The Creation and Validation of E-Management's Measurement Scale

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Abstract— This paper deals with the understanding of the concept of E-management and the development of a measuring instrument adapted to the new problems encountered during the application of this new practice within the modern enterprise. Two principal e-management factors have been isolated in an exploratory study carried out among 260 participants. A confirmatory study applied to a second sample of 270 participants has been established in a cross-validation of the scale of measurement. The study presents the literature review specifically dedicated to E-management and the results of the exploratory and confirmatory phase of the development of this scale, which demonstrates satisfactory psychometric qualities.

Keywords— e-management, mode of management, ICT deployment ,creation, validation.

I. INTRODUCTION

Researchers in Information Systems (IS) are increasingly interested in the notion of E-management. The ambiguity of this notion comes from various definitions proposed to define it. E-management is a continuous dynamic process, ensuring the harmony between all the components of the relationship management mode / ICT in order to improve the management of the company [1]. Indeed, E-management is generally regarded as an approach that obviously contributes to the evolution of modern enterprises [2].

II.   RELATED WORK

Through the deep recovery of the literature in management, precisely what concerns the concept of e-management; One can cite, precisely, two major research observatories founding this new theory which is called the e-managerial theory:
  1. The French observatory in e-management: (the birth of the concept of e-management)
  2. The Tunisian observatory in e-management: (the development and enrichment of the theory of e-management)

The French observatory in e-management: (the birth of the concept of e-management)
In 2000, [3] defined the concept of e-management as follows: _"E-management can be defined by the integrating in all the management processes, that is, finalization, organization, animation, control, impacts and opportunities of the new Information and communication technologies "._

The Tunisian observatory in e-management: (the development and enrichment of the theory of e-management)
In 2005, [4] has developed in the framework of a study carried out by the Tunisian Observatory in e-management, a study in e-management through Tunisian companies. Indeed, this study was carried out on a sample of 407 companies, all of them are Tunisian. He showed that the use of new technologies of the company has been developed in a very significant and varied way. Indeed, he noted that this theory has made it possible to discover the very rapid development of the culture of the net with the heads of companies and even the staff of the company. The main result of the Tunisian e-management observatory is that e-management is a continuous or development of traditional management.

Apart from these founding and representative works of e-managerial practice, we can mention other works of researchers, most of which are simple definitions of the concept of e-management.

Indeed, [5] represents the management as a set of activities of organization, management of the company, and its personnel, through computer tools.

Finally, after a deep recension of the literature in e-management, there is no published work, up to the present day, which allows to apprehend a scale of measurement of the concept of the-management. This is why our work is important for e-management research.

Given this observation, the main objective of this study is to develop A scale of measurement of E-managerial practice which is a new management model based on the

integration of ICTs for use in any type of e- organization. It will be a question of proposing the first elements of validation, by testing its internal validity, the stability of its factorial structure.

III. THE TWO MAIN DIMENSIONS OF E-MANAGERIAL PRACTICE (MANAGERIAL AND TECHNOLOGICAL DIMENSION)

This study asserts that the concept of e-management has two dimensions: The managerial dimension and the technological dimension.

The managerial dimension
[6] Shows that e-management contributes to the improvement of management functions, thanks to the use of ICT. Based on this finding, the present research determines the key factors that can help the company considering making an investment in IT to improve their management mode. Also, [7], proposed a measurement of the construct "mode of management", through formalization, risk taking, creativity and performance-oriented management.

The technological dimension
[8] Were among the first to define the concept of technological deployment, which combines information systems and ICT strategy. According to the authors, companies would have a different technological deployment according to their main strategic activities: prospecting, analysis, defense and reaction [9].

Adapted from the work of [10] presented a model of technological deployment in six dimensions: The technological architecture, the strategic impact of the information systems department, technological intelligence, the source of information systems development, the evaluation of information systems and the team's management style.

With the continuous introduction of new information and communication technologies within the company, a complete reconfiguration of the company's managerial process is taking place. In fact, according to [11], management is confronted with multiple demands such as the need for new human resources strategies or the emergence of new forms of work (e-collaboration, e-working, E-learning, management 2.0, 3D management, ...).

In this vision, [12] argue that e-management is the right mix that allows for the harmonization between the management mode exercised by the company and the technological resources that help to provide support for their deployment.

Through this new e-management, measurement tool, it would allow us to know how e-managers practice e-managerial theory within their companies.

To develop this scale and to provide elements of validation, three successive stages are proposed. Firstly, a pre-survey phase will allow to isolate the evaluation indices on which E-management is based, which is a new management model based on the integration of ICT. The analysis of these data will lead to the construction of the items on the scale. In a second study, the scale developed will be administered to a second sample. The objective of this step is to explore the factorial structure of the scale. Finally, a third study will verify the stability of the structure previously identified. Data will then be collected from a new sample and confirmatory analyzes will be conducted for these purposes.

IV. CONSTRUCTION OF ITEMS IN THE E-MANAGEMENT SCALE

The non-existence of an e-management, measurement instrument led us initially to construct a scale, mainly based on a qualitative study and the contributions of literature.

A pre-survey was carried out in order to generate the constituent items of the scale. Trent semi-directive interviews were conducted by e-managers. The interview guide consisted of questions relating to the managerial and technological aspects related to the ideal working environment in its various dimensions. Thirty semi-directive interviews were conducted by e-managers. The interview guide consisted of questions relating to the managerial and technological aspects related to the ideal working environment in its various dimensions.

A thematic content analysis applied to the answers to the questions allowed to isolate a set of indices specific to the e-managerial practice relating to the managerial and technological environment of the modern enterprise.

The identification of these indices has made it possible to construct a scale of e-management, measurement as a new management model based on the deployment of ICT which includes 30 items to which the employee answers on a Likert scale in 5 points ranging from 1 (strongly disagree) to 5 (strongly agree).

In accordance with [13] and more recent work on scale development [14], the e-management, measurement tool we created was tested with two independent samples: A sample of the first study consisting of 260 e-managers, followed by the second study sample of 270 respondents. There are many studies dealing with the advantages of information systems like CRM, SCM ….[15].

The sample of our first exploratory study includes 260 Tunisian industrial companies. The quiz was distributed in each company with the agreement of the head of the IS department or the e-managers. We then conceive e-management as a latent multidimensional construct, not directly observable, which requires defining it in a precise manner.

For statistical processing reasons, the exploratory factor analyses were separately carried out on each of the two themes of the quiz, namely the mode of management and the deployment of ICT. Table 1 shows all 30 items on the e-management scale.

Table 1. E-Management Start Scale

Theme « MANAGEMENT MODE »
Dimension 1: Formalization and modification of interpersonal or hierarchical relationships   1. Standard procedures exist for carrying out the work of each one.   2. Written procedures shall be provided for each type of situation so that it can be settled   3. There is a strict application of written rules and procedures   4. The e-managers are strongly controlled so that not to break the established rules   5. e-managers are encouraged to carry out their work well (1)   6. e-managers are happy about their job performance (1)
Dimension 2: Risk taking   The systems put in place by the company encourage ...   7. Being prone to risk taking   8. Consider failure as a learning opportunity (1)   9. Consider risk taking as a way to improve business   10. Easily obtain resources for innovation projects even if they are uncertainly profitable   11. Easily obtain resources for innovation projects even if they are far-reaching (2)
Dimension 3: Valuing creativity   12. Sufficient autonomy is given to each person to carry out his work. (1)   13. Creativity and new ideas are strongly valued.   14.The company has set up formal and / or informal means to collect "good ideas" from e-managers   15.E-managers participate in problem-solving and / or problem-solving groups   16.E-managers are called upon to take action for the continuous improvement of working methods. (1)
Theme "DEPLOYMENT OF ICT"
Dimension 1: Technology Watch   17. E-managers are continuously learning new technologies and applications,   18. E-managers regularly read newspapers and journals specializing in information technology, (2)   19. E-managers participate in professional associations of computer scientists,   20. Learning how to integrate new information technologies is continuously promoted by our company.   21. E-managers are interested in technological innovation.
Dimension 2: Technological Architecture   22. The company integrates IS with an open architecture,   23. The company designs and implements a data architecture that

guides the development of applications (1),
24. The company contributes to the efficient use of information resources,
25. The company promotes the establishment of a flexible and efficient telecommunications infrastructure (1),
26. The information technology infrastructure meets the needs of our company,
27. The company improves the security and control of information. (2)

Dimension 3: Source of e-management system development

28. The e-management system is mainly developed by resources external to our company.
29. Sources external to our company mainly develop our information systems,
30. The management system is developed by resources internal to our company (1).

(1) Items suppressed following the exploratory factor analyzes carried out on the sample of the first study.
(2) Items suppressed following the exploratory factor analyzes carried out on the sample of the second study.

V.   RESULTS

We present successively the results of these two analyzes.

EXPLORATORY STUDY: DEMONSTRATION OF THE STRUCTURE OF THE SCALE

We therefore decide to redo an ACP for the "management mode" construct according to 3 components with rotation varimax, in order to increase the saturation coefficients of the items with the factors. The criteria used to eliminate the items were as follows:

• Rejection of items with factor scores below 0.5
• Rejection of isolated items
• Rejection of items with high factor scores on several factors

Results of exploratory factor analyzes: The exploratory analysis carried out on the first sample (the sample of the exploratory study) for the first theme, "mode of management" reveals 3 factors, according to the number of theoretical dimensions that we had identified. The solution chosen during the exploratory analysis carried out on the initial version of the scale. We found an explained variance of 92.688% for a KMO of 0.761 and an internal coefficient of coherence of 0.790. Cronbach's alpha coefficients for each of these dimensions as well as for the scale remain very good (0.997 for the Formalization dimension, 0.961 for the Risk Price dimension,0.959 for the valuation dimension of creativity, and 0.790 for the scale).

The exploratory analysis carried out on the second theme "deployment of ICTs" reveals three factors. The solution obtained during the exploratory analysis carried out on the initial version of the scale, we found an explained variance of 88.593% for a KMO of 0.810 and an internal coefficient

of coherence of 0.790. Cronbach's alpha coefficients for each of these dimensions and for the scale remain very good (0.956 for the technological watch dimension, 0.964 for the technological architecture dimension, 0.932 for the e-management system's development source dimension, and 0.828 for the scale).

The convergent validity of each of the dimensions of the "management mode" the theme was then tested. It is acceptable for the dimensions: "formalization", "risk taking" and "creativity".

The convergent validity of each dimension of the "ICT deployment" theme was then tested. It is acceptable for the dimensions of "technological monitoring", "technological architecture" and "source of development of the e-management system". The discriminant validity has been verified since the square root of the pvc is greater than the correlation coefficients that the dimension studied shares with the others.

In order to evaluate the correct fit of the model to the data, it is necessary to examine the values of the various indexes of adjustment: The value of khi 2 / dl is less than 5, it is equal to 3.532. Adjustments have quite acceptable values. Thus, the GFI index is equal to .929. The RMR index, with a value of .01, is good. The values of the incremental indices are also quite suitable: the TLI, IFI and CFI are respectively equal to .972, .985 and .985. The examination of the contributions of the indicators to the factors also shows that each of the 23 items contributes significantly to the expected dimension. The factorial contributions of the 2 sub-dimensions to the aggregate construct are also very good.
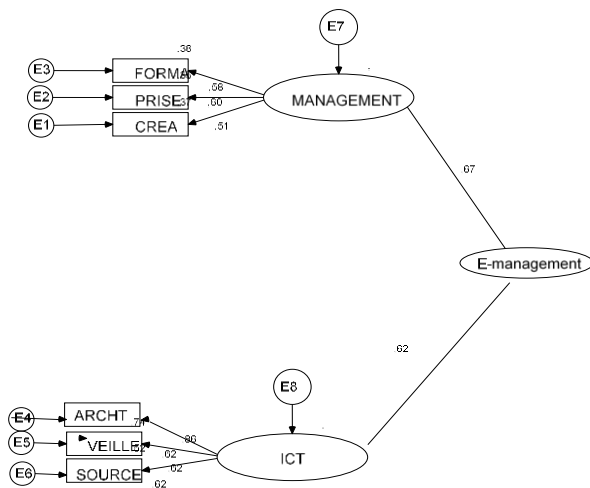

Figure 1. Measurement model obtained for e-management (N = 260)1

CONFIRMATORY STUDY: COUNTER-VALIDATION OF THE SCALE

The sample of the second study consists of 270 Tunisian industrial companies belonging to the different sectors of activity (automobile, construction, banking sector,

transport organization, care center, telecommunications). The data collection procedure is identical to that adopted in the first study.

The PCA as well as the Confirmatory Factor Analysis carried out in the first study made it emerge that e-management is obviously a new management model that favors the deployment of ICT within the Tunisian company. We then wanted to do a counter-validation of the scale built with another sample (N = 270) to test the stability of our scale of e-management measurement. The value of the Cronbach Alpha amounts to .781 for the "management mode", and .759 for the "deployment of ICT".

Confirmatory factor analysis is carried out using the structural equation method (use of the Amos 21 software) to test the fit of the scale to the collected data and to ensure the convergent and discriminant validity of its various dimensions.

Validation of a measuring instrument also requires verification of its convergent and discriminant validity. The convergent validity of each of the dimensions of the "management mode" construct was then tested. It is acceptable for the "formalization", "risk taking" and "creativity" dimensions. As for discriminant validity, it has been verified since the square root of the ρVC is greater than the correlation coefficients that the dimension studied shares with the others.
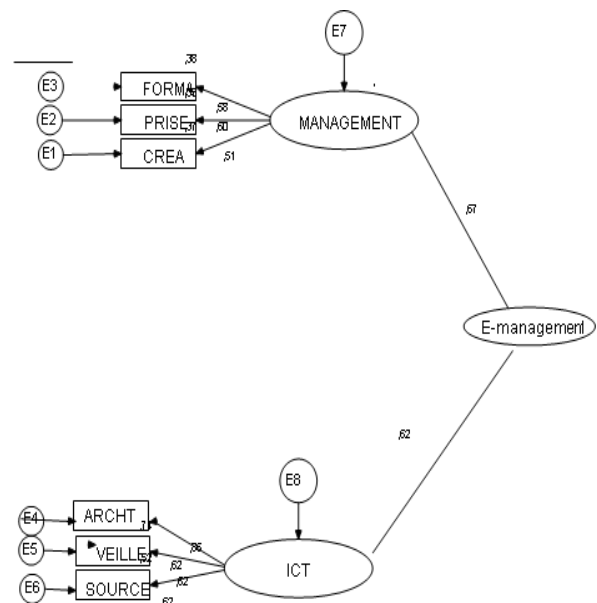

Figure 2. Measurement model obtained for the counter-validation of the e-management scale (N = 270)

In order to improve the quality of the model, some modifications have been made. This shows that the modified measurement model is better adapted to the data than the first model. Although chi2 has been always significant (which is frequent with a large sample). The value of khi 2 / dl is less than 5, it is equal to 2, 115. Thus,

the GFI index is equal to .972. The RMSEA, with a value of .079, is good. The values of the incremental indices are also suitable: the TLI, IFI, NFI and CFI are respectively equal to .991, .996, 994 and .996.

VI.   CONCLUSION AND FUTURE SCOPE

The objective of this study was to elaborate an e-management scale and to provide the first elements of validation. The various analyzes performed confirm the good psychometric qualities of the scale constructed from the results obtained in two successive studies (exploratory study and confirmatory study). All the analyzes we have carried out allow us to confirm the reliability and validity of the e-management measurement scales. Two components of e-management are isolated: the sub-dimension of "mode of management" and that of "deployment of ICT". These two dimensions, estimated by first order factors, would define a broader construct that would correspond to e-management.

In a second step, confirmatory analyzes allowed to validate the two-dimensional model of "e-management" by checking its stability with a second sample. The values of the various adequacy indices also justify the relevance of the model chosen. The proposed tool is a short, easy-to-use questionnaire. It is original in comparison with the few scales already existing since it was built so that it can be used with e-managers working in different working environments. The main limit of our study is sample-related. Two samples were studied during our analyzes, which do not cover all the companies in the Tunisian industrial sector. Ultimately, the development of a management, measurement scale offers the company a new vision of modern management.

The contribution of this research lies in the construction of a scale of e-management, measurement that respects most of the established standards, as well as the requirements of reliability and validity. Refinement of this model is one of our main research priorities.

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