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Towards an improved acceptability assessment model of innovative solutions in the design phase

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Abstract: The development of innovative solutions that satisfy stakeholder needs and have successful selling is one of the main challenges of design processes. To estimate this success, the assessment of acceptability or acceptance of innovations has been the subject of multiple research studies and has led to different models that mainly concern the acceptance of the new technology in the usage phase. However, with regard to evolution in design, these models do not seem to be adapted. This paper proposes to characterize existing evaluation models by a literature review, reveals unexplored characteristics of acceptability evaluation and provides guidance for future research.

Keywords: Innovation, user-centred design, evaluation, acceptability, Technology Acceptance Model

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1. Introduction

Innovation is a complex concept, which has been widely defined in the literature in various disciplines (Baregheh, Rowley and Sambrook, 2009). There is no one universal definition. Its meaning changes according to disciplines, organizational structures (Akenroye, 2012) and domain (Weberg, 2009). Innovation can be the process or outcome of creating, developing and introducing new ideas, products, services or methods that meet needs and create compelling value for users (Boly, Camargo and Morel, 2016). Innovation changes the systems of use and knowledge of which they are a part, it encourages the emergence of new solutions and the evolution of our lifestyles (Skiba, 2014; Taylor, 2017). However, for a new solution to be considered as an innovation, it must be inserted and adopted by society (OECD and Eurostat, 2018).

The design and development processes for innovative solutions have evolved over time. They first focused on the technical and functional characteristics. Changes in the market and consumption trends have led to the integration of users into these processes. Considering their needs allows a greater differentiation and competitiveness of companies. Various user-centred design approaches have been developed in recent years, including user innovation, user experience, emotional design, design thinking, open innovation (Skiba, 2014). These trends are characterized by collaborative and iterative work with future users at different stages of the design process (project definition, ideation and prototyping). These steps aim to provide an innovative solution that meets needs. However, to ensure the relevance of the solution and increase its acceptance, it is necessary to integrate an evaluation step with future users and other stakeholders (Lacombe and Esselimani, 2017).

The assessment activity is a critical step in the design process. It allows the solution concept to be tested by future users in an iterative way. The objective is to assess the acceptability of the proposal in order to gradually improve it until an innovative solution is consolidated. By carrying out this step, the risk of rejection of a finished product can be limited, which increases the probability of success of the innovation project (Bobillier-Chaumon and Dubois, 2009).

The notions of acceptability and acceptance are often confused. Studies have been carried out to differentiate between these two concepts (Bobillier-Chaumon and Dubois, 2009; Alexandre *et al.*, 2018; Busse and

Siebert, 2018). These definitions are summarized in Figure 1. The main difference between the two concepts is based on the stage at which they are evaluated in the new product development process and the purpose for which the evaluation is being conducted. Acceptance is the demonstrated willingness (within a group of users) to start or continue using an innovative solution, for the tasks it is intended to support (Morris and Turner, 2001; Salavaara *et al.*, 2009). Acceptance assessment aims to estimate the perception of benefits and risks of solutions based on the users' experience and feelings in their use, taking into account various factors. It is carried out in the marketing and use stage and mainly concerns finished products. Acceptability is defined as the subjective representation (attitudes, opinions, etc.) of the use of an innovative solution during the design phase (Tricot *et al.*, 2003; Arbelaez Garcés, Bonjour and Rakotondranaivo, 2016). The acceptability assessment aims to predict the behaviour of future users, in order to limit the risks of rejection and ensure the success of innovation projects. It evaluates some of the factors in Intermediate Design Objects (IDO) (Février, 2011). IDO is a partial result achieved during the project, such as a plan, a model, a prototype (Galvez Manriquez, 2015).

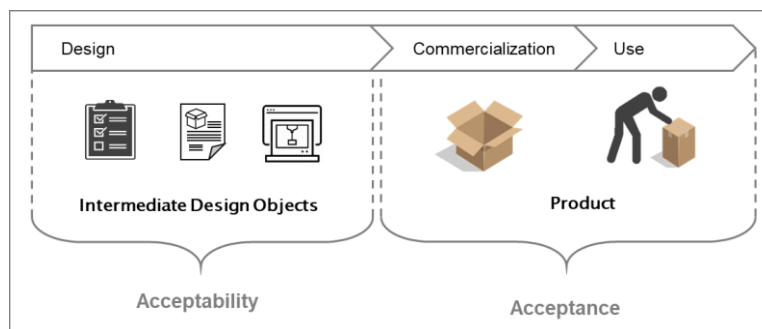


Figure 1. Acceptability and acceptance concepts

A great deal of research has been conducted on the acceptability or acceptance assessment of innovations and has proposed several theoretical models. These models have evolved over time by integrating new factors and new relationships between these factors (Taherdoost, 2018). The main motivation for this evolution has been the constant development of new technologies and the diversification of fields of applications (Sharma and Mishra, 2014). The first models published were based on the intention of

individuals to predict their behaviour. The pioneer concerns the theory of reasoned action (Theory of Reasoned Action – TRA) (Fishbein and Ajzen, 1975). A series of technology acceptance behaviour models followed, including the Theory of Planned Behaviour (TPB) (Ajzen, 1991) and the Technology Acceptance Model (TAM) (Davis, 1985). The latter is the most widely used model to predict the acceptance of technology by individuals, thanks to its simplicity and generality (Hornbæk and Hertzum, 2017). TAM explains the attitude and intent of a person to use a technology by using two factors: perceived usefulness and perceived ease of use. This model has been modified several times to assess different solutions and obtain a better acceptance prediction. New factors and relationships between factors were proposed. In this way, many models have been created, including TAM 2 (Venkatesh and Davis, 2000), UTAUT (Unified Theory of Acceptance and Use of Technology) (Venkatesh *et al.*, 2003), TAM 3 (Venkatesh and Bala, 2008). In addition, other models have been created from the extension of the previous ones, such as (Ghazizadeh, Lee and Boyle, 2012; Munir, 2014; Alharbi, 2017).

Recent literature reviews have identified and analysed various publications on existing assessment models (Sharma and Mishra, 2014; Marangunić and Granić, 2015; Momani and Jamous, 2017; Taherdoost, 2018). These studies focused on existing acceptance assessment models, their components (factors, groupings, relationships between them) and application domains. Few studies have examined acceptability assessment models and no review of these models associated with design processes has been found. Moreover, they did not characterize the models taking into account other aspects related to the assessment activity, such as the purposes of the evaluation, the actors involved, the evaluation sites, the time when the evaluation was carried out, the resources used.

In addition, the characteristics of new design methods (dynamic and collaborative processes, where multiple actors participate in the different stages of solution development) must be taken into account. In this context, the improvement of these acceptability assessment models has become important. Before claiming to propose improved models, it is necessary to have a good knowledge of the current models in order to identify the necessary adaptations. This paper presents a review of the scientific literature to characterize the assessment models used and the promising research directions.

The following section presents how the 4W1H (What, Who, Where, When and How method, adapted from the well-known Five W's approach (Who, What, Where, When, Why?) was applied to conduct the literature review and which corpus of publications was considered. The third section describes the results obtained with discussions. A fourth section proposes ways to improve the assessment activity. Finally, the last section concludes this study by highlighting its implications and limitations.

2. Literature Review Process

The literature review applies a 4W1H method to characterize acceptability or acceptance assessment and to identify the information needed for the study. This method is applied to publications in the SCOPUS database. The following subsection presents the implementation of the 4W1H method while the second subsection gives details about the document selection process.

2.1. Method of Identifying Information

For the analysis of the publications, the 4W1H methodology was used. Unlike other techniques, it makes it possible to identify all the characteristics of a situation, a problem, an activity, by asking and answering the appropriate questions (Lannoy, 2009; Dubuisson-Quellier *et al.*, 2013). Other research has used this method to understand a knowledge domain (Bajaj *et al.*, 2018), collect and categorize information (Palafox and Hashimoto, 2010), characterize challenges in a structured way (Zhang *et al.*, 2014) and guide projects (Dautelle, 2013).

As part of our research, this method was used to characterize models for the acceptability and acceptance assessment of innovative solutions presented in the literature, by systematically answering the following questions:

- What: What acceptability or acceptance assessment about? This question aims at identifying the types of innovative solutions that are the objects of the evaluation. These innovative solutions can be: computer technology products (software, websites, or digital applications), non-computer technology products (communication technologies, robots, or cars), non-technology products (food products,

handicrafts), services (home help, deliveries), organizations (product-service organizations, stakeholder organizations) and practices or procedures (programs, protocols, management system).

- **Who:** Who are the actors involved in the assessment of acceptability or acceptance? This question has been divided into two parts: how many types of actors? And which profile of actors? The answers to the first question concern the number of types of actors who participated in a study. For example, if a group of students has participated in the evaluation of a self-learning application, then they are considered as one type of actor. However, if a group of teachers also participated in the evaluation of this application, they are considered as two types. In the second question, the stakeholder profiles were divided between users and experts.
- **Where:** Where is the assessment of acceptability or acceptance carried out? This question is intended to determine where the assessments were conducted. Possible answers are: in the actual context of use (real context), in locations different from the actual context of use (experimental context), or in a non-established context, since the evaluation was done by electronic means (virtual or digital context).
- **When:** When is the acceptability assessment or acceptance carried out? This question is intended to determine the phase of the design process during which the evaluation was conducted. Three response options were identified: during the design phase, before the use phase or during the use phase.
- **How:** How is the assessment of acceptability or acceptance carried out? This question aims to identify how the evaluation activity was conducted. For this reason, the question is divided into four parts: which model was used? What method was chosen to collect data? What technological tool was used in the collection? And what kind of analysis was done? The answers to the first question concern the models set out in the introduction, such as TRA, TAM, and UTAUT. In the second question, we refer to the use of methods such as interviews, questionnaires, observations. In the third question, we seek to identify the type of tools, for example the paper or digital questionnaire, or virtual reality. Finally, the fourth question asks whether the methods used to analyse the information collected are quantitative or qualitative.

The information identified by applying these questions was coded and listed in an Excel document.

2.2. Publication Selection

The process followed for the selection of publications is graphically represented in Figure 2. The Scopus database was used because it contains

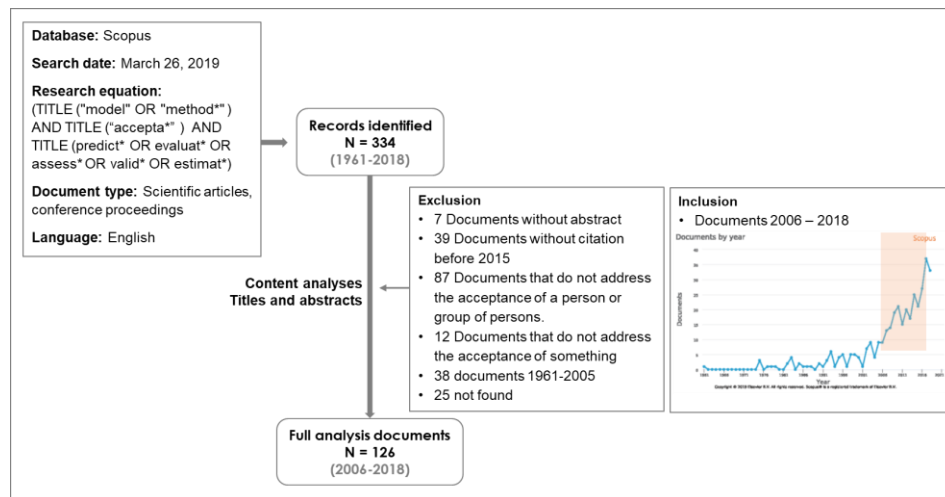


Figure 2. Publication selection process

the largest number of documents compared to other databases (Gudanowska, 2017). The journals and conferences referred to in this database cover multiple disciplines (Engineering, Computer Science, Decision Sciences, Social Sciences, “Business, Management and Accounting”, Psychology) that may be concerned with innovation acceptance topics. Their papers have been reviewed by international peers from various scientific fields (Regolini and Jannés-Ober, 2013). The research we present below was conducted in March 2019. We identified journal articles and conference proceedings in English from 1961 to 2018, where the heading "title" contained the word "accepta*", plus one of the following terms: ("model* or method*") and ("predict* or evaluat* or assess* or valid* or valid* or estimat*"). The asterisk was used to search for all variations of the word used, this encouraged the inclusion of publications dealing with acceptability and acceptance.

The search found 334 publications. The representation of results by year

showed an increase in the number of results between 2006 and 2018. Documents published on these dates have been included in the analysis. The following inclusion criteria were used: (1) publications cited at least once (except for the last three years of the sample, as it is likely that these documents have not yet been cited because of their novelty); (2) publications that assess the acceptability or acceptance of an innovative solution (products, services, organizations); (3) publications that conducted the evaluation with one or more people.

As a result, several publications were not selected: 38 documents published between 1961 and 2005; 7 documents without abstracts; 39 publications without any citations; 12 documents that did not assess the acceptability or acceptance of an innovative solution, such as publications that dealt with the acceptance of an individual, by himself or by a group of people in a particular life context; 87 documents that did not assess acceptability or acceptance by people, for example publications that addressed acceptance in accordance with standards. In addition, 25 additional documents were excluded because the full text was not found. Finally, 126 publications were selected for the study.

3. Characterization of Models for Assessing Acceptability or Acceptance

The 126 selected publications were published mainly in the thematic areas of computer sciences, social sciences, engineering and business (Figure 3). These publications included articles and conference proceedings with titles containing the words acceptance and acceptability. The presence of one of these words in the title has been quantified. The

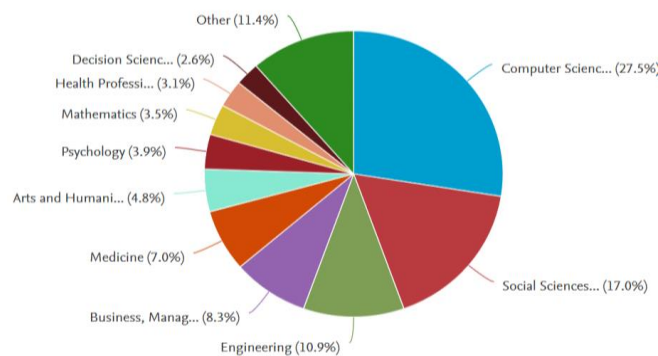


Figure 3. Publications by thematic domain (Source: Scopus)

results obtained show that a large proportion of the publications use the word acceptance (87.3%), while a smaller percentage use the word acceptability (8.7%). Other publications used both words. The analysis is carried out on the totality of articles, independently of the content of the word acceptability or acceptance. Appendix 1 lists the publications analysed with the coded results and Appendix 2 shows the responses for both the publications dealing with acceptance and acceptability and for all publications. For each item of the questionnaire, the results obtained are presented and discussed.

3.1. Technologies are the first object of the assessment (what)

A high percentage of publications (66.7%) assessed the acceptability or acceptance of computer products. These are mainly mobile websites, programs or applications that aim to encourage, for example, e-learning (Dai *et al.*, 2011; Alsofyani and Eynon, 2012), e-shopping (Halbach and Gong, 2011; Shukla and Sharma, 2018), financial resource management (Lai and Pires, 2010; Kumar and Shenbagaraman, 2017). In addition, 24.6% of the publications evaluated non-computer technologies, including mainly health technologies. For example: a device for threading a compression stocking (Arbelaez Garces, Bonjour and Rakotondranaivo, 2016), a remote monitoring system (Gagnon *et al.*, 2012). The remaining documents assessed practices (such as medical procedures or engineering processes) (4.8%), non-technological products (2.4%), services (0.8%) and organizations (0.8%).

Innovation can involve a wide variety of artefacts. However, the results obtained show that most acceptability or acceptance assessments are done on technological products.

3.2. Innovative solutions are evaluated by a single type of actor, the users (who)

According to the results obtained, in 86.5% of the publications, the acceptability or acceptance assessment involved only one type of actor. In 10.3%, two types of actors were involved. The remaining percentage corresponds to documents that included three (2.4%) or four actors (0.8%).

The main profile of these actors is that of users or future users (89.7%),

such as employees who evaluated a production system (Jokonda, 2015), students who evaluated new online learning systems (Yi-cheng *et al.*, 2007). In addition, some documents included experts as evaluators of the solution (1.6%) and a very small percentage included both users and experts (0.8%). Finally, 7.9% of publications did not make an assessment with some type of actor, but instead reviewed literature on acceptability or acceptance models, generally to propose new models (Turner *et al.*, 2010).

The publications analysed show a low integration of the various types of actors in the acceptability or acceptance estimation, mainly users or future users. Assessments carried out with different actors analyse the results as a whole. This means that the preferences of different types of actors are not differentiated and no conflict between preferences is identified. For example, in Randell's paper (Randell, Backhouse and Nelson, 2015), the use of videoconferencing in a clinical study centre was evaluated with paediatricians, diabetologists, trial coordinators and nurses. Although different actors participated in the assessment, their preferences were analysed as a single group of "technology users" actors.

The treatment of preferences according to multiple types of actors can generate different conflicts, such as contradictions and paradoxes (Amason, 1996; Ballard-Reisch and Turner, 2017). The failure to identify and manage these conflicts can be decisive for the future acceptance of an innovative solution.

3.3. The real context of use is the place most often used (where)

Thirty-two publications do not specify the context in which the assessments were conducted (25.4%). Of the documents that provided this information, 59.5% conducted the evaluation in the real context of use. For example, a new water supply system has been evaluated among individuals (Nancarrow, Porter and Leviston, 2010), or a shared bicycle system is being assessed in the city (Hazen, Overstreet and Wang, 2015). In addition, 8.7% of publications assess acceptability or acceptance in a virtual or online context, such as virtual robots (Weistroffer *et al.*, 2013). Less significantly, 6.3% of the documents evaluated innovations in an experimental context, in other words, a place different from the context of use, for example a home help robot was evaluated in a public place (Weiss *et al.*, 2008).

Each context has its own characteristics, including rules (formal and informal), individual forms of interaction between people, or a culture (Bobillier-Chaumon and Dubois, 2009). The context in which an assessment is conducted can influence how individuals perceive innovation. Places for assessing acceptability or acceptance must be chosen while knowing the possible biases.

3.4. The assessment is carried out mainly in the use phase (when)

Twenty-four of the publications reviewed do not specify the phase at which innovations were assessed (19%). Of the documents that provided this information, 65.9% conducted the evaluation during the use of the innovative solution. For example, Wu (Wu *et al.*, 2008) evaluated medical devices that have been in use for some time. Among other results, 8.7% of the publications assessed an innovative solution before use, such as the evaluation of mobile communication devices by a future and potential user (Sek *et al.*, 2010). Only 6.3% of publications conducted the assessment in the design phase. In these studies, no finished product was evaluated. They concerned acceptability evaluation of concepts, models or prototypes of a proposed solution (Osswald *et al.*, 2012; Weistroffer *et al.*, 2013).

The high percentage of assessments during the use phase means that most publications are focused on acceptance. Solutions evaluated correspond, in most cases, to finished products. That is, solutions that have completed the design process and on which modifications or improvements deemed necessary cannot be incorporated. It is easier and less costly to modify the proposed solution if the evaluation is carried out as early as possible in the design phase.

3.5. TAM model and quantitative data analysis methods are most commonly used for the assessment (how)

Model used: Eleven publications do not specify the method used to assess acceptability or acceptance (8.7%). Most documents that include the word acceptability in the title do not refer to a specific model. Among the publications that provided this information, a high percentage use known models. The two most important percentages are the original version of TAM (36.5%) and the adaptations it has undergone (36.5%). These adaptations include the addition of new factors, different groupings and

redefinition of the relationships between them. A smaller percentage used the UTAUT method (6.3%). Other publications, used an alternative model (7.9%), either adopted by another author or proposed by the study. Generally, they are developed from known models. Finally, 4% of the documents integrated between three and four models, where TAM is included in most proposals.

Data collection methods: Publications used only one method (86.5%) or 2 to 3 methods (13.5%) for data collection. Among them, questionnaires are predominant (82.5%) followed by individual interviews (6.3%), observation sessions (4%), focus groups (2.4%) and physiological measurements (0.8%). In addition, twenty-four publications compiled information from other research, reviewing the literature (19%).

Technological tools: In 81% of the publications, it was not possible to identify the tools used. These publications largely correspond to those that used questionnaires and interviews. Among the tools identified, e-mail is the most widely used (15.9%), followed by telephone (1.6%), virtual reality (0.8%) and other audio-visual tools (0.8%).

Data analysis method: the analysis methods used were mostly quantitative (81.1%). The most commonly used methods are regressions and factor analysis. However, very few publications have used other quantitative methods such as multi-criteria analyses (Lee *et al.*, 2011) or artificial intelligence methods such as Bayesian networks (Luo, Su and Lee, 2011; Arbelaez Garces, Rakotondranaivo and Bonjour, 2016a). A smaller percentage used qualitative methods (4.8%), mainly content analysis (Durodolu, 2016). The other publications did not specify the method used (13.5%).

3.6. Additional Elements from Other Literature Reviews

Other literature reviews have not addressed many of the model characteristics, as in this study. However, in addition to our results, this research has examined other model characteristics, which describe their evolution. For example, Momani and Jamous (Momani and Jamous, 2017) studied the evolution of assessment models and found that the structure is very similar. The main reason, they explained, is because they were developed from previous models and most of them come from behavioural studies. The difference between these models is how acceptability or

acceptance is explained, that is, with the factors and the various ways of linking them.

The degree of acceptability of a product varies depending on the type of factors taken into account to explain it (Barcenilla and Bastien, 2009). Alexandre, Reynaud, Osiurak and Navarro (Alexandre *et al.*, 2018) found that the factors are generally the same in several models, but named differently. These factors are generally associated with cognitive abilities, emotional aspects such as anxiety or fear should also be taken into account (Marangunić and Granić, 2015). In addition, Liu and Cheng (Liu and Cheng, 2015) considered that most factors are mainly profit-oriented, in other words, they do not take into account negative aspects such as risks or disadvantages. Assessing benefits and risks for each stakeholder is necessary to ensure that the satisfactory decisions (or trade-offs) are made about an innovation.

4. Future Research Avenues

The characterization of existing assessment models using the 4W1H methodology clearly confirms the under-representation of acceptability assessment models and the evaluation is mainly applied to finished products. On this basis and considering the results of other research, we propose some elements of reflection to improve these models. The proposed aspects aim to better adapt acceptability assessment models to new innovative design processes (user-centred, collaborative and iterative). The points proposed here should be studied and further developed in future research, in order to integrate them into acceptability assessment activities.

- Innovation is not limited to technology development. Other types of innovations such as new services, product-service systems, practices, methods, layouts of workplaces, processes and responsibilities could be further assessed. The identification of factors related to other innovation types and the assessment of their relationships should be the subject of future research.
- The current innovation design processes are collaborative. They involve multiple actors in the different phases. Innovations have multiple stakeholders. The integration of the latter into the design phase will increase the probability of future acceptance. An

acceptability assessment model should incorporate the opinions of various types of users and profiles.

- Assessing the acceptability of an innovative solution with several stakeholders can lead to disagreements and conflicts. The identification and management of these problems could contribute to improving the acceptability of the innovative solution.
- The evaluation context is a crucial factor in shaping user's assessments and perceptions about innovation (Valacich, Wang and Jessup, 2018). Real contexts are relevant for the assessment of innovative solutions. However, in the face of collaborative design processes, it is not always possible to evaluate the product at different stages of development and in different contexts of use. In response to these difficulties, various innovation approaches, such as living labs (Hossain, Leminen and Westerlund, 2019), have been developed, allowing users and multiple stakeholders to be involved in designing a solution. The living lab uses neutral evaluation spaces, where real conditions of use can be simulated physically (scale model, prototype) or virtually (virtual reality, augmented reality) in the same space.
- Evaluating an innovative solution in the use phase makes it difficult to improve it, as it is more expensive to make changes to the product. It is necessary to develop a new acceptability assessment model for solutions under development. The results can lead to product improvements at a lower cost and increase the probability of market success. In addition, they contribute to the work of the design team, allowing the sharing of common cognitive representations of the solution being developed (Tricot *et al.*, 2003).
- The design processes are also iterative, which involves the development of progressive representations of the innovative solution (concept, idea, plan, scale model, prototype) in the different design stages. The assessment of these representations, not only lead to the fidelity of the proposal, but also allow a better understanding of the problem and consequently, a better definition of the design specifications. The models of acceptability assessment must be adapted to the progressive evolution of the design specifications and to the different representations of the proposed solutions, for which, the dynamic models are the most convenient.
- To obtain information from a user, technological advances allow us to have more advanced tools than online or paper questionnaires. These

technologies also make it possible to understand psychological and physiological aspects that are not easily expressed by people. It is possible to use technologies such as physiological sensors, eye-tracking systems, videos.

- The factors for acceptability or acceptance assessment used in existing models are principally oriented towards the benefits of using the solution. However, negative aspects, such as risks, are decisive in rejecting an innovative solution. In the design process, the assessment of acceptability should include joint modelling of benefits and risks.
- The analytical methods used to assess acceptability must be capable of processing a large amount of information. This data can come from different sources of information such as questionnaires, observations, or physiological measurements. In addition, the models should also be able to evaluate causality between factors. The statistical methods commonly used in the literature are not sufficient to process this type of information. The use of artificial intelligence methods may be relevant. For example, Arbelaez, Bonjour and Rakotondranaivo (Arbelaez Garces, Rakotondranaivo and Bonjour, 2016b) and Luo, Su and Lee (Luo, Su and Lee, 2011) tested Bayesian networks for acceptability or acceptance assessment.

Conclusions

This research makes two contributions to the body of knowledge on the acceptability assessment. The characterization of existing models for assessing acceptability or acceptance through criteria, on the one hand, and the proposal of research and improvement axes for future models for assessing acceptability in the design phase, on the other hand, have not been considered by other literature reviews.

The 4W1H method applied to characterize assessment model confirmed and identified the differences between acceptability and acceptance. The differences between these two types of assessments have not been examined using this method in previous studies. With regard to the first two questions of the method "what" and "who" there is no significant difference. Both models could be used to evaluate several types of innovations and with different users and stakeholders. With regard to the third question "where", both types of evaluations could be conducted in a real context. However, other contexts could be used to assess the

acceptability of different product representations in the design phase. As for the question of the "when", these two types of assessment differ in the stage at which they are carried out in the design process. Acceptability is assessed from the early stages of design and acceptance in the use phase, when the product is finished.

With regard to the question "how", the acceptability and acceptance assessment has several common aspects. Such as the use of questionnaires and other methods of collecting information from users, the use of different technologies to collect information and data analysis using quantitative analysis methods. The differences between these two types of assessments relate to the theoretical models and techniques used to collect the information. Known theoretical models include factors associated with the experience of using a finished product and in a real context, which is relevant for acceptance assessment. However, these factors must be adapted to the intermediate design object being evaluated and the context in which the evaluation is being conducted.

The method used to conduct this study has some limitations that should be addressed in future studies. On the one hand, publications from a single database were selected. Although these documents have been published in thematic areas relevant to the research topic, it is possible that other databases may contain other relevant publications that have not been incorporated into this research. On the other hand, several studies were excluded because they did not contain a summary and the full text could not be found. Some of these documents may have been relevant for analysis purposes. Finally, another limitation of this study is that some publications did not provide sufficient data for our analysis.

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Appendix 1. List of publications

Author, year	What	Who		Where	When	How			
		Profile	#			Model	Data collection	Tool	Analysis method
(Taherdoost, 2018)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Razmak and Bélanger, 2017)	CTP	Us	2	EC	BU	TAM	Qn	Nn	Qt
(Khan <i>et al.</i> , 2018)	CTP	Us	1	RC	DU	UTAUT	Qn	Nn	Qt
(Chen and Lin, 2017)	CTP	Us	1	VC	BU	TAM+	Qn	Em	Qt
(Beldad and Hegner, 2017)	CTP	Us	1	VC	DU	TAM+	Qn	Em	Qt
(Hong and Yu, 2018)	CTP	Lt	1	NS	NS	TAM	Lt	Nn	NS
(Shukla and Sharma, 2018)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Helia <i>et al.</i> , 2017)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Al Khasawneh and Shuhaiber, 2018)	CTP	Us	1	VC	DU	TAM+	Qn	Em	Qt
(Nagy, 2018)	NCTP	Us	1	RC	DU	TAM+	Qn	Em	Qt
(Nikou and Economides, 2017)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Kim <i>et al.</i> , 2016)	NCTP	Us	1	VC	BU	TAM	Qn	Em	Qt
(Napitupulu, Kadar and Jati, 2017)	NCTP	Lt	1	NS	NS	TAM	Lt	Nn	Qt
(Rahi, Ghanib and Alnaser, 2017)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Munir, 2014)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Dawson, Mackrill and Cain, 2017)	NCTP	Us	1	RC	ID	TAM+	Qn	Nn	Qt
(Girgis <i>et al.</i> , 2017)	CTP	Us	1	RC	DU	NS	Qn/IE	Nn	Ql
(Sharif <i>et al.</i> , 2017)	Pt	Us	1	RC	BU	TAM+	Qn	Nn	Qt
(Bervell and Umar, 2017)	CTP	Us	1	RC	DU	UTAUT	Qn	Nn	Qt
(Aiztrauta and Ginters, 2017a)	NCTP	Us	1	NS	NS	AM	Lt	Nn	NS
(Suroso, Retnowardhani and Fernando, 2017)	CTP	Us	1	NS	DU	TAM	Qn	Nn	Qt
(Jamil, 2017)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Rigopoulou, Chaniotakis and Kehagias, 2017)	NCTP	Us	1	RC	DU	2M+	Qn	Em	Qt
(Alryalat, 2017)	CTP	Us	1	EC	DU	TAM+	Qn	Nn	Qt
(Kumar and Shenbagaraman, 2017)	CTP	Us	1	RC	DU	2M+	Lt/Qn	Nn	Qt
(Sánchez-Prieto, Olmos-Migueláñez and García-Peñalvo, 2016)	NCTP	Us	1	NS	DU	TAM+	Qn	Nn	NS
(Lin and Kim, 2016)	CTP	Us	1	RC	DU	TAM+	Qn	Em	Qt
(Kwee-meier, Bützler and Schlick, 2016)	CTP	Us	1	VC	DU	TAM	Qn/IE	Em	Qt
(Ducey and Coover, 2016)	NCTP	Us	2	VC	DU	TAM+	Qn	Em	Qt
(Guarino <i>et al.</i> , 2016)	CTP	Us	1	EC	DU	NS	Qn/IE	Nn	Qt
(Wu <i>et al.</i> , 2016)	CTP	Us	2	RC	DU	TAM+	Qn	Nn	Qt
(Durodolu, 2016)	CTP	Lt	1	NS	NS	TAM	Lt	Nn	Ql
(Mcperson <i>et al.</i> , 2016)	Pt	Us	1	RC	DU	NS	Qn	Nn	Qt
(Jokonda, 2015)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Sol and Baras, 2016)	NCTP	Us	1	RC	DU	TAM+	Qn	Em	Qt
(Besbes <i>et al.</i> , 2016)	CTP	Us	1	RC	DU	TAM+	Qn	Em	Qt
(Arbelaez Garces, Rakotondranaivo and Bonjour, 2016a)	NCTP	Us	3	NS	ID	TAM+	Qn	Nn	Qt
(Pattansheti <i>et al.</i> , 2016)	CTP	Us	1	RC	DU	2M+	Qn	Nn	Qt
(Aiztrauta and Ginters, 2017b)	NCTP	Lt	1	NS	NS	AM	Lt	Nn	Qt
(Randell, Backhouse and Nelson, 2015)	CTP	Us	4	RC	DU	NS	Qn/IE	TP	Ql

(Abu-dalbouh, 2016)	Pd	Us	1	NS	DU	TAM+	Lt	Nn	NS
(Wasitarini and Tritawirasta, 2015)	CTP	Us	1	NS	DU	UTAUT	Qn/IE/Ob	Nn	Qt
(Hakami, Hussei and Adenuga, 2016)	CTP	Lt	1	NS	NS	TAM	Lt	Nn	Qt
(Arbelaez Garces, Bonjour and Rakotondranaivo, 2016)	NCTP	Us	1	RC	ID	UTAUT	Ob/Qn	Nn	Qt
(Briz-ponce and García-peñalvo, 2015)	CTP	Us	2	RC	DU	TAM	Qn	Nn	Qt
(Strudwick, 2015)	NCTP	Us	1	NS	NS	TAM	Lt	Nn	NS
(Tarhini <i>et al.</i> , 2015)	CTP	EU	2	RC	DU	TAM	Qn	Nn	Qt
(Hoefst <i>et al.</i> , 2015)	Pt	Us	1	EC	DU	NS	Qn/GE	Nn	Ql
(Liu and Cheng, 2015)	CTP	Us	1	RC	DU	AM	Qn	Nn	Qt
(Hazen, Overstreet and Wang, 2015)	OG	Us	1	RC	DU	TAM	Qn	Em	Qt
(Tanaka <i>et al.</i> , 2015)	Pd	Us	1	RC	BU	NS	Qn	Nn	Qt
(Aizstrauta and Ginters, 2015)	NCTP	Us	1	NS	NS	AM	Lt	Nn	NS
(Füssli <i>et al.</i> , 2015)	NCTP	Us	1	NS	NS	AM	Lt/Qn/GE	Nn	NS
(Ramayasa, 2015)	CTP	Us	1	NS	NS	2M+	Lt	Nn	NS
(Persico, Manca and Pozzi, 2014)	CTP	Us	3	RC	DU	TAM+	Qn	Nn	NS
(Calisir <i>et al.</i> , 2014)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Jongchul and Sung-joon, 2014)	CTP	Us	1	NS	NS	TAM+	Lt	Nn	Qt
(Poniatowski <i>et al.</i> , 2014)	CTP	Us	1	RC	DU	NS	Qn	Nn	Qt
(Lindsay, Jackson and Cooke, 2013)	CTP	Ex	1	NS	NS	TAM+	IE	Nn	Ql
(Kloekner <i>et al.</i> , 2014)	NCTP	Us	1	RC	DU	NS	Qn	Em	Qt
(Rana <i>et al.</i> , 2014)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Cheung and Vogel, 2013)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Kung-Teck <i>et al.</i> , 2013)	CTP	Us	2	RC	DU	TAM	Qn	Nn	Qt
(Weistroffer <i>et al.</i> , 2013)	NCTP	Us	1	VC	ID	AM	Qn/PM	VR	Qt
(Ambak, 2013)	CTP	Us	1	RC	DU	TAM	Qn/IE	Nn	Qt
(Aizstrauta <i>et al.</i> , 2013)	NCTP	Lt	1	NS	NS	UTAUT	Lt	Nn	NS
(Shah <i>et al.</i> , 2013)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Manimaran and Lakshmi, 2013)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Zahid, Ashraf and Malik, 2013)	CTP	Us	2	EC	DU	TAM	Qn/GE	Nn	Qt
(Alotaibi and Wald, 2013)	CTP	Us	1	NS	ID	UTAUT	Qn	Nn	Qt
(Park, Nam and Cha, 2012)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Ghazizadeh, Lee and Boyle, 2012)	NCTP	Lt	1	NS	NS	TAM+	Lt	Nn	NS
(Gagnon <i>et al.</i> , 2012)	NCTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Osswald <i>et al.</i> , 2012)	CTP	Us	1	EC	ID	TAM+	Qn	Nn	Qt
(Pardamean and Susanto, 2012)	CTP	Us	1	RC	DU	UTAUT	Ob/Qn	Nn	Qt
(Chang <i>et al.</i> , 2012)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Zhu, Lin and Hsu, 2012)	CTP	Us	1	NS	NS	TAM	Lt	Nn	NS
(Alsofyani and Eynon, 2012)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Chen <i>et al.</i> , 2012)	CTP	Us	1	NS	NS	TAM	Lt	Nn	Qt
(Bahry, Anwar and Amran, 2012)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Lin, Fofanah and Liang, 2011)	CTP	Us	1	RC	DU	TAM	Qn	Em	Ql
(Kowitlawakul, 2011)	NCTP	Us	1	NS	BU	TAM+	Qn	Nn	Qt
(Orruño <i>et al.</i> , 2011)	NCTP	Us	3	VC	DU	TAM	Qn	Em	Qt
(Lee <i>et al.</i> , 2011)	Pt	Ex	1	RC	DU	TAM+	Qn	Nn	Qt
(Faqih, 2011)	CTP	Us	1	NS	NS	TAM+	Qn	Nn	Qt
(Luo, Su and Lee, 2011)	NCTP	Us	1	NS	NS	AM	Lt	Nn	Qt
(Dai <i>et al.</i> , 2011)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Halbach and Gong, 2011)	CTP	Us	1	RC	DU	TAM+	Qn	Em	Qt

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(Alshibly, 2011)	CTP	Us	2	RC	DU	TAM+	Qn	Nn	Qt
(Turner <i>et al.</i> , 2010)	CTP	Lt	1	NS	NS	TAM	Lt	Nn	Qt
(Heerink <i>et al.</i> , 2010)	NCTP	Us	1	RC	DU	AM	Ob/Qn	Av	Qt
(Gamal Aboelmaged, 2010)	CTP	Us	2	RC	BU	TAM+	Qn	Nn	Qt
(Lee <i>et al.</i> , 2010)	NCTP	Us	1	RC	BU	TAM+	Qn/IE	Nn	Qt
(Yusoff, Crowder and Gilbert, 2010)	Pt	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Ahmad <i>et al.</i> , 2010)	NCTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Nancarrow, Porter and Leviston, 2010)	Sv	Us	1	RC	DU	AM	Qn	TP	Qt
(Schrier, Erdem and Brewer, 2010)	CTP	Us	1	VC	DU	TAM+	Qn	Em	Qt
(Sek <i>et al.</i> , 2010)	CTP	Us	1	RC	BU	TAM	Qn	Nn	Qt
(Mohamadali and Garibaldi, 2010)	CTP	Us	2	NS	NS	NS	Qn	Nn	NS
(Teo, 2010)	NCTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Alkis and Özcan, 2010)	CTP	Us	1	RC	DU	TAM	Qn	Nn	NS
(Bennani and Oumlil, 2010)	CTP	Us	2	RC	DU	TAM	Qn	Nn	Qt
(Teo <i>et al.</i> , 2009)	CTP	Us	1	RC	BU	TAM	Qn	Nn	Qt
(Lai <i>et al.</i> , 2009)	Pd	Us	1	RC	DU	NS	Qn	Nn	Qt
(Calisir, Altin Gumussoy and Bayram, 2009)	CTP	Us	1	RC	BU	2M+	Qn	Nn	Qt
(Dasgupta <i>et al.</i> , 2009)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Lai and Pires, 2010)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(López-Nicolás, Molina-Castillo and Bouwman, 2008)	CTP	Us	2	VC	DU	TAM+	Qn	Em	Qt
(Wu <i>et al.</i> , 2008)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Weiss <i>et al.</i> , 2008)	NCTP	Us	1	EC	ID	UTAUT	Ob/Qn	Nn	Qt
(Rezaei <i>et al.</i> , 2008)	CTP	Us	2	RC	DU	TAM	Qn	Nn	Qt
(Fares <i>et al.</i> , 2008)	NCTP	Us	1	EC	DU	NS	Qn	Nn	Qt
(Ham, Kim and Forsythe, 2008)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Martignoni, Stanoevska-Slabeva and Mueller, 2008)	CTP	Us	1	VC	ID	TAM	Qn	Em	Qt
(Chen, Fan and Farn, 2007)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Wu, Chen and Lin, 2007)	NCTP	Us	1	NS	NS	TAM+	Lt	Nn	Qt
(Schneberger, Amoroso and Durfee, 2007)	CTP	Us	1	RC	DU	TAM+	Qn	Em	Qt
(An <i>et al.</i> , 2007)	CTP	Us	1	NS	NS	TAM+	Lt	Nn	NS
(Chan and Teo, 2007)	CTP	Us	1	NS	DU	TAM	Lt/Qn	Nn	Qt
(Yi-cheng <i>et al.</i> , 2007)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Chooprayoon, Fung and Depickere, 2007)	CTP	Lt	1	NS	NS	TAM+	Lt	Nn	NS
(Seen, Rouse and Beaumont, 2007)	CTP	Lt	1	NS	NS	AM	Lt	Nn	NS
(Wolk, 2007)	CTP	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Alper <i>et al.</i> , 2007)	Pt	Us	1	RC	DU	TAM	Qn	Nn	Qt
(Al-khateeb, 2007)	CTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt
(Rouibah and Abbas, 2006)	NCTP	Us	1	RC	DU	TAM+	Qn	Nn	Qt

What: Computer technology products (CTP), Non-computer technology products (NCTP), Practices (Pt), Service (Sv), Organizational (Og), Product (Pd),

Who: Users and Future Users (Us), Experts (Ex), Experts/Users (EU), Literature (Lt),

Where: Real Context (RC), Virtual/Digital Context (VC), Experimentation Context (EC), Not specified (NS)

When: During use (DU), Before use (BU), In design (ID),

How: TAM (TAM), Adapted TAM (TAM+), UTAUT (UTAUT), Another model (AM), More than two models (2M+), Questionnaire (Qn), Individual interview (IE), Observation (Ob), Group interview (GE), Physiological measurement (PM), None (Nn), E-mail (Em), Telephone (Tp), Virtual reality (VR), Audiovisual (Av), Quantitative (Qt), Qualitative (Ql),

Appendix 2. Results

		Acceptability 11 (8.7%)	Acceptance 110 (87.3%)	Acceptance /acceptability 5 (4%)	General 126 (100%)
What	Computer technology products (CTP)	4 (36.4%)	77 (70.0%)	3 (60.0%)	84 (66.7%)
	Non-computer technology products (NCTP)	5 (45.5%)	25 (22.7%)	1 (20.0%)	31 (24.6%)
	Practices (Pt)	2 (18.2%)	4 (3.6%)	0	6 (4.8%)
	Service (Sv)	0	0	1 (20.0%)	1 (0.8%)
	Organizational (Og)	0	1 (0.9%)	0	1 (0.8%)
	Product (Pd)	0	3 (2.7%)	0	3 (2.4%)
Who	Profile of actor				
	Users and future users (Us)	11 (100%)	97 (88.2%)	5 (100.0%)	113 (89.7%)
	Literature (Lt)	0	10 (9.1%)	0	10 (7.9%)
	Experts (Ex)	0	2 (1.8%)	0	2 (1.6%)
	Experts/Users (EU)	0	1 (0.9%)	0	1 (0.8%)
	How many types of actors				
	1	10 (90.9%)	95 (86.4%)	4 (80.0%)	109 (86.5%)
	2	0	13 (11.8%)	0	13 (10.3%)
	3	0	2 (1.8%)	1 (20.0%)	3 (2.4%)
	4	1 (9.1%)	0	0	1 (0.8%)
Where	Real Context (RC)	5 (45.5%)	67 (60.9%)	3 (60.0%)	75 (59.5%)
	Virtual/digital context (VC)	1 (9.1%)	10 (9.1%)	0	11 (8.7%)
	Experimentation context (EC)	3 (27.3%)	5 (4.5%)	0	8 (6.3%)
	Not specified (NS)	2 (18.2%)	28 (25.5%)	2 (40.0%)	32 (25.4%)
When	During use (DU)	7 (63.6%)	73 (66.4%)	3 (60.0%)	83 (65.9%)
	Before use (BU)	0	11 (10.0%)	0	11 (8.7%)
	In design (ID)	2 (18.2%)	4 (3.6%)	2	8 (6.3%)
	Not specified (NS)	2 (18.2%)	22 (20.0%)	0	24 (19.0%)
How	Theoretical model				
	TAM (TAM)	0	44 (40.0%)	2 (40.0%)	46 (36.5%)
	Adapted TAM (TAM+)	0	45 (40.9%)	1 (20.0%)	46 (36.5%)
	UTAUT (UTAUT)	1 (9.1%)	6 (5.5%)	1 (20.0%)	8 (6.3%)
	Another model (AM)	3 (27.3%)	6 (5.5%)	1 (20.0%)	10 (7.9%)
	More than two models (2M+)	0	5 (4.5%)	0	5 (4.0%)
	Not specified (NS)	7 (63.6%)	4 (3.6%)	0	11 (8.7%)
	Méthode de recueil de données				
	Questionnaire (Qn)	10 (90.9%)	89 (80.9%)	5 (100.0%)	104 (82.5%)
	Individual interview (IE)	3 (27.3%)	5 (4.5%)	0	8 (6.3%)
	Observation (Ob)	1 (9.1%)	4 (3.6%)	0	5 (4.0%)
	Group interview (GE)	2 (18.2%)	1 (0.9%)	0	3 (2.4%)
	Physiological measures (PM)	1 (9.1%)	0	0	1 (0.8%)
	Literature (Lt)	2 (18.2%)	22 (20.0%)	0	24 (19.0%)
	Technological tool				
	None (Nn)	9 (81.8%)	89 (80.9%)	4 (80.0%)	102 (81.0%)
	E-mail (Em)	0	20 (18.2%)	0	20 (15.9%)
	Telephone (Tp)	1 (9.1%)	0	1 (20.0%)	2 (1.6%)
	Virtual Reality (VR)	1 (9.1%)	0	0	1 (0.8%)
	Audiovisual (Av)	0	1 (0.9%)	0	1 (0.8%)
	Method of analysis				
	Quantitative (Qt)	7 (63.6%)	91 (82.7%)	5 (100%)	103 (81.7%)
	Qualitative (Ql)	3 (27.3%)	3 (2.7%)	0	6 (4.8%)
	Not specified (NS)	1 (9.1%)	16 (14.5%)	0	17 (13.5%)
		11	110	5	126