Modélization of User Satisfaction in IS research

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Abstract—**One among the major concerns of managers since the emergence of Information Technology (IT) in organizations in the sixties is to prove that the IT /IS (information system) investments have a positive impact on the organization.**

Over time, the IS's evaluation dominated the research in IS field. Several variables of IS measurement, called IS success measurements, like user satisfaction, system use, organizational performance and user decisional performance [41] were developed and considered as substitute for the effectiveness of IS (IS effectiveness is measured against the achievement of objectives according to Hamilton and Chervany [25]). User satisfaction is the most used in measuring the success of IS and their impact on the organization.

This article focuses on the "user satisfaction". Through the analysis of a set of selected articles from the literature about the evaluation of IS, we have developed a class model (using UML formalism) about the construct user satisfaction. The proposed model synthesizes the characteristics of the construct obtained especially from the user satisfaction measurement literature.

Keywords:

**   *Keywords*—IS evaluation, user satisfaction, modelization of user satisfaction.**

I.   Introduction

A considerable and significant effort of many researchers has been directed to the identification of factors contributing to the success of IS. The evaluation of IS is one of the most important areas of research in IS research. The goal through the evaluation of IS is measuring the added value of IT/IS on the organization: " it is a process which through quantitative and qualitative techniques establish the value of IS/IT on the organization [54]. The evaluation of the IS also measures the effectiveness of the IS which according to [25] reflects the IS's contribution in achieving the organization's objectives. The evaluation was launched in the early years of introduction of IT to prove that they have a positive impact on the organization. The evaluation of IS has been named "assessment of the success/success assessment" by Delone and Mclean [16]. These authors consider that it is difficult to define success of IS as these systems are an abstract concept which can not involve direct measurements. Some researchers are engaged in measuring success by the use of economic indicators (cost/benefit) the informational value and organizational performance [56]. These measures which continue to be used showed their limits because some benefits are quantifiable, but others are intangible and therefore difficult to quantify. This is justified by Gatian [22], if an effective system is defined as one that adds value to the firm, any measure of system effectiveness should reflect some positive changes in user behaviour i.e improved productivity, fewer errors or better decision making. So if the value of the information is difficult to quantify, the user remains the only one to express the value of information throughout its views [56] it is the perceptual measurement of IS success measures. For this reason, the researchers chose the user's satisfaction as a measure. The success of the IS

can't be attributed to a single factor. There are complex and interdependent relationships between IS, environment, organization, users and management. This character has motivated researchers to the factors that influence the success directly or indirectly. In this context, Delone and Mclean offer a model in 1992 and revisited it in 2003. They identified six factors of success: the quality of the IS, the quality of information, user satisfaction, the use of IS, individual impact and organizational impact and quality of service. This model later became a reference in evaluating the success of IS where researchers have made refinements to the model according to the specificities of the evaluated IS [12] [11] etc.

This article is about the "user satisfaction ". The aim is to synthesize its characteristics and properties mentioned in the literature in a class model of UML formalism. These characteristics and properties are derived from three sections. The first section deals with the presentation of the construct. It reflects the way as it is seen by some authors and how they justify their intense use compared to other successful measures of IS success. The second section is dedicated to various measurement models in which the focus is on dimensions and measurement variables that influence this construct. The third section is devoted to the limits and criticisms of user satisfaction. The conceptualized model is presented in section four. At the end in the conclusion are listed the main points of this work in a synthesized way.

II.   User Satisfaction

User satisfaction is one of the measurement variables of IS success. It is the most used dependent variable and surrogate measure of information system effectiveness [5] [27][7][19] [16] [22] [23]. This concept was inspired from the field of psychology and proposed for the first time in the field of IS by Cyber and March [14] in Their Behavioral Theory of the firm. They assume that "the IS that meets the needs of its users will enhance the satisfaction of its users and if the IS does not produce the desired information, users will be dissatisfied and will look elsewhere". According to Mélone [38] the most widely use of this measure is due to its ease of use, the ex-post evaluation, the lack of the system monitoring software for the application under study, and the potential influence of direct measurement of usage behaviors of the system. [16] also explains its widespread use in three reasons. Validity: Satisfaction: has a high degree of face validity, it is hard to deny the success of a system which users Say That They Like. Existence of a measurement standard: The development of Bailey and Pearson instrument and its derivatives has provided a reliable tool for measuring satisfaction and for making comparisons among studies. Ease of Use: For the appeal of satisfaction as a success measure is that most of the other measures are so poor; they are either conceptually or empirically difficult to obtain. [22] notes two reasons in the literature regarding the attention given to this measure,

many believe in the theory that expectancy psychological attitudes (ie satisfaction) are linked to behavior (i.e. productivity). It is believed that satisfied users will be more productive. The second reason, it is difficult to measure efficiency or productivity directly. Raymond [47] in a validation study of user satisfaction in small organizations says that researchers indicate that approach based on user satisfaction, i.e. on the user's subjective judgment, is preferable to an approach based on objective measures of use and performance. This concept was studied by several authors where each defines and justifies its use according to its own point of view; there are as many definitions as studies [37]. In its definition in the dictionary LaRousse; satisfaction results from the comparison of expectations and what was delivered. This definition coincides with point of view of Shirani [1994]; user satisfaction is a measure of user's belief about how well a system meets his requirements and expectations. For Bailey and Pearson [5], satisfaction in a given situation is the sum of feelings or attitudes toward a variety of factors affecting that situation. For Ives et al. [27] it is the degree of user belief that the IS provides information needs. They consider satisfaction as a significant substitute for the organizational effectiveness as a critical and immeasurable impact. For Doll and Torkzadeh [19]; the end-user satisfaction is conceptualized as an effective attitude towards a specific application with which the user interacts directly. For Gatian [22]; the main reason for using this concept lies in the theoretical foundations of psychology where it is believed that attitudes are related to behavior. Delone and Mclean [17] consider satisfaction as an antecedent that leads to individual and organizational performance and that it depends on the quality of the information as the IS product and its service quality. From there, it is clear that the user satisfaction occupies an important place in the literature on evaluating the success of IS and takes the front compared to other measurement variables. Prove the effectiveness of the IS is a major concern both for managers and researchers. The use by the researchers of the user satisfaction as a surrogate measure for IS success [16] is mainly due to the difficulties of measuring return on part of major unquantifiable and intangible investment [Shirani 1994] . It is the user who evaluates the IS expressing its point of view on the IS, his contentment or discontent towards the IS and its uses [56]. The measurement of user satisfaction was widely studied and several instruments were proposed.

III. User Satisfaction measurement :

The first research works on the measurement of user satisfaction as a surrogate of IS success, were conducted between the 70s and the early 80s [18], [47] [24]. Existence of a correlation between user satisfaction, use and IS success were noted during this period. It was admitted also that no standard has been developed to realize the comparison between different studies conducted during this period. This need has interested numerous researchers. Bailey and Pearson [5] have developed an instrument for user satisfaction that represents an important achievement in the evolution of this construct that no other study could realize

at that time [50]. The instrument appeared as the first reliable and pertinent tool of user satisfaction measurement [16]. The authors draw works on satisfaction in psychology and human-computer interaction to conduct their work. The model is in the form of questionnaire with 39 factors classified into five dimensions: involvement of management, the services offered by the team in charge of the IS, users, quality of IS and quality of information. They designed a 7 point semantic differential adjective with 4 bipolar statements for each question, emphasizing the user᾽s positive/negative feelings toward the system. At the end they recommended the focusing on the relationship with IS function and participation. This important work was continued and the authors who have made outstanding instruments are Ives et al. [27] Baroudi and Orlikowski [7], Doll and Tokzadeh [20]. Ives et al. 1983 duplicated and expanded Bailey and Pearson findings and developed a short instrument of measuring user satisfaction. They consider it based on solid theoretical foundations, empirically valid and full because it covers the IS itself and the services rendered around the IS. On the basis of a factorial analysis and validation, they reduce the questionnaire to thirteen (13) factors grouped into three (3) dimensions: the IS Product (quality of information), the support (quality of services provided by IS function) and knowledge or involvement of the user. Baroudi Orlikowski [7] based their work on the instrument of Ives et al. 1983. They perform a psychometric evaluation of this short instrument. With a survey and a case study they lead to the same results and the same dimensions as Ives et al. 1983. Thus their result was a support for the instrument of Ives et al. 1983. They claim that the instrument tested is a standard tool for measuring user satisfaction and diagnosing dysfunction points related to the use of IS in an organizational context. Doll and Torkzadeh [19] continue the work on the basis of the previous measurement models [5][7] and take into account the new context of use of IS adapted to the new client / server environment and marked by a high degree of autonomy vis-à-vis of the IS users [32]. The authors assume that existing instruments in a traditional data processing environment where users do not interact directly with the applications are unavailable. So they interested in the satisfaction of end users of IS. This gave to the concept of "End User Computing Satisfaction: EUCS". They measure the attitude towards a specific application of a user who interacts directly with this application. They provide a measure of end user satisfaction in the form of a questionnaire with 12 factors, categorized into five dimensions the content, accuracy, format, ease of use and availability. They are groups in two dimensions the quality of information and the quality of the IS. These works on the discovery of the factors affecting the user satisfaction continued. Sanders and Jones, Myers et al. [40] examine the ability of IS function to responds to the needs of users, this comes from performance of the quality of services provided by the IS. Thus in their revised model [17] integrate the quality of services provided by IS as a determinant of user satisfaction, it is thus another element considered in the perceptual assessment of IS. The participation and commitment of users appear also as key dimensions of user satisfaction throw the study conducted by[6] by doing a psychological and behavioural analysis. They assume that the user who participates in the

development of the IS project can influence the design of the IS, satisfy his/her needs and understand well how the IS can help his/her work, thus the new IS is relevant and important. This result was confirmed by Kappelman and Maclean [29]. Research studies of the determinants of satisfaction continue as one item at one time but other research attempt to list the determining factors [37] [56]. The most important synthesis work as mentioned in the literature and which was able to synthesize many works is that of Mahmood et al. [37]. These authors conducted a synthesis and validation of the factors that influence the user's satisfaction evoked in studies related to the measure of user satisfaction between 1986 and 1998. They identified nine variables grouped into three dimensions: the perceived benefits of an IS, involvement and the background of the user and the organizational support. According to the review of the literature conducted by [56] about the factors affecting the user satisfaction; five categories of factors were identified: relations between the organisations management and the IS, relation between the users and the information received from the IS, IS's features IS's service provider.

Synthesis

The main factors that influence the measuring user satisfaction have been proposed in the reference models developed by [5] [27] [19] [16]. Research studies that were conducted after are either basis models adaptations of IS studied, or empirical studies measuring validity and relations between variables or proposals for new variables and test of their validity and reliability but conducted as one item at one time. We propose in table 1 a synthesis of variables for measuring user satisfaction through the literature determinants of measuring user satisfaction in traditional data processing environment, end user computing environment and application support decision.

TABLE 1 *:* USER SATISFACTION VARIABLES MEASUREMENT AND DIMENSIONS.

| Dimension	Variable	References
Quality of information	**Exactness Reliability Completeness Usefulness Actuality Format Clarity Usefulness Comlexity**	**Motivalla and Pheny 1982 Bailey and Pearson 1983 Ives et al. 1983, Baroudi and Orlikowsky 1988, Doll and Torkwadeh 1988, D & M 1992, Nelson et al.2005 Mahmood et al. 2000, Taibouni 2014**
Quality of system	**Accessibily Reliability Integration Flexibility Timeliness Ease of use Perceived usefulness and understanding of the system Level of user commitment and participation**	**Power and Dickon 1973 Lucas 1974, Swanson 1974 Ginzberg 1981, Bailey and Pearson 1983, Ives et al. 1983, Ives and Oloson 1984 Doll and Torkwadeh 1988 Baroudi and Orlikowsky 1988, D & M 1992, Baraki and Hartwick 1994 MacKeen et al. 1994 McLean and Kapel,an 1994, Kappelman 1995, McKee Guimaraes 1997, Mahmood et al. 2000, Nelson et al.2005 Leclerq 2007**
Organizational support and services provided by the IS function	**Reliability of support service Disponibility of support service Competence of support service Timeliness in solving problems Confidence to support service Implication of top management Training**	**Kettinger et Lee 1997, Bailey and Pearson 1983, Ives et al. 1983, Saunders and Courtney 1985, Baroudi and Orlikowsky 1988, Saunders and Jones 1992 D & M 1992 , Baraki and Hartwick 1994, MacKeen et al. 1994, McLean and Kapelman 1992, Myers et al. 1998, D & M 2003, Mahmood et al. 2000, Taibouni 2014.**
Users characteristics	**Age Genre Function Experience Education Cognitive style**	**Zmud 1979, Fuerst and Cheney 1982, Huber 1983, Saunders and Courtney 1985Venkatech and Davis 2000, Bailey and Pearson 1983, Taibouni 2014**

IV. Critical analysis of user satisfaction

User satisfaction has been recognized by many researchers as a key variable measurement of IS success but it has also been the subject of criticism demonstrating its limits. From the criticisms in the literature [32], we classified the criticisms in five classes: the concept itself as a measure of IS success, the operationalization of perception's variables, the heterogeneity of individuals who participate in the survey, the consequences of non- reaction to one or more variables, questions defining the theoretical variables and the use of question for an overall satisfaction that detailed. The operationalization of user perceptions, as the weighted arithmetical sum of a set of criteria is invalid [50][38]. For the heterogeneity of individuals; it is very difficult to add and compare the scores of heterogeneous individual items [Galleta and Lederer 1989]. Bailey and Pearson [5] recognize that the overall score of satisfaction of an individual will be very medium if he feels no reaction to one or more factors. The variables are too often defined in ambiguous terms or questions. Most of the questions reflect or operationalize poorly the selected theoretical variables [50]. Sometimes it is more useful to use one single overall measure of satisfaction and not the whole set of measurement factors, the synthesized questions are sometimes more reliable than the detailed questions [7]. Other authors have rejected the concept itself as a measure of IS success. Davis [1989] proposes the IS acceptance instead of satisfaction. The success of the IS depends on its acceptance by users that it is measured through perceived usefulness and ease of use. Goodhue [1995] proposes the use of user evaluation (UE) instead of user satisfaction, the UE is an assessment made by a user about certain qualities of the IS, the appropriate perspective is that of task-technology fit. This perspective suggests that there is a fit between the IS functionalities, the task needs and the competences of the users that determines the perceptions of individuals. The individuals evaluate the IS on the basis of the fit between the IS and their needs.

V. Modelization of User satisfaction

User satisfaction is a concept widely discussed in the literature as a key variable for measuring the effectiveness of IS. Our goal through all the previous sections was to identify from the literature the properties, characteristics, outcomes variables and dimensions of measuring instruments associated to the user satisfaction. In this section we will use this knowledge to modelize the user's satisfaction concept. The user satisfaction is a perceptual variable (nature) used in measuring the success of IS (domain of use), inspired from the field of psychology (basic theory) introduced in the field of IS by Cyber and March (originator) in 1963 (emergence). It is the subject of various studies (Nature Study), empirical studies measuring validity and relations between variables or proposals for new variables and test of their validity and reliability but conducted as one item at one time   is therefore to be either. These studies have been studied in different types of IS (type IS) that are essentially the MIS (Management Information System) and DSS (Decision Support System) . The technologies (DSS Technology) associated to the DSS are Web-based DSS, Data Warehousing and Data Mining [13]. It is measured by measuring instruments (Instrument), developed by researchers (author). Each instrument is a set of measurement variables (variable) , operationalized by questions and grouped in dimensions (dimension). We retain here the characteristics of the user, the quality of IS, the quality of information and organizational support. The user (user type) can be the manager who uses the information in the decision-making processes or the one responsible for providing IS output. The developed measuring instruments are subject of tests of validity and reliability through either interviews or questionnaires (Test Method) by assigning weights to each variable (score) to facilitate automatic processing. The user satisfaction has been widely criticized despite it has been recognized as a key measure of the IS success. These criticisms (criticism category) relate to the concept itself as a measure of IS success, its operationalization and its evaluation. At the basis of this summary, we obtain the class model associated to the construct of user satisfaction presented in Fig 2.

Figure 2 : User satisfaction model
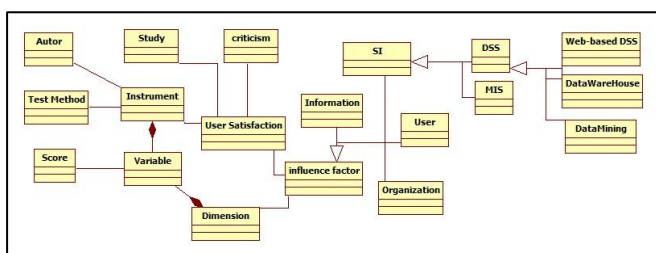
VI. Conclusion

This review of the literature was at the same time rich in diversity of concepts and exciting in how the studies are conducted in a continuous way by the authors. Some authors provide more arguments to increase the use of a measurement variable, others highlight links between measurement variables, others conduct empirical studies to test and validate the reliability of the measurement variable already proposed etc. This study focused on user satisfaction. This variable is a surrogate of IS success. It was inspired from the field of psychology and introduced into the field of IS since the early years of introduction of IT/IS in organizations (the 60s). The evaluation of IS based on this variable has gained importance in the 70s in order to prove the effectiveness of IS and their impact on the organization during a period when they experienced major failures. It is a measure of IS effectiveness characterized by subjectivity because it is based on the opinion of the IS's users. The researchers made use of this variable to be able to measure the impacts and effects of IS which are intangible and unquantifiable that no other variables could measured. Variables; cost / benefit system utilization, organizational performance, performance user decision etc [44] are quantifiable variables that have shown their limits. Our review of the literature has helped us to understand the user satisfaction and to identify its characteristics and properties from the definitions of the authors and measuring instruments. The class model proposed is a schematic summary that highlights the links between concepts and properties that relate to user satisfaction. This study has the value of having synthesizes all the concepts of user satisfaction as a measure of IS success in three components, properties of the construct, influencing factors and evaluation. Reading the model simplifies the understanding of the construct that through literature seems complex.

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