Gartner, 2013). Big companies of IS are creating special units specialised in BI, helping companies become more efficient and effective in daily operations.

Keywords DeLone and McLean model, Seddon model, System use construct, Impact of a business intelligence system

Paper type Research paper

1. Introduction

Business intelligence (BI), one of the most important components of information systems (IS), is playing a very relevant role in business in this time of high competition, high amounts of data and new technology. Currently, companies feel pressured to respond quickly to change and complicated conditions in the market, needing to make the correct tactical, operational and strategic decisions (Chugh and Grandhi, 2013).

BI is one of the most important drivers of the decade (Gartner, 2013). Big companies of IS are creating special units specialised in BI, helping companies become more efficient and effective in daily operations. The field of BI is evolving at a fast speed, to become more innovative and obtaining knowledge of the data stream in a way never before done. Today innovative programmes of BI in all industries are being implemented (Chen *et al.*, 2012; Sharda *et al.*, 2014). A company that uses a business intelligence system (BIS) can be more effective and efficient and can disseminate knowledge inside the company, with business partners, improving the decision-making process and making the enterprise more competitive (Parzinger and Frolick, 2001). Measuring the impact of BIS is very important to get the best outcomes and increase the investment return rate.

In the last 40 years, there have been developed several models to measure the impact of IS. We could mention Theory of reasoned action (1975-1980), Theory of planned behaviour (1985), Technology Acceptance model (1986), User involvement (1984), Delone and McLean (1992), Seddon model (1997), Soh and Markus (1995), the modified model of Delone and McLean (2003), and others (Gonzales, 2008).

From these models, the more relevant has been the Delone and McLean (1992/2003) and its contrasting model, the Seddon model of 1997. We have used the operationalisation of Rai *et al.* (2002) to compare both models (the name of the construct Use is changed by System Dependence, and for the construct, Individual Impact is changed by Perceived Usefulness). In this case, we are comparing the two models and a Modified version of Seddon, in a BIS, used by "real" professionals of IT in "real" situation of several Peruvian companies using that system.

An additional point to review is the construct System Use (System Dependence in this paper), that is a construct that has not been performing well in these Information System Success models.

The objective of this study, as previously mentioned, is to compare the DeLone and McLean (2003) model and the Seddon (1997) model (with one additional variation), applied to a Business Intelligent System. The study was accomplished in Peru, a developing country in South America, by using a sample of 104 users for the system in 13 enterprises, having a quasi-volitional IS use context. After this analysis, the mediators and dependent constructs were reviewed to determine if they were behaving properly (a good level of variance explanation and significant relations with other constructs).

2. Literature review

2.1 The Delone and McLean information systems success model

Delone and McLean (1992) established a model that tried to measure the impact of the information system, considering six constructs. After ten years, DeLone and McLean (2003)

reviewed the model, weighing several studies that used partially or completely their model. They said that the model had fulfilled the main objective established: to obtain the information system success, through multidimensional and interdependent constructs. They modified the model considering the next constructs: information quality, system quality, service quality, system use or intention to use, user satisfaction and net benefits. The model can be observed in Figure 1.

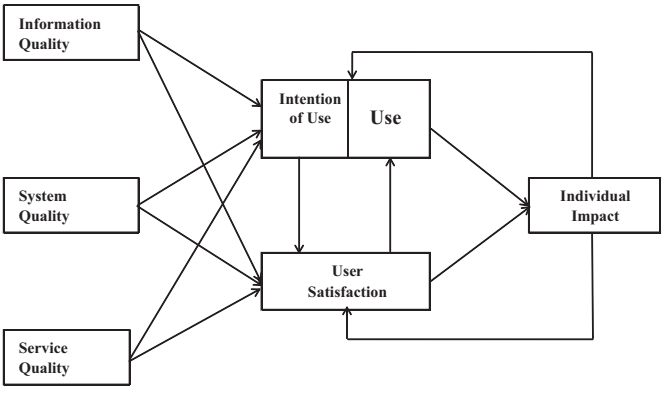
One of the independent constructs is Information Quality, and the variables related to it are accuracy, precision, output timeliness, reliability, completeness, relevance and currency. The second independent construct is System Quality, which recommends the consideration of variables such as performance of the system, trustworthiness of the computational system, on time and on-line response, and the ease of use of terminals (Swanson, 1974).

The third independent construct is Service Quality, which can be evaluated through technical competence of the IS staff, their attitude, their ability to complete the development of products and services on time, the span of time required to develop the systems. Marketing measuring tools such as SERVQUAL used to measure the dimensions of tangibles, responsiveness, assurance, reliability, and empathy (Chen *et al.*, 2000).

In past years, several evaluations of the DeLone and McLean model have been made during studies that have been used partially or completely (Petter *et al.*, 2008), corroborating most of the relations between constructs.

2.2 The Seddon information systems success model

The Seddon model (1997) tries to improve the DeLone and McLean (D&M) model from 1992. According to Seddon, the model was derived from the combination of a process models with another of variance. This model maintains a great part of the D&M model but is divided into two variance models, eliminating the process model. The first variance sub-model is the Partial Behavioural Model of IS Use. The second sub-model is the IS Success Model, a great part of the D&M model. Both models of variance are united, first from the Partial Behavioural model of IS Use, through the Individual, organisational, and Societal Consequences of IS Use, after that, from the IS Success model through the Partial Behavioural model of IS Use, from the User Satisfaction construct to the Expectations about the net benefits of future IS Use.



Source: DeLone and McLean (2003)

Figure 1.
DeLone and McLean's model from 2003

The Partial Behavioural model of IS Use is composed of expectations about the net benefits of future IS Use construct, that is directly related to the IS Use construct (behaviour). The IS Success model is composed by three bodies. The first one is Measures of Information and System Quality, with System Quality and Information Quality constructs. The second body is General Perceptual Measures of Net Benefits of IS Use, with the Perceived Usefulness, and User Satisfaction constructs. The second body is Other Measures of Net Benefits of IS Use, with the net benefits for Individuals, Organisations, and Society. The constructs of the first and third body influence the constructs of the second body. Besides that, the Perceived Usefulness of the second body is directly related to the User Satisfaction construct. Finally, the User Satisfaction Construct offers feedback with construct Expectations about benefits for future IS Use, of the Partial Behavioural model of IS Use. The Seddon model can be observed in Figure 2.

Seddon indicates that IS Use must be after impact and benefits because it does not cause them. It is affirmed by Seddon that IS Use is a behaviour that expresses a belief of goodness from using an information system. The Seddon model labels IS Use as behaviour caused by IS success. IS Use being a consequence of IS success. In relation to the construct System Use, this model was developed for volitional and non-volitional usage, in contrast to the DeLone and McLean model that solely assumes volitional use (Rai *et al.*, 2002).

Several recent studies have used the Seddon model because it explains adequately the impact of an Information System (Brown and Jayakody, 2009; Kulkarny *et al.*, 2006; and Sabherwal *et al.*, 2006).

2.3 The modified Seddon information systems success model

Rai *et al.* (2002) used the DeLone and McLean model (1992) and the Seddon model (1997) to estimate the validity of both. It was found that both models exhibited a reasonable fit. They considered a third alternative, modifying the Seddon model. It was estimated that the perceived usefulness was related to individual impacts, considering that DeLone and McLean (1992) connected several constructs to individual impacts.

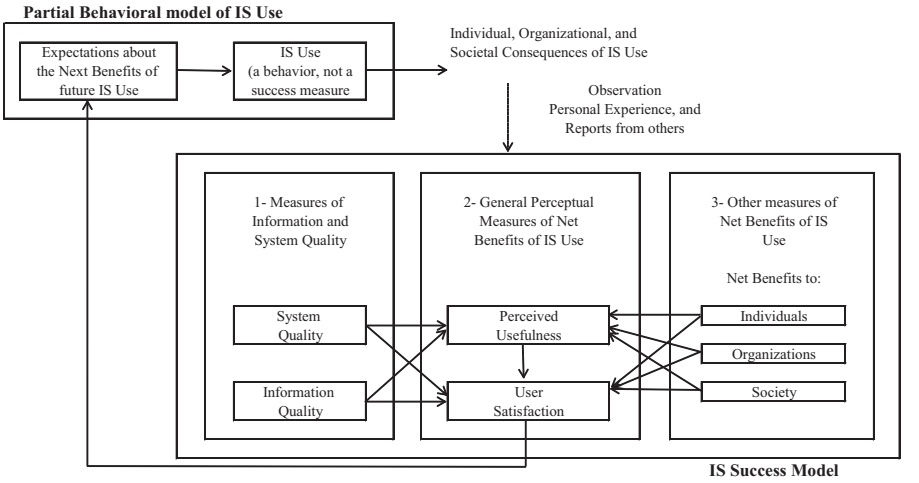


Figure 2.
The Seddon IS Success model

Source: Seddon (1997)

In this way, Rai *et al.* (2002) established a model of five constructs: system quality, information quality, perceived usefulness (individual impact), user satisfaction and system use. Besides that, they represent system use in terms of system dependence. The Seddon model was modified, including a correlational path between system use (system dependence) and perceived usefulness, so the best fit and variance explanation would be obtained. The model can be observed in Figure 3.

The more relevant studies that analysed the impact of Information System and *Business Intelligence*, using the DeLone and McLean, and Seddon models could be observed in Appendix 1.

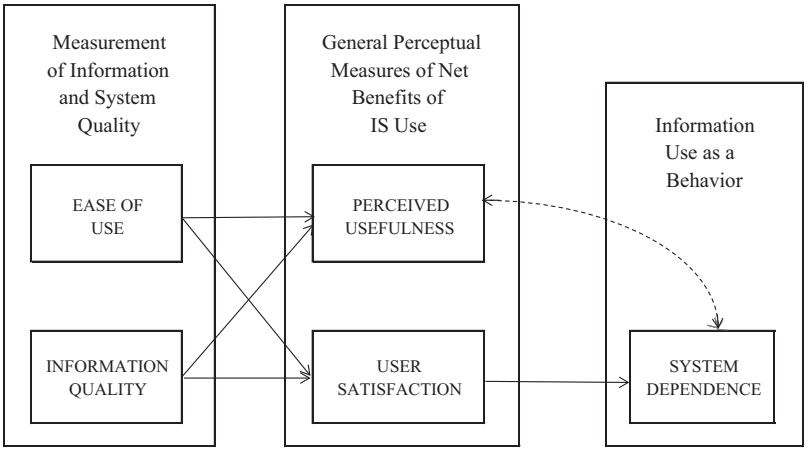
3. Methods

The models used are quantitative, in which the individual User of the BIS, in a company that employs the system, is the unit of analysis. A Pilot Test was employed to test the tools, the questionnaire, and the model. Structural Equations were used for the analysis. The model is analysed with the DeLone and McLean model, the Seddon model, and the Modified Seddon model.

The study sample includes the most important companies in the Peruvian economy from different economic sectors: banking, food industry, consumer marketing products, pension funds, government, beauty products, market research, and credit cards. The Use of BISs in those companies is not mandatory and users have other channels providing the information, but in general, it is more cumbersome and perhaps the data is not as precise for the analysis, so the BIS is assumed as quasi-volitional or quasi-mandatory.

4. Quantitative analysis

A previous analysis of the data was realised to check the main characteristics of them that could be observed in Appendix 2 and 3. Reviewing the correlation table we find that the correlations are between medium and high, and that is because the variables are related to business, and we are going to find high correlations between items of the same construct, but using structural equations of covariance (SEM) that is not a problem (Hair *et al.*, 2006).



Source: Rai *et al.* (2002)

Figure 3.
The modified Seddon IS Success model

Several tests were implemented to check the all the requirement for a multivariate analysis: normal distribution, completeness of the data, outliers, homoscedasticity, and linearity between dependent variables and independent variable. The Kolmogorov-Smirnov test was applied to all variables to verify the normality (Appendix 4). The multivariate normal distribution was verified using the EQS programme for SEM, eliminating the variables that could not satisfy this requirement.

The data was complete for each one of the 29 items for the analysis. There were only a few descriptive variables that were incomplete. The homoscedasticity was checked through a homogeneity test of variance between the dependent variables and the independent variables and mediator variables, using the Barlett and Levene test. We found only two variables with problems: IIDU and IIWU and were corrected through a mathematics factor of elevating the variable to the cubic power and then divided by 7. To verify the linearity between dependent variables and independent variables, a regression was run for each combination, and then check a graphic representation of the residuals to verify the random distribution, with favourable outcomes.

We compare the DeLone and McLean model, the Seddon model and a modified Seddon¨*s* model, in a sample of companies that use BISs. The initial sample was of 110 surveys, but after eliminating some outliers, the final sample consisted of 104 (Hair *et al.*, 2006). The measurement of the constructs was made using a seven-point scale (semantic differential, Likert, ordinal and ratio: Iivari, 2005; Hong *et al.*, 2006; Chen *et al.*, 2000; McKinney *et al.*, 2002). The questionnaire has 29 statements for the six constructs. The questionnaire was obtained from several sources, and it was translated three times. From English to Spanish, then from Spanish to English and then from English to Spanish, through different translators to fulfil the correct procedure in research.

The validity of the constructs was verified through face validity, convergent validity, discriminant validity, and nomological validity. All construct¨*s* validity statistics were considered satisfactory. The general reliability coefficients in the CFA and Structural model were satisfactory: Cronbach¨*s* alpha of 0.954 and Rho of 0.974. A pilot test was conducted with 68 observations to verify the questionnaire and apply the Exploratory Factor Analysis through Principal Components and Varimax rotation to verify that each item pertained to only one construct. The main results of the analysis could be observed in Appendix 5.

4.1 Sample analysis

A standard procedure was performed, starting with the Confirmatory Factor Analysis (CFA), and thereafter the Measurement model was established. The estimated method used in structural equations was Maximum Likelihood Estimation, with the complementary method of Robust from the EQS programme.

The CFA was initially established, using all the observable variables. The fit of the model was modified, working with X^2, CFI, RMSEA, multivariate normal distribution adjustment, and the average variance extracted (AVE) (Byrne, 2006). Thereafter, the final Confirmatory Factor Analysis (CFA) was obtained with 22 items derived from 104 observations. The software used for the statistical analysis was Minitab, while the structural equations used EQS version 6.1. See Table I for statistics from the Confirmatory Factor Analysis.

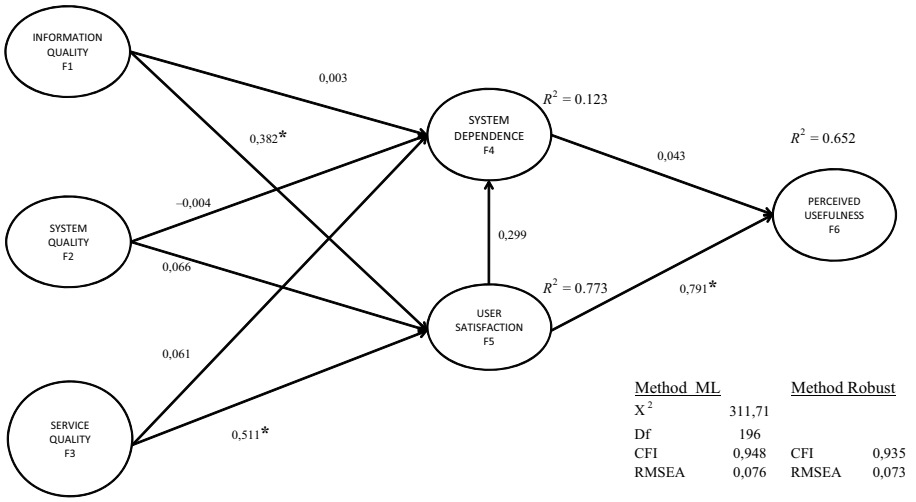
5. Results

After completing the Confirmatory Factor Analysis, the Structural Model was established. Figure 4 presents the structural model found with the DeLone and McLean model, including the relations between constructs and the variance, explained for each dependent construct through R^2.

Statistics – confirmatory factor analysis	
Number of observations	104
Multivariate Kurtois	2.86
Method ML	
Chi-squared	290
CFI	0.956
RMSEA	0.070
Method robust	
Chi-squared	281
CFI	0.946
RMSEA	0.067
Average variance extracted	
Information Quality	39.99%
System Quality	54.41%
Service Quality	53.36%
System Dependence	51.97%
User Satisfaction	70.74%
Perceived Usefulness	61.86%

Source: Own elaboration

Table I.
Main statistics of the confirmatory factor analysis



Source: Own elaboration

Figure 4.
DeLone and McLean structural model

In this case, a variance explanation of 65.2 per cent for Perceived Usefulness (Individual Impact), 77.3 per cent for User Satisfaction and 12.3 per cent for System Dependence (System Use) was obtained, and three significant relations were found (alpha 0.05). The independent constructs Information Quality and Service Quality have significant relations with the mediator construct User Satisfaction. Likewise, User Satisfaction has a significant relation

to the dependent construct, Perceived Usefulness (Individual Impact). In contrast, the independent construct System Quality does not have any significant relation to the mediator constructs. The System Dependence (System Use) construct shows no significant relation to the independent constructs or dependent construct. The dependent construct, Perceived Usefulness (Individual Impact), is explained in 65.2 per cent (R^2).

This model does not find any significant relationship between the System Dependence (System Use) and other constructs of the model, and it is worth considering that, as an indicator of the success of the system, it makes sense if it is voluntary or discretional, and not when the system has captive users, who do not have an alternative system to process information (Lucas, 1978).

For the Seddon model, the next results were found (including the relations between constructs and the variance explained for each dependent construct through R^2), that can be observed in Figure 5.

In this second model, a variance explanation of 12.2 per cent for System Dependence (System Use), 80.3 per cent for User Satisfaction and 68.7 per cent for Perceived Usefulness (Individual Impact) and find five significant relations (alpha 0.05) are presented. The independent constructs Information Quality and Service Quality have significant relations with the mediator construct User Satisfaction. Likewise, User Satisfaction has a significant relationship with the dependent construct, System Dependence (System Use). The independent construct System Quality has a significant relationship with the mediator construct Perceived Usefulness (Individual Impact) and the Perceived Usefulness (Individual Impact) has a significant relation with the User Satisfaction construct. The dependent construct, System Dependence (System Use), is explained in 12.2 per cent (R^2).

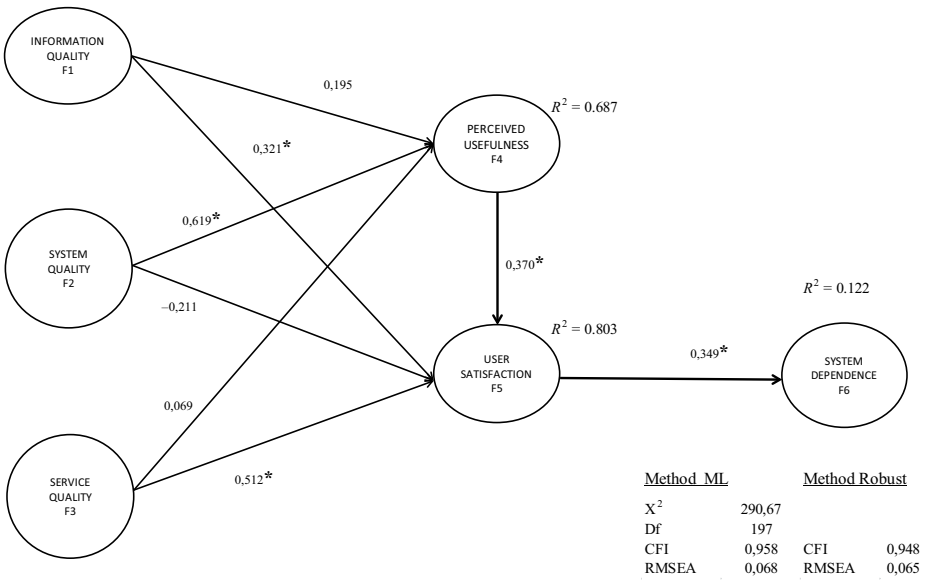


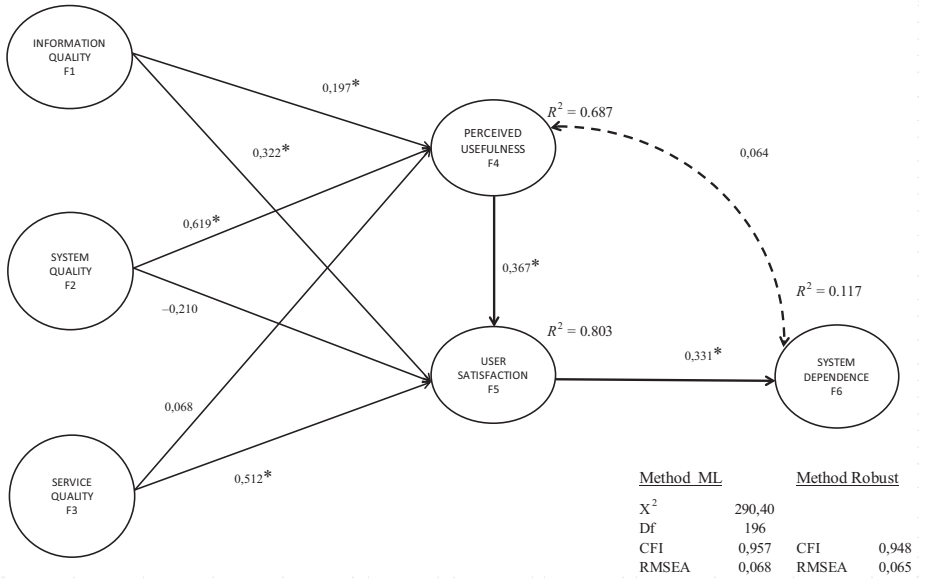
Figure 5.
Seddon structural model

Source: Own elaboration

For the modified Seddon model, the next results were found (including the relations between constructs, and the variance explained for each dependent construct through R^2), that can be observed in Figure 6.

In this third model, a variance explanation of 11.7 per cent for System Dependence (System Use), 80.3 per cent for User Satisfaction and 68.7 per cent for Perceived Usefulness (Individual Impact), and six significant relations are presented (alpha 0.05). The independent constructs Information Quality and Service Quality have significant relations with the mediator construct User Satisfaction. Likewise, User Satisfaction has a significant relationship with the dependent construct, System Dependence (System Use). The independent constructs Information Quality and System Quality have a significant relationship with the mediator construct Perceived Usefulness (Individual Impact) and the Perceived Usefulness (Individual Impact) has a significant relation with the User Satisfaction construct. The dependent construct, System Dependence (System Use), is explained in 11,7 per cent (R^2).

We can compare the three models in the next Table II. The best model is the Seddon model; the second-best model is the Modified Seddon model, which is quite similar to the first model; and thirdly the DeLone and McLean model. The Seddon model has the best for CFI (0.958 against 0.957 and 0.948), RMSEA (0.068 against 0.068 and 0.076), R^2 of Perceived Usefulness (0.687 against 0.687 and 0.652), R^2 of User Satisfaction (0.803 against 0.803 and 0.791). The Seddon model explains the significance of the System Dependence construct in relation to other constructs of the model (like the Modified Seddon model), but the DeLone and McLean does not. The DeLone and McLean better explain System Dependence (R^2 of 0.123, against 0.122 and 0.117 for the other models). In addition, for the total number of significant relations between constructs, the Modified Seddon model explained six relations, against five for the Seddon model and three for the DeLone and McLean model.



Source: Own elaboration

Figure 6. Modified Seddon structural model

Statistics	Models DeLone and McLean	Seddon	Modified Seddon
X^2	311,71	290,67	290,40
Degrees of Freedom	196	197	196
Comparative Fit Index (CFI)	0.948	0.958	0.957
RMSEA	0.076	0.068	0.068
R^2 Perceived Usefulness (Individual Impact)	0.652	0.687	0.687
R^2 User Satisfaction	0.791	0.803	0.803
R^2 System Dependence (System Use)	0.123	0.122	0.117
R^2 Average explained	0.522	0.537	0.536
Significant relation of the System Dependence (System Use) construct with other constructs	No	Yes	Yes
Total significant relations between constructs	3	5	6

Source: Own elaboration

Table II.
Comparison of the three models

Some additional comparisons that we can make are with the study of Rai *et al.* (2002), in which there are various differences, especially with the Delone and McLean model, but less with two models of Seddon. The main differences could be explained by the fact that the Rai *et al.* (2002) study was realised with students of only one university, and this study was realised with executives of the IT department of several companies (Appendix 6).

The other comparison is with Wieder *et al.* (2012), in which they found a significative relation (**) between User Satisfaction and BI Use (System Dependence in this study). In this study we found the same relation in two of the three models: there were no relation in the DeLone and McLean model, but there was a relation in the Seddon model (*) and the Modified Seddon model (*). Wieder *et al.* use a variation of the DeLone and McLean model, using PLS, that is less demanding that EQS (structured equations of covariance).

6. The system use construct (system dependence)

There are several studies related to system usage, user satisfaction and the individual impact that had controversial outcomes. Some authors indicate that there is a direct relationship between system use and individual performance (Goodhue and Thompson, 1995); others did not find any relation between those constructs (Lucas and Spitler, 1999). There is a direct relation between System Use and User Satisfaction (Iivari, 2005; Halawi *et al.*, 2007-2008; Bokhari, 2005; D´Ambra and Rice, 2000), and other authors indicate that there is not that relation (Baroudi *et al.*, 1986). Other authors find a direct relation between System Use and the Individual Impact (Halawi *et al.*, 2007-2008; Rai *et al.*, 2002; Yuthas and Young, 1998; Guimaraes and Igbaria, 1997). Other authors did not find that relation (Gelderman, 1998; Roldan and Millan, 2000).

6.1 Voluntary and mandatory contexts

Norzaidi *et al.* (2008) examined the impact of user resistance on Intranet usage and its relation to performance in middle managers in an organisational context. They examined too, the cause and effect of usage and user resistance in a mandatory and in a voluntary usage. The study demonstrated that usage significantly explain the percentage of variance on the performance of managers. The outcomes of low resistance found in the study imply that the situation where managers are coerced to use Intranet because they do not have other alternatives to complete their jobs. Usage has been observed to have a strong effect on

manager performance, and that is one of the success¨ factors that influence individual performance.

Eom *et al.* (2012) realised a study about the role of information technology in e-learning system success in a mandatory context, using PLS to analyse the results, and found a significant relationship between Use and Individual Impact. They compared this study with the research of Rai *et al.* (2002) that worked in a voluntary context and analysed the data with LISREL and found significant relationships between both constructs. Besides that, compared with the research of Iivari (2005) that worked in a mandatory context analysed the data with PLS, and found no significant relations between both constructs.

He and King (2008), investigated the role of user participation in IS through a meta-analysis and found that the construct Usage was initially thought to be a relevant in Voluntary contexts. As established initially by some researchers like DeLone and McLean (1992), but after that found that some researchers indicated that users still have power over the level of use, grounded on their personal ability (attitude and intention), and after that the variability of their usage qualifies the system use construct as a relevant one (Hartwick and Barki, 1994).

Hennington *et al.* (2009) studied the usage in an electronic medical record system in a mandatory context. They found that understanding the correspondence between key technological acceptance constructs and usage, needed a multidimensional abstraction of the use construct (time spent using the system, timing of use, and mode of use). Although they agreed with Burton-Jones and Straub (2006) for using, context-specific measures for the use construct, instead of using lean measures (time spent using the system); they found that lean measures might be sometimes appropriate for specific conditions.

As was mentioned previously, Petter and McLean (2009) realised a meta-analysis of more than 50 studies that utilised the DeLone and McLean model to determine the validity and explanatory power of the Use (System Use) construct. They indicated that this construct needs to be improved, to establish significant relations with other constructs, and explain the impact of an IS model.

6.2 New conceptualizations of the system use construct

Dishaw and Strong (1998) tried to explain the System Use construct with a model with a mediator construct, Intention to Use, and the independent constructs related with the Task-Technology Fit: Intrinsic Fit, Contextual Fit, Representation Fit and Accessibility Fit; and with the Behavioural Control construct. They could explain 16 per cent of the variance of the System Use construct and 70 per cent of the Intention to Use construct.

Burton-Jones and Straub (2006) re-conceptualize the system usage construct in specific nomological circumstances, working in two phases, definition and selection. This scheme permits researchers to establish precise measures of system usage for a particular context. The first phase necessitates a definition of the system use and determines basic assumptions. In the selection phase, the system usage needs to be designed according to its structure and function.

To explain in a better way the System Use construct (duration, frequency, and intensity), Venkatesh *et al.* (2008), use a mediator construct, Behavioural Expectations, and two independent constructs, Behavioural Intentions and Facilitating Conditions, in a longitudinal field study, and explained between 60 per cent and 65 per cent of the variance of the dependent construct, System Use.

Continuing research to further specify the System Use Construct, Lallmahomed *et al.* (2013) utilised a model with the mediator construct Behavioural Intention, the independent constructs Performance Expectancy, Effort Expectancy, Social Influence, Facilitating

Conditions and Hedonic Performance Expectancy, and System Use as dependent construct (Cognitive Absorption; volume, frequency and intensity; and Deep Structure Use), and achieved a variance explanation of 71 per cent of the dependent construct.

As could be observed in the previous lines, there are contradictory results of the relation of the System Use construct (System Dependence construct) with the Perceived Usefulness construct (Individual Impact construct), and other constructs as User Satisfaction. It is not completely clear too when specifying the voluntary or mandatory context, if the System Use construct has a direct and significant relationship with other constructs. Furthermore, some authors as Venkatesh *et al.* (2008) and Lallmahomed *et al.* (2013) has tried new conceptualisation of this construct, working with predictors of use, and have obtained good explanations of the System Use construct (between 60 and 65 and 71 per cent of the variance explained).

7. Discussion

The results received from this research indicates that the Seddon model performs and explains better what is happening with the BIS, compared to the DeLone and McLean model and with the Modified Seddon model. The fit is better than in the DeLone and McLean model (CFI of 0.958 vs 0.948; RMSEA 0.068 vs 0.076), the same goes for R^2 Average explained (0.537 vs 0.522). The Seddon model has a significant relationship between the System Dependence (System Use) and the other constructs, whereas the DeLone and McLean do not. The Seddon model has five significant relations between the constructs, while the DeLone and McLean has only three. The Modified Seddon model obtains an almost as good result, as the Seddon model, with the only advantage that explains one additional significant relation between constructs (six in total).

In the last years, the DeLone and McLean model, which is one of the more used models to estimate the impact of an IS, has been evaluated through several studies that have used it partially or completely. Most of the relations between constructs have been confirmed (Petter *et al.*, 2008). The construct System Use, as previously mentioned, could be a good indicator of a successful system when it is voluntary or discretional, and not when the system has captive users, who do not have an alternative system to process information (Lucas, 1978). Besides that, Petter and McLean (2009) performed a meta-analysis on the DeLone and McLean Success of IS model, considering 52 studies. They concluded that the User construct needed to be improved. Given that there no more consistent or confident measures exist, it would be difficult to find relations between this construct and the others of the model.

Wieder *et al.* (2012) performed research about the impact of BI tools on Performance working with the DeLone and McLean model of IS Success. They did not find a significant relation between User Satisfaction and BI Use but found a weak relation between BI Use and Performance Indicators. They indicated that it is possible to find several particularities in BISs: first, the most advanced users of the system use the system more, in its full capacity, find errors, create difficult questions about the system, become less satisfied with the system and possibly use it less. On the other hand, the less experimented users look for the simple ways of using the system, find everything they need, are happy with the system, and would use it more.

Second, the BIS are configured to elaborate reports for easy usage in a fully-automated way. Users who want to get the most from the system need to have advanced technical skills and need to know a little more about the basic configuration of the system. This is related to the frustration of the user, indicating a lack of friendliness and adequate technical characteristics of the system. Finally, there would be an inadequate System Use because of a

shortage of mental and cultural awareness of BI, and the BIS would lack performance. Because of those reasons, the construction of the System Dependence (System Use), according to Rai *et al.*, 2002, is not working well in the DeLone and McLean model, it does not get a good fit, nor does it have a good level of explanation.

The Modified Seddon model considers an additional restriction compared with the Seddon model. It indicates that there is a correlation between the Perceived Usefulness (Individual Impact) and the System Dependence (System Use) constructs. In this way, a better explanation and fit will exist. The supposition here is that the users of the Information System only have one viable choice for getting and analysing information, increasing the perceived benefit of the Perceived Usefulness (Individual Impact), so there is a correlation between Perceived Usefulness (Individual Impact) and System Dependence (System Use), with no causal relation between them.

The System Use (System Dependence) construct seems to work well in this research, using the Seddon IS Success model, nevertheless that variance explanation is not so high (12.2 per cent), and showing no relation with the Individual Impact (Perceived Usefulness) (observed when applying the modified Seddon IS Success model). Therefore, it could be interesting to make future research comparing these three models but working with a modified System Use (System Dependence) construct, considering the predictors of use, as proposed by Venkatesh *et al.* (2008) and Lallmahomed *et al.* (2013). The System Use construct could be mediated by a Behavioural Intention construct that works with the next independent constructs: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. The System Use construct would have the next variables or components: User aspect (cognitive absorption), System Aspect (volume, frequency, intensity), and Task aspect (deep structure use).

As a way of attesting the practical and theoretical implications, and insinuate some conclusions, we can say that the Seddon model seems to explain better what happens with a BIS and will be preferable to use this model when making a research, nevertheless that it would be relevant to repeat this analysis to confirm the results. In the case of the Use Construct (System Dependence), it seems necessary when using it as a part of an Information System Success model, like the Delone and McLean model or Seddon model, that it has to be established with more detail, considering some complementarities like the mentioned by Burton-Jones and Straub (2006), Venkatesh *et al.* (2008), or Lallmahomed *et al.* (2013).

8. Limitations and recommendations for future studies

It is estimated that the sample includes more than 15 per cent of all the companies that use a BISs in Peru, so the size of the sample is adequate, but it is not entirely random and therefore limits the generalizability of outcomes. Besides that, a sample size that is bigger could be better for the sake of making a more detailed analysis, permitting the use of some items with less power, or the use of another statistical procedure for structural equations such as the Asymptotical Distribution Free, permitting a more detailed analysis (Hair *et al.*, 2006).

As mentioned previously in the Discussion section, it would be interesting to continue the research of this subject, comparing the same three models, but conceptualising the System Use construct considering the predictors of use, to obtain a better explanation (variance) and getting more significant relations with other constructs. Another point would be to try to be more rigorous would be equally better, allowing the utilisation of some objective measures, not only perceptual measures for several of the constructs.

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	Authors	Description/Objective of the Study	Type of Study	Measures	Research Strategy
1	Iivari (2005)	Test the IS Success of DeLone and McLean in the adoption of a new IS	Quantitative	System quality, Information quality, Actual use, User Satisfaction and Individual Impact	Sample through questionnaire
2	Rai, Lang & Welker (2002)	Assess the validity of IS models	Quantitative	Ease of Use, Information Quality, System Dependence, User Satisfaction & Perceived Usefulness	Sample through questionnaire
3	Lee, Hong & Katerattanakul (2004)	Impact of DW in the performance of retail companies	Quantitative	Financial performance: improvement in Sales by employee, ROS, growth of Sales Not financial performance: promotional performance by customer, seller, and marketing segmentation	Sample through questionnaire
4	Hong, Katerattanakul, Hong & Cao (2006)	Use and perceptual impact of the DW in financial companies in Korea	Quantitative	Individual Impact, Use of the System, Perceived Ease of Use, Percieved Use, Data Quality, Reply time accessibility, Support *t* and training	Sample through questionnaire
5	Park (2006)	Effect of DW as support for performance improvement with the use of DSS	Quantitative	Effect in decision process (precision) and income maximization	Laboratory experiment
6	Wixom & Watson (2001)	Success factors in the implementation of a DW	Quantitative	Perceived net benefits, Data quality, System quality, administrative support, user's involvement, development techn.	Field study Primary data
7	Nelson, Todd & Wixom (2005)	Antecedents of the quality in the DW (System quality and Information quality)	Quantitative	System quality and Information quality	Field study Primary data
8	Shin (2003)	Success Factors of the DW	Quantitative & Qualitative	Data quality, ability to locate data, access authorisation, ease of use, user training, system performance & information utility	Sample through questionnaire
9	Brown & Jayakody (2009)	IS Success model applied to B2C e-Commerce	Quantitative	Continuance Intention, User Satisfaction, Perceived Usefulness, Service quality, System quality, Information quality, and Trust	Sample through questionnaire
10	Chen, Soliman, Mao, & Frolick (2000)	Satisfaction in DW Exploratory study	Quantitative Exploratory	21 items related with the satisfaction of the use of a DW	Sample through questionnaire

Notes: Elaborated by Gonzales (2008) and the authors. Significance (*p*-values): * (<0.05), ** (<0.01), *** (<0.001)

(*continued*)

Table AI.
Main Studies of the Impact of IS and BI

Table AI.

	Category	Theoretical Model	Explanation of Constructs/R^2	Significant relations
1	Benefits	DeLone & McLean (1992)	Individual Impact = 0.35 Actual Use = 0.18 User Satisfaction = 0.58	User Satisfaction – Individual Impact** Actual Use - Individual Impact - No Actual Use - User Satisfaction - No
2	Benefits	DeLone & McLean (1992) & Seddon (1997)	Usefulness = 0.60 System dependence = 0.30 User Satisfaction = 0.51	System dependence-Usefulness** User satisfaction-Usefulness** User satisfaction-System dependence**
3	Benefits	DeLone & McLean (1992), Pitt, Watson & Kavan (1995) Myers, Kappelman & Prybutok (1998)	Anova analysing impact of DW on organizational outcomes	Promotional Effects* Vendor Effects* Customer Effects** Market Segmentation Effects*
4	Benefits and outcomes of the system	DeLone & McLean (1992) TAM	Ease of Use = 0.523 Usefulness = 0.637 Individual Impact = 0.699 System Use = 0.342	Ease of use-Usefulness* Usefulness-System use* System use-Individual Impact*
5	Benefits and Decisions Laboratory Experiment	DeLone & McLean (1992, 2003) Seddon (1997)	Anova Analysis Dependent variable: decision performance. Independent: Tradicional vs DW	Two hypothesis related with the advantage of the DW were supported, and three hypothesis rejected
6	Benefits	DeLone & Mc Lean (1992) Seddon (1997)	Net benefits = 0.369 Data quality = 0.016 System quality = 0.128	Data quality-Net benefits* System quality-Net benefits***
7	Benefits	Seddon (1997) & (1994) DeLone & McLean (1992)	Infor mation quality = 0.761 System quality = 0.759	System quality-Information Satisfact.** System quality-System Satisfaction***
8	User Satisfaction	De Lone & McLean (1992, 2003)	User Satisfaction = 0.70	Data quality-User satisfaction* Ability to locate data-User satisfact.* System throughput-User satisfaction*
9	Contin uance Intention	DeLone & McLean (1992, 2003) Seddon (1997) Seddon & Kiev (1996)		Usefulness-User Satisfaction* Usefulness-Continuance Intention*** User Satisfaction-Continuance Intention*
10	21 items in a five points Likert scale	DeLone & McLean (1992) Bailey & Person (1983) Doll & Torkzadeh (1988)	Factor analysis: found 3 factors: Support provided to end-users, Accuracy, Fulfilment of end-user needs	End-user satisfaction is related with the support provided by Information centres

Appendix 2

Variable	Abreviated Variable	N	N lost	Averg	SD	Variant Coeff	Min	Max
Business Sector	BUSS-SECT	110	0	2.790	2.279	82%	1	9
Activity user of the system	ACT-USU	109	1	3.991	2.602	65%	1	7
Years of experience	YEARS	86	24	5.372	3.767	70%	1	20
Information quality- Data relevance	IQ-DR	110	0	5.909	1.080	18%	2	7
Information quality- Detail level	IQ-DL	110	0	5.473	1.029	19%	3	7
Information quality- Data accuracy	IQ-DA	110	0	5.273	1.188	23%	2	7
Information quality- Data currently	IQ-DC	110	0	5.582	1.252	22%	1	7
Information quality- Data understanding	IQ-DU	110	0	5.536	1.147	21%	2	7
Information quality- Data completeness	IQ-COM	110	0	5.091	1.138	22%	2	7
System quality- Data retrieveness	SQ-DR	110	0	5.291	1.251	24%	2	7
System quality- System access	SQ-SA	110	0	5.491	1.319	24%	1	7
System quality- Access tools	SQ-AT	110	0	5.264	1.155	22%	2	7
System quality- Waiting time	SQ-WT	110	0	4.873	1.421	29%	1	7
System quality- Flexibility	SQ-F	110	0	4.455	1.542	35%	1	7
Service quality- User training	SEQ-UT	110	0	5.309	1.457	27%	1	7
Service quality- Rapid repply	SEQ-RR	110	0	5.027	1.371	27%	1	7
Service quality- Effective solution	SEQ-ES	110	0	5.145	1.107	22%	1	7
Service quality- Management Encouragement	SEQ-ME	110	0	5.373	1.439	27%	1	7
Service quality- Management support	SEQ-MS	110	0	5.336	1.221	23%	1	7
Use- Common use	USE-C	110	0	5.364	1.276	24%	2	7
Use- Average use	USE-A	110	0	4.936	1.486	30%	2	7
Use- Average time	USE-AT	110	0	4.273	1.670	39%	2	7
User Satisfaction- After using the system	US-AU	110	0	5.191	1.153	22%	2	7
User Satisfaction- After using the system-2	US-AU2	110	0	5.164	1.146	22%	2	7
User Satisfaction- When using the system	US-WU	110	0	5.036	1.234	25%	1	7
User Satisfaction- After using the system	US-AUS	110	0	5.055	1.074	21%	2	7
User Satisfaction- Suggesting the system to other company	US-SOC	110	0	5.091	1.282	25%	1	7
Individual Impact- Swiftness doing my tasks	II-SDT	110	0	5.409	1.069	20%	3	7
Individual Impact- Job performance improvement	II-JPI	110	0	5.482	1.090	20%	3	7
Individual Impact- Productivity improvement	II-PI	110	0	5.382	1.211	23%	2	7
Individual Impact- Decisions upgrade	II-DU	110	0	5.709	1.120	20%	3	7
Individual Impact- Work usefulness	II-WU	110	0	5.700	1.208	21%	2	7

Source: Own elaboration

Table AII. Descriptive statistics

Appendix 3

	IQ-DR	IQ-DL	IQ-DA	IQ-DC	IQ-DU	IQ-COM	SQ-DR	SQ-SA	SQ-AT	SQ-WT	SQ-F	SEQ-UT	SEQ-RR	SEQ-ES	SEQ-ME	SEQ-MS	USE-C	USE-A	USE-AT	US-AU	US-AU2	US-WU	US-AUS	US-SOC	II-SDT	II-JPI	II-PI	II-DU
IQ-DL	0.485 0.000																											
IQ-DA	0.513 0.000	0.532 0.000																										
IQ-DC	0.467 0.000	0.525 0.000	0.627 0.000																									
IQ-DU	0.455 0.000	0.390 0.000	0.504 0.000	0.458 0.000																								
IQ-COM	0.470 0.000	0.590 0.000	0.681 0.000	0.620 0.000	0.595 0.000																							
SQ-DR	0.475 0.000	0.484 0.000	0.495 0.000	0.465 0.000	0.574 0.000	0.510 0.000																						
SQ-SA	0.399 0.000	0.335 0.000	0.388 0.000	0.403 0.000	0.340 0.000	0.435 0.000	0.680 0.000																					
SQ-AT	0.453 0.000	0.504 0.000	0.375 0.000	0.451 0.000	0.356 0.000	0.456 0.000	0.619 0.000	0.571 0.000																				
SQ-WT	0.459 0.000	0.493 0.000	0.412 0.000	0.429 0.000	0.245 0.010	0.450 0.000	0.423 0.000	0.523 0.000	0.362 0.000																			
SQ-F	0.267 0.005	0.372 0.000	0.352 0.000	0.280 0.003	0.291 0.002	0.395 0.000	0.506 0.000	0.634 0.000	0.468 0.000	0.600 0.000																		
SEQ-UT	0.543 0.000	0.440 0.000	0.454 0.000	0.449 0.000	0.339 0.000	0.420 0.000	0.468 0.000	0.465 0.000	0.529 0.000	0.440 0.000	0.370 0.000																	
SEQ-RR	0.454 0.000	0.387 0.000	0.480 0.000	0.429 0.000	0.323 0.001	0.398 0.000	0.509 0.000	0.678 0.000	0.523 0.000	0.571 0.000	0.614 0.000	0.551 0.000																
SEQ-ES	0.456 0.000	0.374 0.000	0.416 0.000	0.461 0.000	0.350 0.000	0.375 0.000	0.499 0.000	0.755 0.000	0.623 0.000	0.571 0.000	0.600 0.000	0.552 0.000	0.831 0.000															
SEQ-ME	0.506 0.000	0.382 0.000	0.407 0.000	0.424 0.000	0.489 0.000	0.450 0.000	0.571 0.000	0.483 0.000	0.691 0.000	0.342 0.000	0.431 0.000	0.583 0.000	0.581 0.000	0.570 0.000														
SEQ-MS	0.455 0.000	0.318 0.001	0.341 0.000	0.441 0.000	0.453 0.000	0.427 0.000	0.500 0.000	0.455 0.000	0.678 0.000	0.337 0.000	0.386 0.000	0.580 0.000	0.504 0.000	0.588 0.000	0.826 0.000													
USE-C	0.424 0.000	0.119 0.214	0.218 0.022	0.211 0.027	0.304 0.001	0.198 0.038	0.347 0.000	0.291 0.002	0.302 0.001	-0.030 0.757	0.027 0.778	0.275 0.004	0.319 0.001	0.254 0.007	0.400 0.000	0.351 0.000												
USE-A	0.294 0.002	0.146 0.128	0.270 0.004	0.163 0.089	0.182 0.057	0.117 0.222	0.262 0.006	0.180 0.060	0.165 0.085	0.066 0.496	0.029 0.766	0.272 0.004	0.253 0.008	0.173 0.071	0.316 0.001	0.245 0.010	0.772 0.000											
USE-AT	0.177 0.065	0.181 0.059	0.267 0.005	0.200 0.036	0.071 0.458	0.137 0.155	0.225 0.018	0.197 0.039	0.096 0.320	0.189 0.048	0.133 0.166	0.184 0.055	0.265 0.005	0.197 0.039	0.152 0.113	0.126 0.191	0.487 0.000	0.654 0.000										
US-AU	0.515 0.000	0.488 0.000	0.524 0.000	0.520 0.000	0.484 0.000	0.588 0.000	0.603 0.000	0.553 0.000	0.568 0.000	0.491 0.000	0.503 0.000	0.570 0.000	0.588 0.000	0.625 0.000	0.598 0.000	0.605 0.000	0.302 0.001	0.275 0.004	0.216 0.024									
US-AU2	0.531 0.000	0.517 0.000	0.540 0.000	0.566 0.000	0.498 0.000	0.643 0.000	0.606 0.000	0.566 0.000	0.543 0.000	0.520 0.000	0.539 0.000	0.568 0.000	0.657 0.000	0.632 0.000	0.586 0.000	0.583 0.000	0.317 0.001	0.260 0.006	0.221 0.020	0.907 0.000								
US-WU	0.443 0.000	0.528 0.000	0.519 0.000	0.515 0.000	0.421 0.000	0.625 0.000	0.534 0.000	0.514 0.000	0.521 0.000	0.505 0.000	0.493 0.000	0.545 0.000	0.531 0.000	0.540 0.000	0.540 0.000	0.576 0.000	0.219 0.022	0.182 0.058	0.120 0.212	0.775 0.000	0.801 0.000							
US-AUS	0.471 0.000	0.549 0.000	0.506 0.000	0.556 0.000	0.512 0.000	0.582 0.000	0.650 0.000	0.486 0.000	0.573 0.000	0.419 0.000	0.517 0.000	0.534 0.000	0.579 0.000	0.533 0.000	0.622 0.000	0.581 0.000	0.320 0.001	0.296 0.002	0.268 0.005	0.799 0.000	0.850 0.000	0.767 0.000						
US-SOC	0.344 0.000	0.454 0.000	0.333 0.000	0.430 0.000	0.403 0.000	0.428 0.000	0.498 0.000	0.451 0.000	0.473 0.000	0.394 0.000	0.503 0.000	0.422 0.000	0.453 0.000	0.495 0.000	0.479 0.000	0.461 0.000	0.030 0.755	0.008 0.935	-0.012 0.904	0.627 0.000	0.615 0.000	0.567 0.000	0.676 0.000					
II-SDT	0.541 0.000	0.531 0.000	0.468 0.000	0.527 0.000	0.418 0.000	0.512 0.000	0.582 0.000	0.501 0.000	0.558 0.000	0.505 0.000	0.431 0.000	0.519 0.000	0.468 0.000	0.507 0.000	0.568 0.000	0.533 0.000	0.267 0.005	0.317 0.001	0.189 0.048	0.688 0.000	0.656 0.000	0.656 0.000	0.700 0.000	0.682 0.000				
II-JPI	0.505 0.000	0.523 0.000	0.464 0.000	0.472 0.000	0.393 0.000	0.534 0.000	0.596 0.000	0.581 0.000	0.649 0.000	0.466 0.000	0.518 0.000	0.437 0.000	0.538 0.000	0.542 0.000	0.586 0.000	0.546 0.000	0.269 0.005	0.212 0.026	0.099 0.306	0.671 0.000	0.671 0.000	0.697 0.000	0.699 0.000	0.697 0.000	0.790 0.000			
II-PI	0.553 0.000	0.509 0.000	0.469 0.000	0.475 0.000	0.426 0.000	0.480 0.000	0.537 0.000	0.525 0.000	0.590 0.000	0.449 0.000	0.412 0.000	0.431 0.000	0.469 0.000	0.485 0.000	0.554 0.000	0.508 0.000	0.248 0.009	0.243 0.011	0.034 0.723	0.630 0.000	0.629 0.000	0.641 0.000	0.619 0.000	0.681 0.000	0.750 0.000	0.839 0.000		
II-DU	0.615 0.000	0.455 0.000	0.474 0.000	0.495 0.000	0.537 0.000	0.525 0.000	0.650 0.000	0.620 0.000	0.578 0.000	0.392 0.000	0.401 0.000	0.399 0.000	0.489 0.000	0.515 0.000	0.580 0.000	0.508 0.000	0.370 0.000	0.187 0.050	0.048 0.620	0.597 0.000	0.610 0.000	0.546 0.000	0.624 0.000	0.613 0.000	0.683 0.000	0.800 0.000	0.759 0.000	
II-WU	0.605 0.000	0.528 0.000	0.531 0.000	0.535 0.000	0.435 0.000	0.547 0.000	0.598 0.000	0.554 0.000	0.642 0.000	0.474 0.000	0.384 0.000	0.434 0.000	0.520 0.000	0.527 0.000	0.598 0.000	0.492 0.000	0.393 0.000	0.327 0.000	0.118 0.219	0.654 0.000	0.646 0.000	0.605 0.000	0.628 0.000	0.604 0.000	0.728 0.000	0.780 0.000	0.825 0.000	0.803 0.000

Cells: Correlation / p-value

Source: Own elaboration

Figure A1.
Variables correlations

Appendix 4

Table AIII. Kolmogorov-smirnov normality TEST

Variable (item)	Average	SD	N	D	Aprox. *P*-Value
IQ-DR	5.90	1.079	110	0.061	>0.15
IQ-DL	5.47	1.029	110	0.032	>0.15
IQ-DA	5.27	1.187	110	0.034	>0.15
IQ-DC	5.58	1.251	110	0.063	>0.15
IQ-DU	5.53	1.146	110	0.052	>0.15
IQ-COM	5.09	1.137	110	0.033	>0.15
SQ-DR	5.29	1.251	110	0.055	>0.15
SQ-SA	5.49	1.318	110	0.059	>0.15
SQ-AT	5.26	1.154	110	0.034	>0.15
SQ-WT	4.87	1.421	110	0.054	>0.15
SQ-F	4.45	1.542	110	0.047	>0.15
SEQ-UT	5.30	1.457	110	0.060	>0.15
SEQ-RR	5.02	1.371	110	0.060	>0.15
SEQ-ES	5.14	1.107	110	0.052	>0.15
SEQ-ME	5.37	1.439	110	0.064	>0.15
SEQ-MS	5.33	1.221	110	0.060	>0.15
USE-C	5.36	1.275	110	0.050	>0.15
USE-A	4.93	1.485	110	0.040	>0.15
USE-AT	4.27	1.669	110	0.059	>0.15
US-AU	5.19	1.153	110	0.039	>0.15
US-AU2	5.16	1.145	110	0.031	>0.15
US-WU	5.03	1.233	110	0.038	>0.15
US-AUS	5.05	1.073	110	0.024	>0.15
US-SOC	5.09	1.281	110	0.049	>0.15
II-SDT	5.40	1.069	110	0.037	>0.15
II-JPI	5.48	1.089	110	0.046	>0.15
II-PI	5.38	1.211	110	0.054	>0.15
II-DU	5.70	1.119	110	0.057	>0.15
II-WU	5.70	1.208	110	0.066	>0.15

Source: Own elaboration

Appendix 5

Construct	Variables	Construct	Variables
Information quality	IQDA	USE (system dependence)	USEC
	IQDC		USEA
	IQCOM		USEAT
System quality	SQDR	User satisfaction	USAU
	SQSA		USAU2
	SQAT		USWU
			USAUS
Service quality	SEQRR	Individual impact	IISDT
	SEQES	(Perceived usefulness)	IIJPI
	SEQME		IIPI
	SEQMS		IIDU
			IIWU
Eliminated observations (6): 34, 39, 47, 56, 76, 107			
Multivariate kurtosis: 2.86			
Maximum likelihood		Robust	
Chi-square	290	CHI-SQUARE	281
CFI	0.956	CFI	0.946
RMSEA	0.070	RMSEA	0.067
Ave by construct		Construct reliability	
IQ	39.99%	IQ	0.66
SQ	54.41%	SQ	0.78
SEQ	53.36%	SEQ	0.82
UES	51.97%	UES	0.75
US	70.74%	US	0.91
II	61.86%	II	0.89
Reliability coefficients			
Cronbach's alpha		0.954	
Reliability coefficient RHO		0.974	

Table AIV. Confirmatory factor analysis

Source: Own elaboration

Appendix 6

(Significance and Variance Extracted (R^2))	Rai *et al.*	This study
DeLone & McLean model		
Easy of use-System dependence	*	–
Easy of use-User Satisfaction	**	–
Information Quality-System dependence	**	–
Information Quality-User Satisfaction	**	*
User Satisfaction-System dependence	**	–
System dependence-Perceived Usefulness	**	–
User Satisfaction-Perceived Usefulness	**	*
R^2		
System Dependence	30%	12%
User Satisfaction	51%	77%
Perceived Usefulness	60%	65%
Seddon model		
Easy of use-Perceived usefulness	**	*
Easy of use-User Satisfaction	**	–
Information quality-Perceived Usefulness	**	–
Information quality-User Satisfaction	**	*
User Satisfaction-Perceived Usefulness	**	*
User Satisfaction-System dependence	**	*
R^2		
Perceived Usefulness	41%	69%
User Satisfaction	55%	80%
System Dependence	27%	12%
Modified Seddon model		
Easy of use-Perceived usefulness	**	*
Easy of use-User Satisfaction	**	–
Information quality-Perceived Usefulness	**	*
Information quality-User Satisfaction	**	*
User Satisfaction-Perceived Usefulness	**	*
User Satisfaction-System dependence	**	*
Perceived Usefulness-System dependence	**	–

(*continued*)

Table AV.
Comparison with the study of rai, Lang and Welker (2002)

(Significance and Variance Extracted (R^2))	Rai *et al.*	This study
R^2		
Perceived Usefulness	41%	69%
User Satisfaction	55%	80%
System Dependence	53%	12%
Main characteristics of the study		
Structural equations	Lisrel	EQS
Year of the study	2002	2014
Unit of analysis	University students of one university	Executives of IT department of thirteen companies
Information System	Computarized student information System	BIS

Note: Significance (p values): * (<0.05), ** (<0.01)
Source: Own elaboration

Table AV.

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