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▶ **To cite this version:**

Claudio Vitari, Aurelio Ravarini. Validation of IS positivist research: an application and discussion of the Straub, Boudreau and Gefen's guidelines. itAIS-Italian Chapter of the Association for Information Systems Conference, 2007, venice, Italy. halshs-01924297

HAL Id: halshs-01924297
https://shs.hal.science/halshs-01924297

Submitted on 15 Nov 2018

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Validation of IS positivist research: an application and discussion of the Straub, Boudreau and Gefen's guidelines

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Abstract Straub, Boudreau and Gefen gave an important contribution in the critical scientific issue of the rigor in IS positivist research. They published an analysis of the state of the art of the research validation methods and heuristics. In an attempt to contribute to the debate on the rigor of IS positivist research, an application of their validation guidelines is practiced and discussed. The validation guidelines are applied to test IS success of a specific type of Information System: the Expert Recommender Service. The application point out some relevant issues regarding the method, such as: the importance of the practice of the expert panels and judges, the quality of the findings of a statistical analysis when the discriminant validity is doubtful, the relevance of the application of different methods altogether, the usefulness of complementary or alternative methods and heuristics and the interpretability of a model when one hypothesis lacks statistical significance.

1 Introduction

Straub, Boudreau and Gefen gave an important contribution to the discussion on the critical scientific issue of the rigor in IS positivist research. They stated that: "Without solid validation of the instruments that are used to gather data on which findings and interpretations are based, the very scientific basis of the profession is threatened".
They published an analysis of the state of the art of the validation methods and heuristics. Their list of validation techniques should be applied to any positivist research instrument in order to improve its validity and to ensure a scientific basis of the findings.
In an attempt to contribute to the debate on the rigor of IS positivist research, their validation guidelines is applied and its outcomes are discussed. This application shows some of the obstacles that the researcher faces in practice and their possible bypasses. Moreover, this article casts light on the divergences between the guidelines proposed by Straub et al. and their actual application. The author tries to question to what extent an IS positivist research can diverge from the proposed validation guidelines without lacking in rigor and without compromising its acceptance at the top IS journals.

2 The context of application of the validation guidelines

The validation guidelines are applied to test IS success of a specific type of Information System: the Expert Recommender Information System (ERS). The DeLone and McLean model of IS success, proposed in 1992 and updated in 2003 , has been adapted to the specific context of the research and extended to include an external variable, the Knowledge of the Other members of the Community of Practice, which emerged as the most important independent variable during the preliminary explorative phase.

2.1 The ERS

The choice of the type of IS has fallen on a type of Knowledge Management Systems, the ERS, as they present several limitations negatively impacting their success . The ERS specific area of application is the identification and display of the individuals who could be potential source of specialized knowledge, which - otherwise – would result hardly accessible . This type of computer-based systems are commonly addressed as ERS because they identify and display the individuals supposed to be experts and in the position to help the users to solve problems of business process breakdown.
In order to avoid information overflow, this Information System should provide information only about a precisely selected subset of all the individuals, who could likely have the knowledge that should most likely satisfy the users' requests

2.2 The adaptation and extensions of the D&M IS Success Model

The adaptation of the D&M IS Success Model has been required to fit the specific context of application: the ERS, through three main variations:

- Service Quality will be the only dimension of the ERS success that represents all the characteristics of the ERS.
- Individual Impact variable will be declined into the variable Perceived Usefulness for the user
- Organizational Impact variable will be declined into the variable Information Access Benefit.

Moreover, the D&M IS Success Model has been extended to include the influence of the Community of Practice through the variable Knowledge of the Others. This inclusion contributes to the relevance of this study. In fact, it is not an exclusive application of an IS success model, as it proposes its extension and adaptation.

3 The Validation Guidelines: application and discussion

Straub's et al. contribution to the development of the methodology of IS research is undebatable. Nevertheless, Straub et al. recognize that "some of these heuristics will, no doubt, be controversial" and "that it is time for the IS academic profession to bring such issues into the open for community debate".
This article tries to contribute to the ongoing debate on the validation methods and heuristics, through a case of application of their guidelines in an empirical study on ERS. In this case, the validation was supported by packaged software: SPSS and AMOS. 265 valid responses to a questionnaire were collected, with a response rate of 31%.
Straub's et al. guidelines propose to ensure: the content validity, the construct validity, the reliability, the manipulation validity and the statistical conclusion validity through a set of 17 different validation tests. All these tests were applied to the empirical study, but given the constraints on the length of the article only those that led the most relevant issues to emerge will be discussed in the next paragraphs.

3.1 Content validity

Content validity concerns the representation, by the instrument, of the content of a given construct, in terms of measurement, substance, and straightforward definition of the construct.
In this study the literature review and the personal opinion of some experts have been used to assess the content validity. The literature review has been the primary source. Concomitant with the literature review, the author asked several experts, colleagues, and users of the ERS to screen the items to find possible inconsistencies. This step brought to a refinement of the instrument in terms of the kind and the number of questions. The original scale used by Pinsonneault for the construct Knowledge of the Others was judged redundant. Seven items seemed excessive and the revision brought to the inclusion of only four items each of one measuring a specific aspect of the individual perception of the awareness on the knowledge domains of the others members of the Community of Practice.
The original scale used by Bhattacherjee for the construct Perceived Usefulness for the User revealed an ambiguity on an item that resulted misleading in its attempt to synthesize the "usefulness" concept. The other three items, on the contrary, seemed well explaining and completely covering the concept. So the fourth item was excluded.
These modifications could make the instrument too much fitted with the Information System experienced by the judges, therefore endangering its applicability in other contexts. Moreover, the content validity ratios and Q-sorting (the other techniques proposed by Straub et al.), would have not solved

the risk of over fitting. A possible by-pass could be the systematization and the compulsory use of the technique of expert panels and judges at each new application of the construct, in order to be sure of the content validity of the instrument in the specific context of application.

3.2 Discriminant validity

The discriminant validity distinguishes the reflection of the items to a specific construct from the items that reflect the other constructs. In our study, this test, through confirmatory factor analysis, was performed with SPSS and AMOS.
The outcomes from AMOS comforted on the discriminant validity of the entire model, while the result of the confirmatory factor analysis in SPSS showed that ERS Quality construct and User Satisfaction construct dangerously loaded on the same factor. A second order confirmatory factor analysis on these two constructs highlighted an unexpected loading on the second factor of an item of the ERS Quality instrument. This item appeared as the potential source of the failed test of the discriminant validity. The test of the Cronbach's Alpha shows that this item is inadequate, maybe due to some misunderstandings for the negative formulation of the sentence. The deletion of the item would improve the Cronbach'Alpha, higher up to acceptable thresholds. So, the item was deleted and confirmatory factor analysis run again, but ERS Quality scale and User Satisfaction still loaded on the same factor.
A second order confirmatory factor analysis on the two constructs highlighted the following critical situation: the ERS Quality scale was now composed of only two items loaded on the two factors. Deleting the item loading on the second factor would have transformed the ERS Quality construct into an instrument with only one item. The wish to avoid it, in order to prevent mono-operation bias, led to the decision to keep the ERS Quality scale as it was.
The loading of two constructs on the same factor is an evident signal of lack of discriminant validity and the deletion of one item of the scale did not entirely solve the problem. The willingness to avoid mono-operation bias prevents the further deletion of another item of the same scale. This arguable choice, between discriminant validity and mono-operation bias prevention, opens the issue of the importance of the statistical demonstration of the discriminant validity versus the importance of avoiding mono-operation bias. A further investigation to understand the prevalence of a criterion on the other is prospected.
A more critical issue arises from this discussion: the reasonability of proceeding further with the statistical analyses. Can the other validities be measured and assessed in the absence of discriminant validity? And if the analyses are carried out, what are the additional limitations of the results? These are all questions that need a further investigation.

3.3 Common methods bias control

The common methods bias is also known as “method halo” or “methods effects” and it occurs when data is collected via only one method, because the different pieces of data share part of the variance that the items have in common with each other due to the data collection method rather than to hypothesized relationships. In order to reduce it, questions’ distribution, in the questionnaire, was randomized.
Nevertheless, only one method has been used, and the randomization does not guarantee against the risk of common method bias. Therefore different methods should be put in place to avoid the bias, but the use of multiple methods increases the complexity and difficulty of data collection. With only one method, a significant incertitude on the importance of the common method bias remains, limiting the quality of results. It seems therefore important to insist to find ways to employing different methods altogether, besides randomizing the questions in the questionnaires, balancing it with the cost of these additional methods.

3.4 Statistical conclusion validity

The statistical conclusion validity assesses the mathematical relationships between the variables of a model and it infers whether the statistical formulation correctly expresses the true covariation.
The dimension of the sample, the number of the questioned items, and the number of the variables of the analysis limit the suitable statistical methods. The sample of 265 answers and the 18 items measured on the 6 variables make the SEM a suitable and preferred method able to ensure trustworthy and sophisticated results. Moreover, the covariance-based SEM is the only method which shows that the null hypothesis of the entire model is plausible, rejecting the path-specific null hypotheses of no effect.
In this study, the covariance-based SEM technique has been employed by the AMOS 6 application. The overall fitness of the model was good, with all the indices over the respective threshold. Moreover, the Post-hoc analysis appeared even superfluous and hence not applied, because the Modification Indexes were not large enough to suggest the ad hoc modification of the model. In terms of the single hypotheses, all the nine hypotheses are statistically significant except the causal relationship of Use on User Satisfaction, which is therefore not validated.

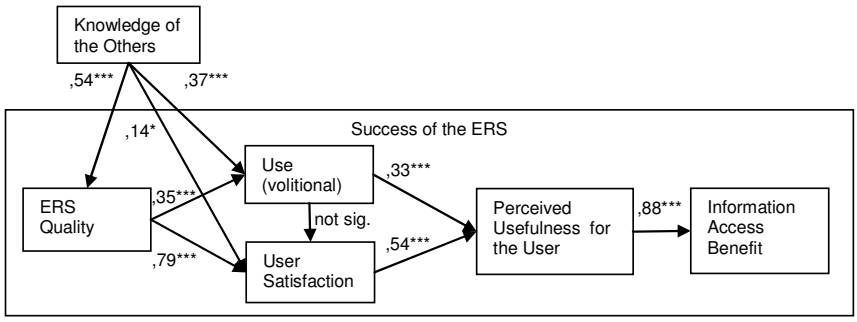


Fig. 1 The model at the quantitative phase (Standardized regression weights. "*" significant at the 0,001%; "*" significant at the 0,05%; "not sig." not significant at 0,05%)**

The critical issue at this step is about the significance of the entire model when a hypothesis is not statistically significant. The covariance-based SEM can be employed only in confirmatory research, therefore the lack of statistical significance of a hypothesis should lead to reject the theory that this application was trying to confirm. Finally, not only one hypothesis is put in doubt, but the entire model could be discredited. The convenience of the post-hoc analysis is also doubtful, as the confirmatory research does not include the exploration of new relationships between variables.

4 Conclusion

Straub et al. gave an important contribution in the critical scientific issue of the rigor in IS positivist research. With this article, the author tried to continue the discussion on this issue, through the application of their guidelines and the discussion of the main results (a detailed analysis of the application and discussion of the guidelines ca be provided on request). This experience highlighted some possible difficulties that the researcher faces in practice and the effects on the quality of the findings and interpretations and finally their publication.

A number of aspects emerged as critical. First, in order to ensure the content validity a regularization of practice of the expert panels and judges is recommended in order to obtain instruments that really fit with the actual application context. Second, the author questioned the reasonability of the continuation of the statistical analysis when the discriminant validity is doubtful. Third, it seems important to insist on the application of different methods altogether to avoid the common method bias. Fourthly, Straub et al. proposes only one method to test the unidimensional reliability, hence the development of complementary or alternative methods and heuristics could improve the assessment of the validity of the instruments. Fifthly and finally,

the lack of a statistical significance in one hypothesis when realizing the statistical conclusion validity in a confirmatory research opens the issue of the validity of the other and significant hypothesis and of the entire model.
An application and discussion of the guidelines of Straub et al. have bee presented in this article, which aimed at sustaining the debate on the rigor of IS positivist research. Nevertheless, the relevance of the rigor of IS positivist research should not undermine the relevance of the research in it self.

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