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## RESEARCH ARTICLE

# EMPIRICAL EVALUATION, USING THE STRUCTURAL EQUATION METHOD, OF THE IMPACT OF THE DETERMINANTS OF INFORMATION TECHNOLOGY CAPABILITY ON THE ORGANIZATIONAL PERFORMANCE OF THE MOROCCAN SCHOOL EDUCATION SYSTEM

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### ABSTRACT

The aim of this article is to empirically validate and quantitatively test (using the structural equation method) the theoretical model communicated in an article ( Elhaddouchi & Elkharraz, 2020), and to strengthen the scientific framework of the results obtained (verification of research hypotheses). We have attempted to highlight the perceptions of the main players, belonging to a particular context (the Moroccan education system) concerning the question of the contribution of technology and IS capabilities to the organizational performance of the Moroccan school education system (ES). Principal component analysis (PCA) was carried out using SPSS V 24.0 as a first step in purifying the measures and estimating their validity. The results of this analysis were used as inputs for a test of the measurement models following the LISREL procedure, as well as an examination of the measurement scales through a confirmatory factor analysis (CFA) under AMOS 24. We concluded our analysis with a test of the one-dimensionality of the variables retained in our research model. To improve the quality of our measures, a number of items were occasionally removed from the analysis, and both conceptual and statistical justifications were put forward to support our choices. Finally, the results of our hypothesis testing were presented and discussed, and proposals for improving the overall model were developed.

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## INTRODUCTION

The Education System (ES) has become a central component of our country's societal project, given its mission to train the citizens of tomorrow (Berdouzi, 2012; Chkili, 2015 ; Fertat, 2014; Zerrouqi, 2015). Framework Law No. 51.17, adopted in July 2019, addresses the education, training, and scientific research system. This law embodies the main principles of the strategic vision (2015-2030) outlined by the Higher Council for Education, Training, and Scientific Research (HCETSR), which aims to modernize and enhance the quality of education. To achieve these objectives, both the Strategic Vision of the 2015-2030 reform and the more recent proposed roadmap (2022-2026) underscore the necessity of investing in Information Technology (IT) and maximizing the potential of these technologies and information systems (IS). These are viewed as essential mechanisms for supporting educational reforms and are crucial for value creation. The performance and rational governance of these systems are vital for the success of many reform initiatives. Consequently, there is a

pressing need to establish a performance management and evaluation model that adapts to the changes brought about by the integration of IT (Watson et Schneider, 1999). In this context, and within the framework of the broader modernization process of the Moroccan Ministry of National Education and Sports (MNEPS), technologies and information systems (IS) are expected to play a central and strategic role in the comprehensive implementation of the new reforms (Hammoumi, 2014; Sedjari, 2008). As highlighted in previous work Ehaddouchi et Elkharraz, (2020), the ministry currently possesses a significant informational arsenal that can serve as a database for our study. This includes MASSAR, MASIRH, ESISE, GRESA, CARTESCO (E-CARTE SCOLAIRE), E-APPLICATIONS DE MOUVEMENT DU PERSONNEL, SAGE and SAGE-PLUS, GALY, GEXAWIN, TAYSSIR (Social Support IS), among others. This informational arsenal has prompted the MNEPS to implement strategies based on the performance of all dematerialized activities, aimed at evaluating the quality of public education and training services for the benefit of internal stakeholders within the sector.

Indeed, the importance attached to the development of these IS as a lever for the development of the Moroccan ES, presents significant growth potential according to professionals in the sector (Elhaddouchi & Elkharraz, 2020), the exploitation of which nevertheless remains conditional on the availability of competent human resources. In fact, we felt it necessary to highlight the problem of studying the impact of this capacity, developed through the use of information technologies and systems, on the organizational performance of the administrative bodies responsible for managing the public service, namely: education and training. This issue has already been heralded as a new test in the discipline of public information systems management. (Ehaddouchi et Elkharraz, 2020).

Our work published in 2020 (Ehaddouchi et Elkharraz, 2020) has enabled us to take stock of the issue of the impact of IT capacity on IS organizational performance from a theoretical, methodological and operational standpoint, i.e. to better identify the factors influencing this technology capacity on IS organizational performance (Henderson et Venkatraman, 1993; Kefi, 2011; Uwizeyemungu, 2008), and the various explanatory variables and contextual factors (moderators and/or mediators) likely to influence this correlational relationship. While this approach — an exploratory qualitative study following the SADT (Structured Analysis & Design Technic) methodology (Ross, 1997) combined with convergent interviews — allowed us to gain a deep understanding of the phenomenon under study by facilitating the exploration and integration of diverse perspectives, its subjective nature may introduce biases into the research. By bias, we refer to the tendency to focus on certain viewpoints over others. More specifically, the validity of the conclusions drawn is difficult to establish, and generalizations are even more challenging (Thiétart et al., 2014). This highlights the need for a quantitative study aimed at validating and testing the theoretical interaction framework (research model) we have developed. The purpose of this article is to shed light on the survey design for the quantitative study envisaged as the final stage of this research. The proposed methodological design is designed to verify, through the quantitative data collected, the veracity and predictive quality of the theoretical representation we arrived at at the end of the previous stage, as well as the research hypotheses derived from it, while accommodating the conditions of observation and possibilities of access to the field, imposed by the very nature of the complex phenomenon in question (Moroccan ES). We will begin by outlining our methodological approach to data analysis (quantitative survey), which we have adopted. We began with descriptive analysis (means and frequencies), supplemented by non-parametric bivariate tests, known as (Kruskal & Wallis, 1952), which enabled us to check whether samples originate from the same distribution, using SPSS V24.0 software. Following a principal component analysis (PCA), carried out in SPSS V 24.0, we then proceed to test our research model and its working hypotheses using the structural equation method (separate works by Karl Joreskog, (1973), Ward Keesling (1972) and David Wiley (1973)).

To this end, we used the LISREL (Linear Structural Relationships) approach (Blunch, 2015; Jöreskog and Sörbom, 1993; Roos et al., 1997), which we judged to be best suited to our data typology and model structure. We therefore used AMOS 24 to carry out all our analyses. We began by

evaluating our measurement model, i.e., the external model relating each latent variable to its measurement variables, in order to estimate the reliability and internal consistency of our model by means of convergent and discriminant validity analysis, using in particular the average variance restored (AVE).

Finally, in order to test the model's hypotheses concerning the existence of causal links between the variables under study, the preferred methods are essentially analysis through confirmatory factor analysis (CFA). The choice of these methods is justified by the nature of the data processed and the type of results we are seeking to produce.

Finally, we will attempt to provide some interpretation and clarification of the results obtained in the course of this work.

## 1 . Conceptual research model

For many researchers, developing a theoretically sound research model that is as close as possible to the reality of the phenomenon (the impact of IT capability on organizational performance, in our case), is a task that is often more complex than one might imagine. For example, for Pedhazur & Schmelkin, (1991), Formulating a research model is a : *«long and difficult process, involving a great deal of critical thinking, creativity, insight and erudition »*.

Based on the aforementioned theoretical framework presented by : Elhaddouchi et Elkharraz, (2020), we judged that the theoretical modeling of IT capacity intervention in the organizational performance IS process of the ES as a complex system (Essaffani et Benaissa, 2013), can be constituted by a combination of the informational model of the (Galbraith, 1979) and the TI capacity model from Anandhi Bharadwaj, (2000). For the qualitative phase of this work, we opted for participant observation in the first instance. It was planned to consult the internal documentation of the Moroccan SE, then a modeling by SADT method enabled us to show the different stakeholders in the educational IS, and an initial categorization of the constructs. Belonging to the Moroccan SE helped us to design and operationalize the interview guide, and also enabled us to pretest it under favorable conditions. Once we had designed our micro-sample for interviewing, the first attempts to contact potential participants were made by telephone, followed by personal visits to their workplaces, and a series of convergent interviews. (Dick, 2017; Jepsen et Rodwell, 2008), was triggered with 23 resource persons from a specific top management population, namely: The Director of the Information Systems Department (DSI) at MNEPS and 2 DSI managers at central level, 5 heads of regional IS centers at regional Academies of education and training (RAET) and 8 heads of provincial IS centers at provincial directorates (PD), to which we have added 2 Académie directors and 3 central directors (planning, HR, and school life) and 2 members of the HCETSR.

Finally, a common thread, the fruit of a long process of reflection back and forth between pooled qualitative data (in particular the data collected in interviews, analyzed by theme using Atlas ti 5 software), and the literature, enabled us to master certain variables in the model that made it possible to capture in situ the complexity of interactions in the Moroccan

SE, and to build and shape the final product that is the research model and define the hypotheses that underpin it (Figure 1). There are 8 main hypotheses and 7 sub-hypotheses and 10 variables, including two moderators. The conceptual framework presented here comprises 4 main groups. The first set consists of the environmental characteristics of the Moroccan ES. Three independent variables:

Characteristics of the educational product: socio-economic dimension:

- ✓ Student flows (student mobility);
- ✓ Interdependence of school decision-making units (Ministry, RAET, PD, and schools);

The 2nd set consists of 4 exogenous variables, intermediate to organizational performance:

- ✓ Technological infrastructure (IS used);
- ✓ The leadership TIC or E-leadership (IT human resources);
- ✓ Business processes: education & training.
- ✓ The degree to which knowledge is shared.

The 3rd set consists of Two contextual moderating variables:

- ✓ Organizational structure (Alignment);
- ✓ Climate & organizational culture.

Finally, The 4th set represented by the dependent variable : Organizational performance SI education & training, grouped into the four organizational performance dimensions of the Morin *et al.* (1994).

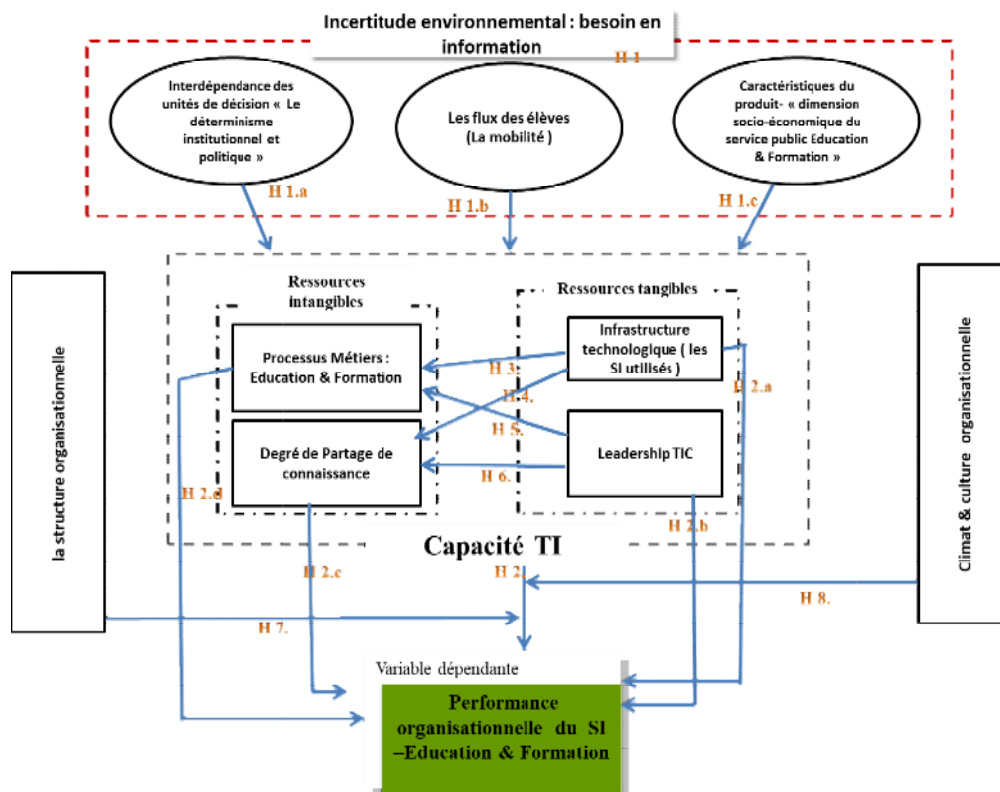
we favour quantitative methods of data collection and analysis (MES). The use of a mixed approach stems from our conviction that the two categories of research methods are complementary, since this complementarity can only strengthen the scientific validity of the work, both internally and externally.

**2. Survey design and operationalization of model variables**

In order to characterize the empirical validation context of the research, in this case the structural and functional complexity of the Moroccan SE. We begin this analysis with a justification of the relevance of the chosen sampling framework to our research problem. We then attempt to retrace the profile of the respondents who took part in the study.

**2.1. Sampling frame**

On this point, it should be noted that the nature of our research theme and its explanatory perspective (the contribution of IT capacity in terms of improving IS education & training performance), imposed, from the outset, the question of the choice of sampling batch. While in the qualitative phase, the sample was dedicated to both top management practitioners (business managers, IT managers, RAET directors, etc.) and academics, since the objective was exploratory in nature: to refine our research problem and gain a better understanding of the related themes. At this stage, on the other hand, the aim is



**Figure 1 : Conceptual search model (Ehaddouchi and Elkharraz, 2020)**

In the preceding lines, we have tried to recall the qualitative approach adopted in order to generate a representative conceptual research model. We have considered, in fact, this phase required in-depth investigations to identify the interviewees' own perceptions of the elements constituting the object of the research. On the other hand, in order to test the hypotheses forming the proposed conceptual model (Figure 1),

more deductive, i.e. to arrive at a research model test. As a result, the context, in addition to being kept constant, should be relevant to the research question in order to test it. It should also be pointed out that the case study requires a relevant theoretical sample. Selecting an appropriate population allows external variation to be controlled and helps define the limits of generalization of results. We have tried to identify the uses

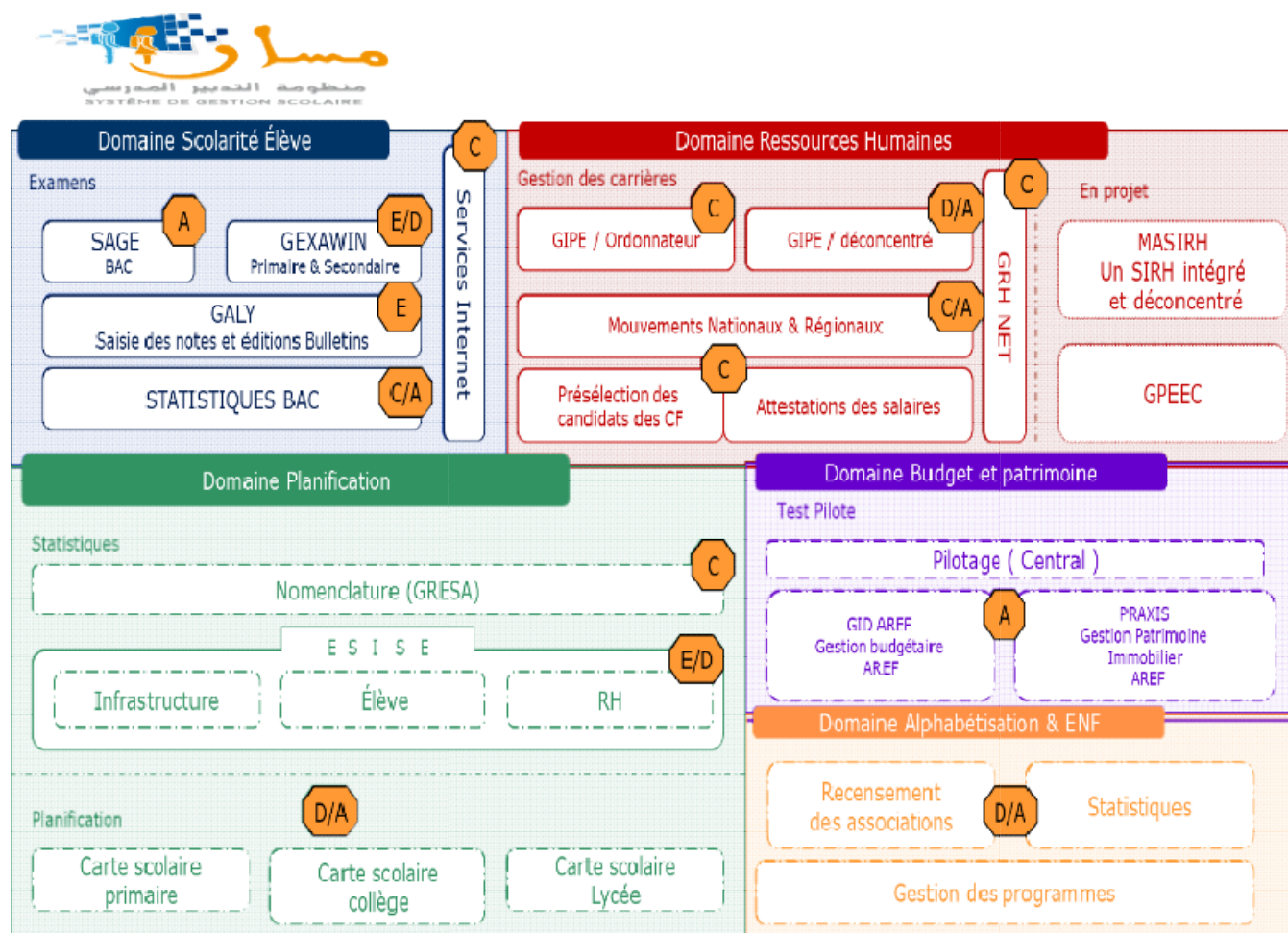


Figure 2. Mapping of current information system technology platforms (MNEPS,2022)

of the various technological platforms implemented within the ES (Figure 2 below) by the different categories of users. In particular, the test enables us to assess which functions are used, and which are not yet used, or are used infrequently. We've noticed that the school principal is the main user of most of these platforms. In the same category, we can add the censor and the general supervisor. These can have access to the same functionalities and possibilities as the school principal. In the interests of relevance, a process of distilling the sample framework was naturally set in motion. Indeed, based on all the administrations in charge of managing the Moroccan school education service, we initially chose the RAET for the Tangier-Tetouan-Alhoceima region and its 8 provincial departments (Tangier-assilah; Fahs Anjra; Tétouan, Mdiq-Fnidek Chefchaouen; Ouezzane; Al-Hoceima) and the schools that belong to it. This choice was clearly reflected in the positions we took in the qualitative phase and in the orientation of our documentary research. The qualitative study revealed that the best contacts for our quantitative survey are the IT center managers, whether at central, regional or provincial level. This does not exclude the head of the IT unit. These managers are directly concerned with IS development and end-user relations. We also added any CRSI OR CPSI members who were more familiar with the objectives and mission of their center. The number of observations, finally obtained after follow-up, was 309 usable questionnaires. The characteristics of the respondents in terms of age, gender and level of training are relatively divergent, due to the diversity of the functions in which they operate (Table 1). The table shows that the majority

of our interviewees were school principals. Secondly, it is interesting to note the large number of female managers who took part in the study (almost 17, 80%), and the number of young people in positions of responsibility: over 50% are under 45 years of age (including almost 11, 97% under 35). Finally, in terms of level of training, we note that almost half the respondents (45.95%) have Master's degrees or similar (Bac+5). On the other hand, the sectoral and geographical distribution of the schools and trades service establishments surveyed shows marked inequalities, due to the concentration of the bulk of school service activity in certain provinces more than others (see in particular the geographical and demographic dimension of the province) (Figure 3).

It should therefore be noted that the Tetouan segment includes 7 RAET Tangier-Tetouan-Al-Hoceima head office entities, as the head office is located in Tetouan. Note that 88% of the population is part of one large academy: the RAET of the Tangier-Tétouan-Alhoceima region, with its 8 provincial directorates (Tangier-assilah; Fahsanjra; Tétouan, Mdiq-Fnidek Chefchaouen; Ouezzane; Al-Hoceima) and the schools belonging to them. Our research survey involved 309 usable questionnaires, 74% of which were from school principals (based on purposive sampling using the quota method (by province)), 11% from provincial heads of PD; 2.5% from academy heads; 4.5% from ministry business heads and, finally, 8% representing the potential population of our enchantments, i.e. heads of DSI, CRSI and CPSI.

Table 1 : Statistical sample profile

Variables	Fréquence des réponses										TOTAL
Sexe	Hommes					Femmes					309-100%
	254 ( 82,20%)					55(17,80%)					
Poste occupé	Responsable ou membre DSI, CRSI ou CPSI	CENTRAL RESP ( CHEF DIVISION OUSCE )	AREF- Chef de division chef du service métier ( RH- planification- Examens- Finance....et c)	DP- Chef de division chef du service métier ( RH- planification- Examens- Finance....et c)	Directeurs des établissements scolaires	Responsable ou membre DSI, CRSI ou CPSI	CENTRAL RESP ( CHEF DIVISION OUSCE )	AREF- Chef de division chef du service métier ( RH- planification- Examens- Finance....et c)	DP- Chef de division chef du service métier ( RH- planification- Examens- Finance....et c)	Directeurs des établissements scolaires	309-100%
	17	12	7	27	191	8	3	1	6	37	
	5,50%	3,88%	2,27%	8,74%	61,81%	2,59%	0,97%	0,32%	1,94%	11,97%	
Niveau de formation	Bac+ 2		Bac+ 4		Bac+ 5		Au-delà de Bac+5			309-100%	
	3		152		142		12				
	0,97%		49,19%		45,95%		3,88%				
Age (ans)	25-35		36-45		46-55		> 55			309-100%	
	37		121		138		13				
	11,97%		39,16%		44,66%		4,21%				

planning & statistics, school social support management, HR management, etc.

2 .2. Questionnaire design, validation and administration

Our questionnaire investigation tool is built along a six-step process as synthesized in the literature (Churchill, 1979; Malhotra & Galletta, 1999), (figure 4) below:

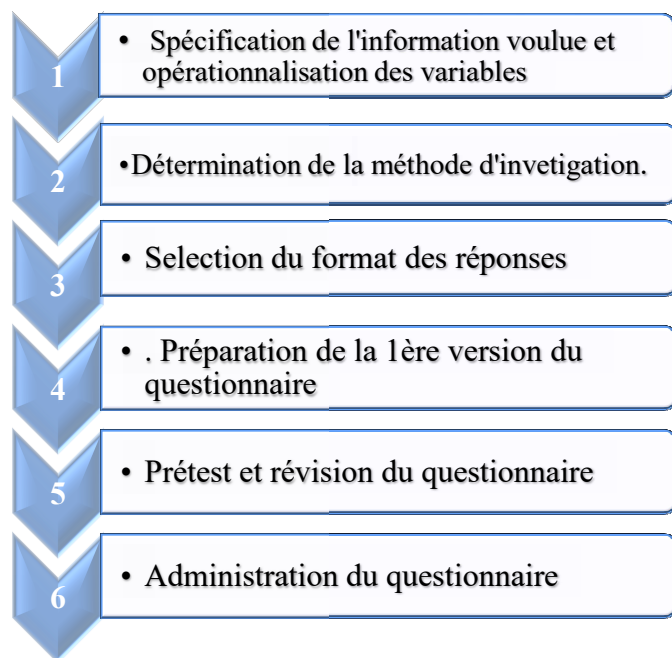


Figure 1 : Diagram of the stages adopted in the construction of the questionnaire

Source: Synthesized from the work of Churchill (1995) et Malhotra (1999).

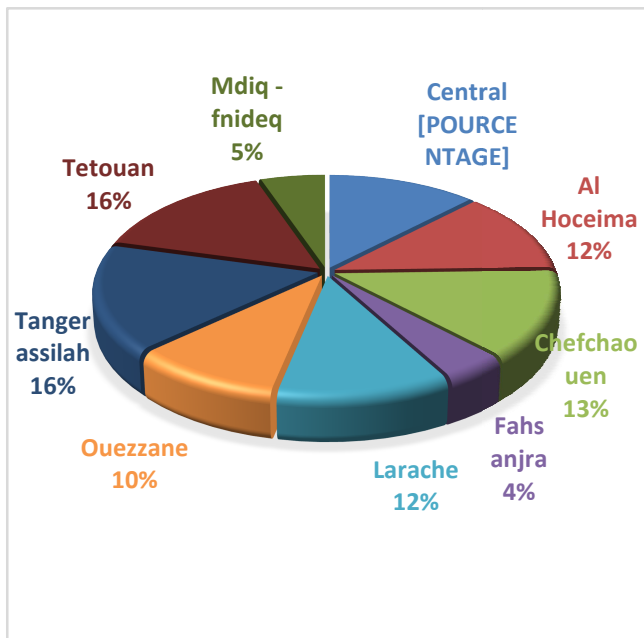


Figure 3 : Geographical breakdown (respondents)

By way of conclusion, it is necessary to point out that, despite the limited number of observations collected, we believe that the composition of our study sample illustrates a qualitatively representative character of the category of entities in charge of managing the Kingdom's school educational affairs. Indeed, we find a panoply of main operators in sectors as varied as School Management: IS & IT management, pedagogical management,

However, one of the essential steps in constructing a questionnaire is to determine the information requirements necessary to achieve the research objectives. Thus, the research model that has been proposed (Figure no. 1 above) in response to our initial problem, presents a general structure tiered into three distinct levels: (I) “The impact of environmental uncertainty in the education system on the development of IT capabilities”, (II) “The role of the organizational and internal context in the relationship between IT capabilities (IT resources) and organizational performance” and finally (III) “The impact of resources developed through the use of IT on the organizational performance of the Moroccan school education system”. Each level of research will be objectified, in the context of this study, in the form of a number of dependent and independent variables whose relationship will make it possible to verify part of our research hypotheses. Before moving on to test all these relationships, the operationalization of our constructs should be made more reliable (Davis, D. and Cosenza, Q. M, 1993). More specifically, it is necessary to ensure that the measures chosen for each variable are conceptually appropriate and empirically sound. (MacKenzie *et al.*, 2011).

In other words, we have sought to justify the reliability of the measurements we have taken, in particular by highlighting the rigour of the approach we have adopted in building our investigative tool (Carricano *et al.*, 2010; Drucker-Godard *et al.*, 2014)<sup>1</sup>. The process of developing a measure involves both conceptualization and operationalization of each of the constructs. To develop a sound theoretical conceptualization, particular attention is paid to formulating clear, specific and unambiguous definitions, adapted to the theoretical framework and context of the study (Evrard *et al.*, 2003; Recker, 2012). The measures and indicators used in this study are chosen for their correspondence to the conceptual definitions adopted. At the outset, we chose the “Google Forms” method of investigation, which has become a very important channel in the development of management surveys both in terms of user-friendliness and cost, making its use by our respondents a necessary, if not obligatory, thing. However, in some cases, as part of the follow-up procedure and as the number of responses dries up, we have had to administer the questionnaire face-to-face at the respondent's place of work (in 29 cases), sometimes at their request.

The questionnaire was administered to the entire study sample. It was sent out in two waves, one month apart. The first wave, carried out at the beginning of October 2021, involved 28 RAET TTH division heads and departments and 300 schools, while the second wave involved 44 questionnaires sent out. This brings the total number of questionnaires sent out to 372. Particular care is taken when administering the questionnaire to ensure a high response rate. However, studies using “Google forms” generally achieve a lower response rate than professional mail. Again, with a view to improving the response rate, we tried to follow up all this upstream work (simplified questions, unambiguous style, etc.) with a follow-up procedure using all available means, i.e. by e-mail, by

telephone or by personally visiting the workplaces of our potential respondents, in particular CRSI or CPSI managers and members. For the purposes of this research, a Likert scale (Likert, 1932) 7-point scale is used: the respondent is asked to express a certain degree of agreement or disagreement with a proposition presented to him/her, on a scale from (1) “Disagree completely” to (7) “Agree completely”, or to express his/her appreciation (by giving a score from 1 to 7) or to express his/her perception of the degree of importance or moderation of a construct, on a scale from (1) “Not at all important” to (7) “Extremely important” from (1) “Strongly prevents” to (7) “Contributes greatly”, on a scale from (1) “very important” to (7) “extremely important” from (1) “strongly prevents” to (7) “contributes greatly”.

Two reasons can be given for choosing a seven-point scale for this study: firstly, research into these issues (i.e. the number of rungs to be considered) shows that the optimum value is around five or seven (Cox, 1980). Since it is an odd-numbered scale, there is a point at equal distance from each end. This “moderately agree” modality allows individuals with an intermediate position or who are centrists to present themselves as such and, above all, not to be obliged to adopt a particular position a position that is not entirely their own (largely favorable or unfavorable).

### 3. Confronting the conceptual model with empirical data: adjusting the measurement model and testing research hypotheses

**3.1. Statistical description of independent and dependent research variables:** In this section, we have carried out preliminary statistical tests to better characterize our study sample. Descriptive analysis methods are ideally suited to this purpose. Thus, we will mainly use frequency and mean tables. The mean gives an indication of central tendencies in the sample, while frequency tables are intended to reveal not only the frequency of the sample population with regard to a given characteristic, but also the distribution of certain variables.

First of all, it should be pointed out that we have made comparisons of means and standard deviations between the different variables in order to identify the existence of certain extreme values, also known as « outliers » (Field, 2009). At this level, the aim was to identify and, if necessary, eliminate these “outliers”, insofar as their presence could contribute to altering the nature and relevance of the statistical results. In our analysis, the comparison of means and standard deviations does not reveal any very high extreme values, likely to affect the credibility of our results, on the selected variables. Our research model, as schematized in (Figure 1), includes the following research variables:

- Three independent variables:
  - ✓ Characteristics of the educational product: socio-economic dimension
  - ✓ Student flows (student mobility);
  - ✓ Interdependence of school decision-making units (ministry, RAET, PD, and schools);
- Four variables IT resources:

Technological infrastructure (IS used) ;

- ✓ The leadership TIC or E-leadership (IT human resources);
- ✓ Business processes: education & training;

<sup>1</sup>This preliminary analysis will be completed and progressively refined by means of an exploratory factorial analysis in SPSS V24, followed by a test of the measurement models using a “LISREL” structural equation method based on variance and covariance (in AMOS 24)..

- ✓ The degree to which knowledge is shared.
- Two moderating variables:
  - ✓ Organizational structure (Alignment);
  - ✓ Climate & organizational culture.
- A dependent variable: Organizational performance SI education & training.
- Two control variables: Decision-making level, administrative seniority.

For each of these variables, we have made comparisons of means and frequencies in order to highlight the main trends that may emerge, and to discuss their significance and scope. An inter-item correlation analysis is also carried out for each variable, in order to make an initial judgement on the internal consistency of each construct. Finally, for methodological reasons, we have grouped our research model variables into four theoretical dimensions. These are in fact the same dimensions we used to structure our investigative tool (the questionnaire). In what follows, we will examine the details relating to each of these variables through certain elements of descriptive statistics (averages, frequencies, Min, Max...) as well as inter-item correlations. The various results presented the percentages and averages of educational service providers at Ministry level and in the Tangier-Tetouan-Al-Hoceima region, who expressed a given level of intensity (low, medium or high) on each of the variable's items, as they emerged from the final sample.

Overall, the level of awareness, integration, communication, mobilization and motivation with regard to IS monitoring and management (role of the CRSI & CPSI) in the respondents' answers is very high (scale average of 7 screens, equal to 3 or 5 in most cases), even if there are differences in level: this level of awareness and integration is average in almost 50% of cases, and fairly high in over 20% of answers. A quick glance at these tables reveals that a good proportion of respondents appear to be performing satisfactorily in terms of the sector's organizational performance, which is dependent on the development of IT capabilities, since only just over 3.90% of managers surveyed stated that they were recording fairly low levels of performance. This situation can be explained, in part, by a relatively favorable national and even international economic climate, with the boom in mobile telephony (Android System) and the development of web technologies. It should also be noted that a number of indicators used to assess the organizational performance of education authorities are not taken into account by some of the schools in our sample, notably the level of performance of in-house staff, notably general supervisors and teachers.

### 3.2. Nonparametric bivariate test and measurement validity

The use of non-parametric tests, as opposed to traditional inferential statistics, is essentially due to the limited number of observations collected and the lack of certainty as to the distribution laws of the variables. Before embarking on statistical testing, we should first highlight the interest of this category of tests (non-parametric), and then explain and justify the test method adopted, in this case the Test Kruskal and Wallis, (1952). The overall descriptive results we have analyzed need to be qualified, since administrative considerations and the seniority of managers and heads of

establishments (which the qualitative analysis has brought to light) seem to bring more affinity to this analysis. The non-parametric test method is used here to assess the significance of the differences in behavior observed qualitatively between the managers surveyed, according to the dual criteria of "decision-making level" and "administrative seniority". In so doing, our aim was to statistically confirm the "control variable" status of these two parameters within our research model. Given that the control variables linked to the groups are nominal and those making up our research model are ordinal, we did not perform a chi-square test. Indeed, this test would have required us to have nominal variables on both sides. For this reason, we opted for the Kruskal Wallis test. This test was chosen here because of the small size of the sample finally analyzed, the number of groups derived from the "decision-making level" (4 groups) and "administrative seniority" (3 groups) typologies, and lastly the nature of the variables in our research model; as these were measured, they can be likened to rank 2.

The test carried out in SPSS 24 showed that the level of decision-making (central-regional-provincial or local) and administrative seniority, depending on whether it was old (over 10 years), medium (between 5 and 10 years) or recent (less than 5 years), was indeed an explanatory factor for the differences in performance perceptions observed among IS in the Moroccan public education & training service (a majority of our study sample with significant "p-values"). Clearly, respondents with several years' experience in the sector seem to have, for example, a more formalized school management process, a greater and more precise quantity of student information, and administrative staff more committed to knowledge-sharing follow-up. Overall, we can make the following observations based on the analyses carried out to date on the sample of school managers and heads analyzed in this study. The Kruskal Wallis test has shown that there are similarities in the distribution of the majority of our research variables across the four decision-making level groups within the ES. Remembering that the number of observations per category is small compared to the total national population (and observations are not evenly distributed between the different categories), it is likely that with a larger sample, more significant relationships could emerge. In other words, this lack of recurring significance can probably be explained by the small size of our sample (N = 309) in relation to the total population, which makes statistical tests difficult.

The results obtained for the majority of the items were very positive, with "significant P-values" in the distribution of the variables in our research model among the departments surveyed, according to the administrative seniority of the heads and directors of the schools surveyed. In fact, the classification according to administrative seniority is very real at this level, and therefore this criterion can be considered to explain the perceived differences in the level of moderation of the various components built into our research model. On the other hand, the tests showed a significant difference in the distribution of the variables in our research model among the managers surveyed, depending on their length of service in the education sector. This means that classification according to administrative seniority is real, and that this criterion can therefore be considered to explain, for example, the differences in effort in terms of participation in IS performance between

the different decision-making levels observed. Finally, only the “administrative seniority” variable can be statistically considered as a control variable within our research model.

### 3.3. Results of measurement validity analysis (PCA)

Principal component analysis belongs to the group of inferential statistical methods or « *factor analysis* »<sup>2</sup>. This method is widely used in marketing. Empirically speaking, factor analysis is a purely statistical approach to data structuring. It consists of summarizing the information contained in a statistical database (Gavard-Perret *et al.*, 2009; Igalens and Roussel, 1998; Roussel *et al.*, 2005). For the purposes of this study, factor analysis is carried out in SPSS v24 in a sequence of four steps:

- Step 1: Check that the data are suitable for this type of analysis. To do this, two tests were carried out: Bartlett's sphericity test<sup>3</sup> (Bartlett *et al.*, 2001) and the “*Kaiser-Meyer-Olkin*” test (or KMO test)<sup>4</sup>, (Kaiser & Rice, 1974); the KMO test must be greater than 0.5 and the Bartlett test must be significant (Malhotra *et al.*, 2007);
- Step 2: Examine the correlation matrix between factors using oblique or orthogonal rotation (Evrard *et al.*, 2000). The principle of rotation is to artificially increase cooperation between items and factors. For (DeVellis, 2003; Nunnally, 1978), Following these recommendations, we used the Oblimin rotation procedure (under SPSS 24.0) for this research.;
- Step 3: Scaling. Only factors with a significant percentage of information are retained. As far as item analysis is concerned, items with low communalities (below 0.5 according to Evrard *et al.* (2000)), items that do not saturate on a single factor, items that do not contribute to improving measurement reliability (i.e. items whose removal would make it possible to improve the alpha coefficient of Cronbach, (1951).
- Step 4: Check the percentage of variance explained by PCA.
- Step 5: Check the value of Cronbach's alphas: Cronbach et Shavelson, (2004)

The results of a PCA on all the items of each of the variables making up each dimension were presented, in order to extract the most significant factors and thus assess their reliability. Through this first stage of scale purification, reliability and internal consistency were noted for 84 verified items, 11 of which were statistically rejected. This analysis of the reliability and validity of our scales will be continued in the following

<sup>2</sup>In addition to PCA for tables of quantitative variables, this group includes Correspondence Factor Analysis (CFA) for contingency tables and Multiple Correspondence Analysis (MCA) for tables of qualitative variables.

<sup>3</sup>This measure indicates whether the correlation matrix is an identity matrix within which all correlations are equal to zero. It is used to test the null hypothesis that all correlations are equal to zero. In general, this test is very sensitive to the number of cases (*always significant on a sufficiently high number of cases, with more than 5 observations per variable*) (Gavard-Perret *et al.*, 2009).

<sup>4</sup>Also known as a measure of sampling precision, according to Malhotra (1999) this test compares the magnitudes of observed correlation coefficients with the magnitudes of partial correlation coefficients.

lines by a verification of the exploratory factorial structure through confirmatory factorial analysis (CFA).

### 3.4. Confirmatory analysis of variables and model independents (CFA)

A confirmatory factor analysis was set up to test the scale of measurement of the variables of the different dimensions of our research model, as well as the estimation of the reliability of the latent variables, which is traditionally measured by the “*Cronbach's alpha*” coefficient. By contrast, in structural equation methods, the reliability of a construct is commonly calculated using the “*Rhō*” coefficient proposed by Jöreskog, (1974) also known as the internal consistency coefficient. With the LISREL procedure, the Rhō coefficient is calculated directly from the respective item *loadings*. The rule relating to the reliability of a construct, applied in the (Jöreskog *et Sörbom*, 1993), is that every construct with a Rho value equal to or greater than 0.70 is reliable and should therefore be retained.

#### 3.4.1. Results of confirmatory analysis of variables in the first dimension of environmental uncertainty

At the same time, a confirmatory factorial analysis (CFA) of the environmental dimension variables, using AMOS 24.0 software, enabled us to confirm the initial PCA results. At the same time, a confirmatory factorial analysis (CFA) of the environmental dimension variables, using AMOS 24.0 software, enabled us to confirm the initial PCA results and related measurement errors, we found a very high factorial contribution of all items of the variable (i.e. >0.80) (figure 5) below:

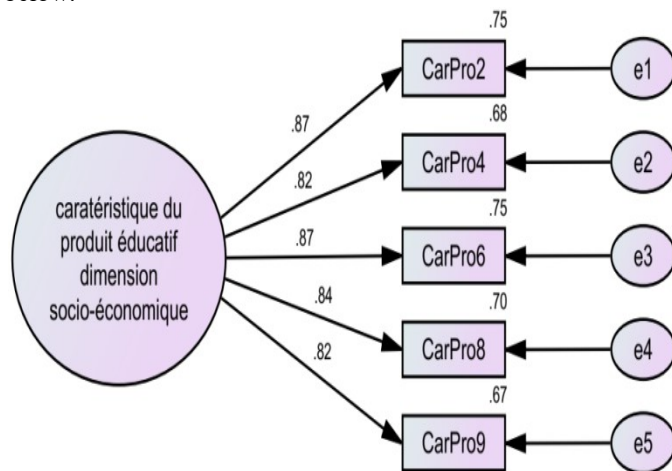


Figure 5 : Results of a confirmatory factorial analysis of the variable “characteristics of the educational product (under AMOS24 Output”

This problem was confirmed by calculating Jöreskog's Rho measure (1971)<sup>5</sup> which yielded a value of 0.56, below the threshold of 0.70, thus compromising the scale's reliability. To improve the fit of the measurement model to the N empirical data, we proceeded with the definitive elimination of the CarPt1, CarPt3 and CarPt7 items. This specification of the model improved the fit indices of this measurement to the field data.

<sup>5</sup>On the basis of the factor contributions generated by AMOS 24



Secondly, the variables “student flow ‘and ’interdependence of decision-making units”, initially made up of four indicators, showed significant factorial contributions through CFA analysis in AMOS, as all were below the recommended threshold of 0.50 (Figures 6 and 7).

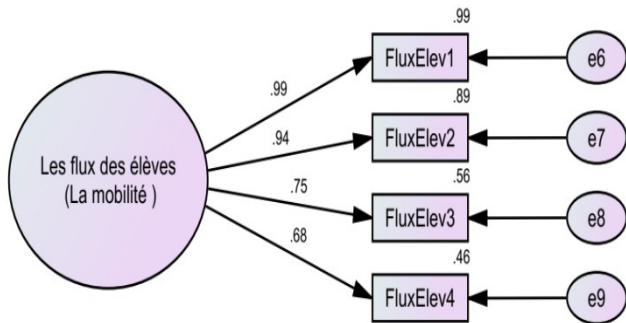


Figure 6 : Results of the confirmatory factorial analysis of the variable “High student mobility (flow of students)”

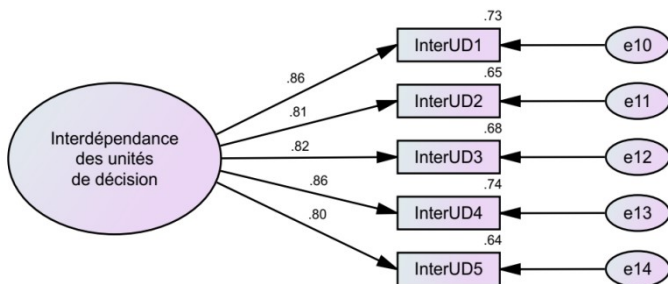


Figure 7 : Results of a confirmatory factorial analysis of the variable “Interdependence of school management and decision-making units”.

Finally, having reviewed all these estimates, we can conclude that the reliability of each of these scales is established. To deepen our analysis, we then examined the correlations between these three latent variables in AMOS 24. The results generated can be summarized as follows (Figure 8):

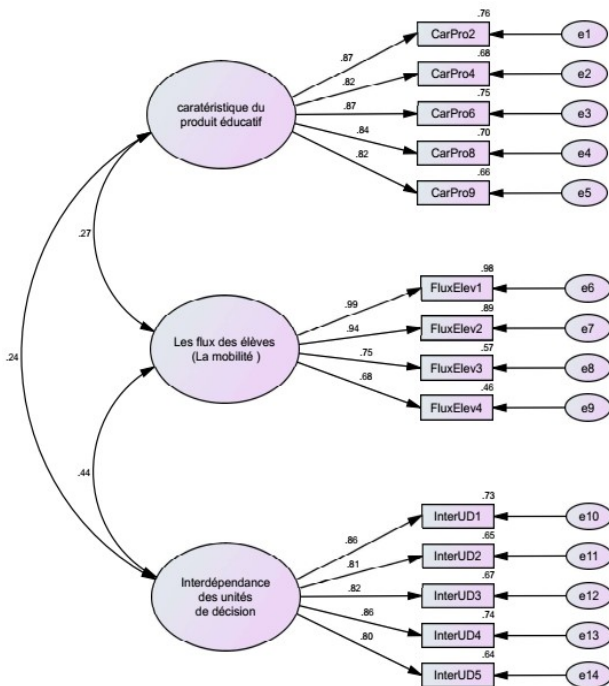


Figure 8 : Test of the covariation model between variables of the environmental dimension

According to the figure below, there is an average correlation between the three constructs. This suggests the existence of a generic latent dimension that encompasses them (Roussel et al., 2005). The “environmental uncertainty” dimension widely discussed in the first part of this work is thus statistically justified. Also, as independent variables of the model, this correlation between the three facets of environmental uncertainty (characteristics of the educational product, “student flows” and “interdependence of decision-making units”,) confirms the fact that each factor never acts alone but rather concomitantly with the other two factors in reinforcing the model's dependent variables.

3.4.2. Confirmatory factor analysis of variables (IT Resources)

These variables are represented by the two latent constructs: technological infrastructure (IS used), ICT leadership or E-leadership (IT human resources). Business processes: education & training and the degree of knowledge sharing. The results of the measurement model test under AMOS 24 are shown in the following diagrams:

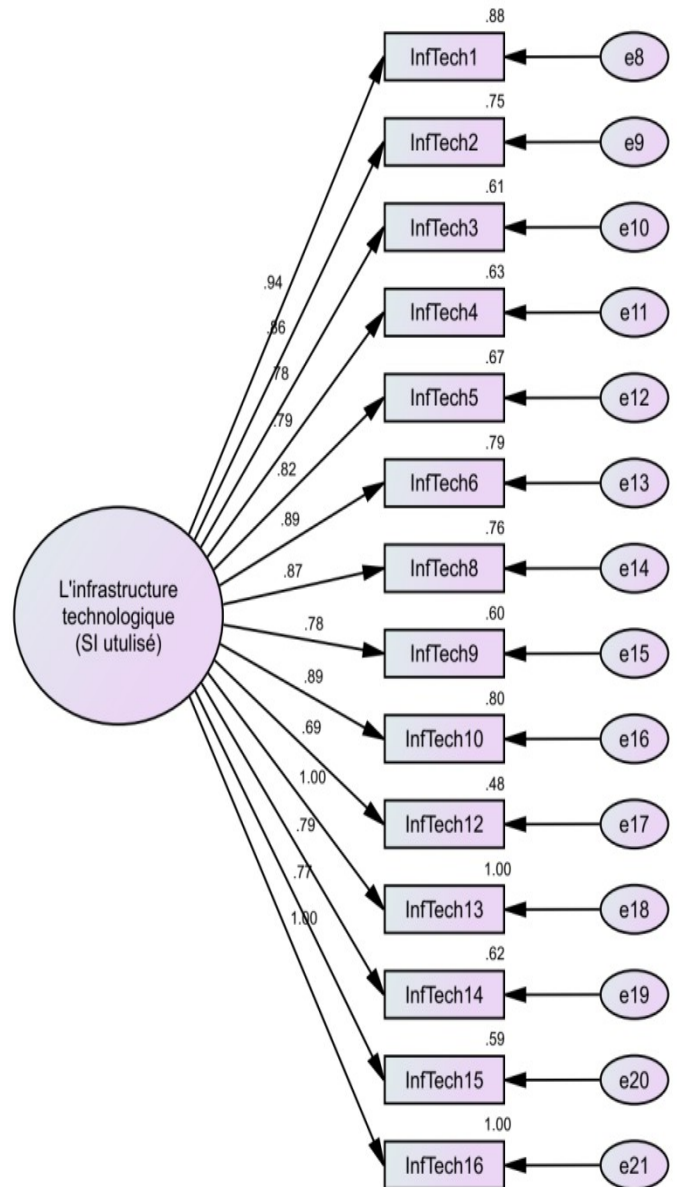


Figure 92. Results of confirmatory factor analysis of variable: technological infrastructure (IS used)

In the case of the “ICT leadership or E-leadership” variable, analyses using AMOS enabled us first of all to report the factorial contribution of the LeaderTic2 item (relating to the management of technological problems) with a value equal to 0.60, adding very little to the explanatory power of the measurement model (Figure 10).

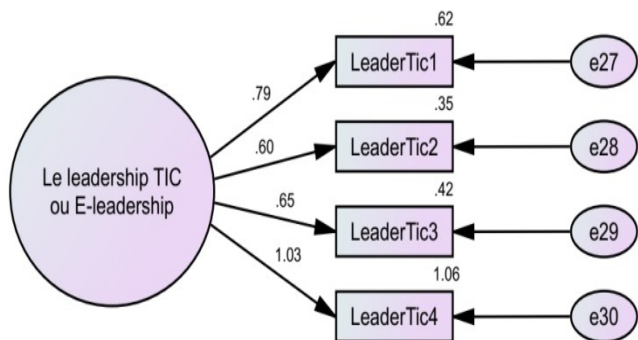


Figure 103: Results of Confirmatory Factor Analysis of variable: ICT leadership or E-leadership

Finally, an examination of the mean variance extracted from this variable shows a value of 0.801, which is above the 0.50 threshold. This demonstrates the adequate convergent validity of this scale. (Hair Jr *et al.*, 2016). At the same time, a confirmatory factor analysis under AMOS for the third item “degree of knowledge sharing”, which we have just carried out for the measurement scale of the “IT capacity” variable, revealed that the standardized parameters generated after the Bootstrap procedure showed very significant factorial contributions, with the exception of the PartConn2 item, whose representational quality proved to be very low (Figure 11).

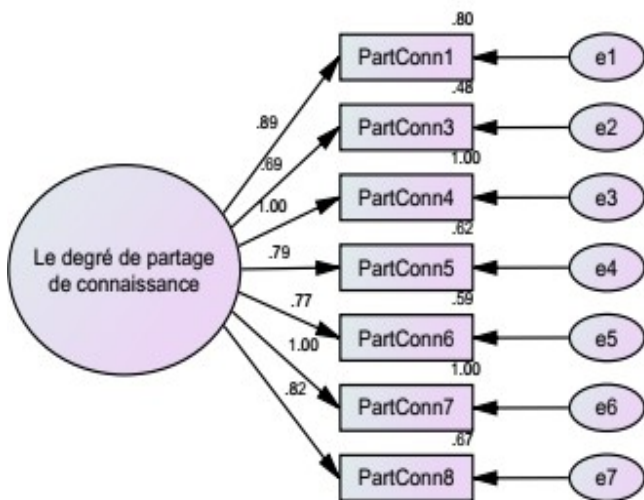


Figure 11 : Results of Confirmatory Factor Analysis of variable: Degree of knowledge sharing

With regard to the variable “Formalization of education & training business processes”, it should be remembered that our study presents an attempt to develop this measurement scale. This leaves us a priori flexible with regard to the purification rule, by accepting items with loadings of up to 0.50. Of the 6 items in this scale, 7 have a loading greater than 0.70, 5 items between 0.804 and 0.964, and only one is less than 0.50 (ProcMet5: 0.061). To improve the internal consistency of the scale, we eliminated this last item, as recommended by Chin (1998). The new values of loadings and weights based on the specified measurement model are presented in the same table

n°51 above. Also, the internal reliability (0.89) is well above the recommended threshold. The fit of this construct with its indicators. Statistical examination of the factorial contributions of the indicators showed us a very satisfactory reliability of internal consistency (Figure 12) as follows:

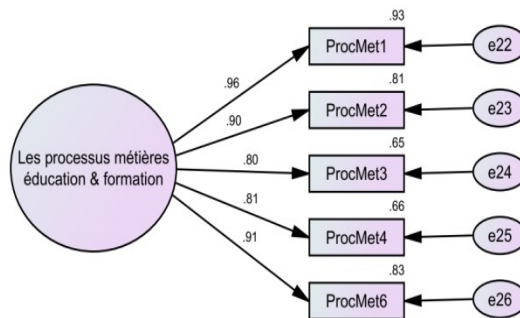


Figure12 : Results of confirmatory factor analysis of variable: education & training business processes

On the other hand, we examined the correlation between these two variables in AMOS 24: IT resources by two blocks defined in the literature (tangible and intangible resources):

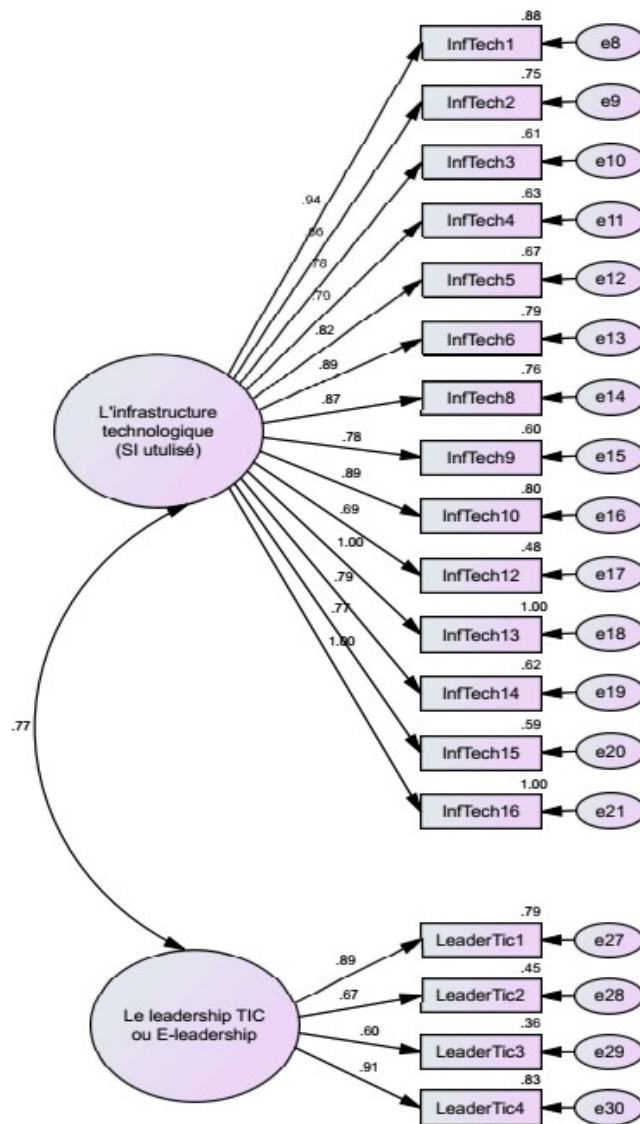


Figure 13 : Test du modèle de covariation entre les ressources incorporées

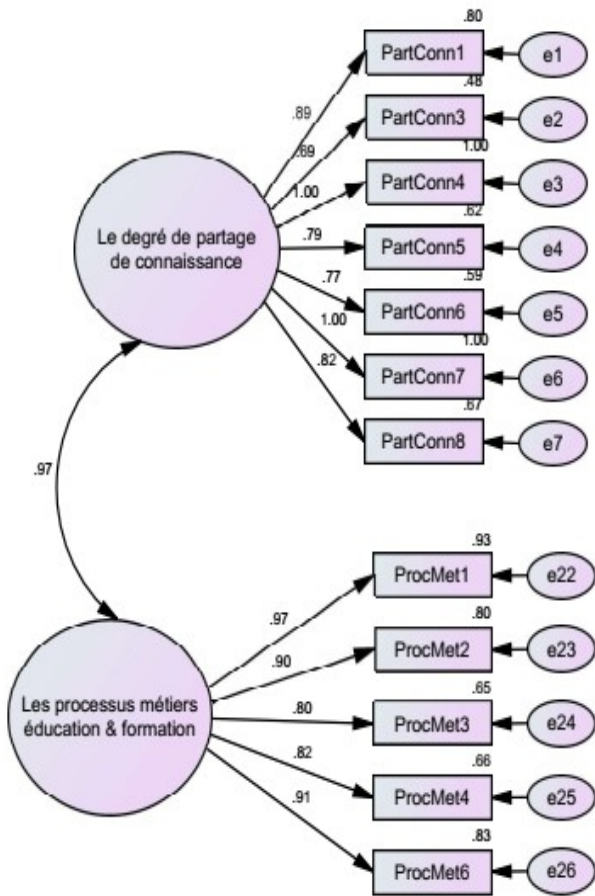


Figure 14 : Test of the covariation model between intangible resources

the performance standards of the company's technological infrastructure, and enhance the degree of knowledge sharing. This will have a positive impact on the formalization of education & training business processes. This correlation also indicates that the effect of IT capacity (as a block of independent variables) through one of the two tangible resource variables is both direct (see corresponding research hypotheses) or indirect through the other block of variables: intangible resources. Concerning the correlation test between the variables: IT resources, The results show that the interaction effects between variables of the same dimension as defined in the literature (tangible and intangible resources): is positive.

**3.4.3 Confirmatory analysis of organizational dimension variables (moderator variables) :**

These variables are represented by the two latent constructs “Alignment - Organizational Structure” and “Climate & Organizational Culture”. The results of the measurement model test under AMOS 24 are shown in the diagrams below. the factorial contributions of the 6 items making up this measure are statistically significant after elimination of the “StrOrgA5” item. In the case of the “Organizational climate & culture” variable, analyses using AMOS enabled us first to point out the low factorial contribution of two items: CtCult1 and CtCult4, with values successively below 0.420 and 0, 126. The composite reliability score for this variable improved significantly. It now stands at 0.899 (well above 0.70), demonstrating very acceptable scale reliability. This allows us to conclude that the removal of these items in subsequent analyses is once again statistically justified after confirmatory

	AVE	CarPt	FluxEle v	InterU D	StrOrgA	CtCult	InfTec h	LeaderTi c	PartConn	PROSS/ MET	FactPER/ ORG
CarPt	0, 711	0, 843									
FluxElev	0, 727	0.278 **	0, 853								
InterUD	0, 688	0.223 **	0.432**	0, 829							
StrOrgA	0, 701	0.498 **	0.552**	0.513**	0, 837						
CtCult	0, 66	0.385 **	0.393**	0.377**	0.700**	0, 812					
InfTech	0, 815	0.502 **	0.559**	0.511**	0.788**	0.732* *	0, 903				
LeaderTic	0, 642	0.479 **	0.527**	0.497**	0.783**	0.654* *	0.902* *	0, 781			
PartConn	0, 779	0.479 **	0.531**	0.501**	0.777**	0.668* *	0.845* *	0.776**	0, 853		
PROSS/MET	0, 738	0.498 **	0.544**	0.505**	0.788**	0.774* *	0.889* *	0.769**	0.755**	0, 857	
FactPER/ORG	0, 698	0.499 **	0.544**	0.498**	0.787**	0.748* *	0.886* *	0.769**	0.754**	0.792**	0, 881

From the two Figures above (no. 13 and no. 14), we can see a fairly strong correlation between the two TI resource variables in our research model; this confirms the idea of the existence of a mutually reinforcing effect between variables of the same category (same block of resources). More specifically, strengthening the role of ICT leadership will help to improve

analysis . In sum, and on the basis of all these tests, we can state that the reliability of the two moderating variables of the organizational dimension is established.

**3.4.4 Confirmatory analysis of the dependent variable**

Organizational Performance IS Education & Training” is the dependent variable of our research model, as shown in (Figure

17). Examination of the factorial contributions of each item showed that all 11 items contained in the latent variable had a loading greater than 0.70. The associated Student's T values are all above the 1.96 threshold. We then assessed the reliability of this scale using Fornell and Larcker's (1981) measure of internal reliability. According to Table 3 below, the internal reliability score for this variable is well above 0.50. The convergent validity of the scale is therefore established. The convergent validity of the scale is therefore established, and the results are presented as follows (Table 2):

**Table 2: Testing measurement models for organizational dimension variables in SPSS**

Variable	Weight	Loading	Mesure	
			p-value	AVE
FactPER/ORG1	0.934	0.776	0.000	0.698
FactPER/ORG2	0.863	1.205	0.000	
FactPER/ORG3	0.781	0.975	0.000	
FactPER/ORG4	0.694	0.97	0.000	
FactPER/ORG5	0.788	1.204	0.000	
FactPER/ORG6	0.816	0.921	0.000	
FactPER/ORG7	0.934	1.203	0.000	
FactPER/ORG8	0.863	1.138	0.000	
FactPER/ORG9	0.781	0.995	0.000	
FactPER/ORG10	0.694	0.776	0.000	
FactPER/ORG11	0.788	1	0.000	

In addition, calculation of the mean variance measure shows a score slightly above the threshold of 0.698, indicating acceptable scale reliability. (Fornell et Larcker, 1981). We then performed a CFA (using AMOS) of the respecified measurement model for our "IS organizational performance" dependent variable. The factor contributions of the eleven items used to measure this variable are acceptable, being above the 0.50 threshold recommended for this type of analysis. This leads us to conclude that the reliability of this scale has been established. Finally, the factorial contributions of the 11 items used to measure the dependent variable are acceptable. Based on the results of the measurement scale is sufficient and confirmed. of the questionnaires, it appears that the majority of the variables selected are clear and consistent. The analysis, at this level, allows us to state that the conditions required to claim the validity of our constructs are assured, and prove that the homogeneity. We then turn to the measurement models, examining the discriminant validity of the variables in our research model. The aim is to verify that the items finally chosen to measure each construct distinguish it from the others, and consequently to check that there is no confusion between distinct constructs.

**3.4.5 Discriminant validity test AVE: MATRIX phi:**

The discriminant validity test consists in examining the correlations between the latent factor scores of each construct in the model. This set of correlations is called the Phi matrix. More precisely, the test compares the correlations with the square root of the average variance extracted (or AVE) for each pair of constructs. Table 3 below shows the resulting Phi matrix of correlations between latent constructs with the square root of the AVE represented diagonally (and in bold). This allows us to assert the existence of adequate discriminant

validity, in the sense ofFornell et Larcker, (1981), between the variables in our research model. In other words, this analysis enabled us to verify that constructs that are conceptually distinct are indeed differentiated by their respective measurements. In short, after this series of reliability and validity analyses, we can say that the instruments developed for this study, after purification, present satisfactory measurement qualities. The results of the LISREL examination of the measurement scales were broadly consistent with those of the exploratory (SPSS) and confirmatory (AMOS) factor analysis, supporting the robustness of the measurement model estimates.

**3.5. Structural model estimation and hypothesis testing**

The next step is to evaluate the structural model using the LISREL procedure. The results obtained in this section will serve as inputs. The figure summarizes the structural model tested and the statistical relationships between the various latent variables. We note that, for the most part, the main structure of the structural model has been validated insofar as the relationships between the model's variables have remained largely unchanged. Some adjustments had to be made in the form of additions or rather the re-specification of certain relationships: The first is to consider the direct positive effect of IT resources (in particular ICT leadership and the degree of knowledge sharing) on the "organizational performance" of the Moroccan SE; This re-specification of the model is justified insofar as tests of the structural model involving these constructs showed fairly strong correlations between these variables. Regarding the contribution of IT capacity to performance, it appears that the majority of respondents are convinced that organizational performance can be influenced by a good coherence of the different IT resources of the Moroccan SE.

This model, which we'll call "constructed", will now be projected with a base model (called the "reduced" model) in which IT capability will be assumed to have a direct causal influence on SI education & training performance (figure 15).Through fitting the structural model, we can check whether linear relationships between variables are statistically significant or not. Scientific standards suggest that the significance of causal path regression coefficients depends on the number of responses collected (N). Thirdly, we will look at the results of our research hypotheses. Using the LISREL method. Most of our assumed research hypotheses are verified, which leads us to assert that the general structure of the model is validated from this point of view. This means that, on the one hand, this result is consistent with the literature, which has posited environmental uncertainty as an antecedent variable in the development of value-creating IT resources. On the other hand, highlighting the importance of this developed IT capability as a prerequisite for developing organizational performance, which invites the Moroccan SE to go beyond the traditional conception, and adopt an approach oriented towards the development of resources through the use of IT. On the other hand, the relationship between the intensity of use of standardized technological infrastructures and the degree of impact of IT capacity on organizational performance is not decisive, and is found to be insignificant (with a very low coefficient), leading us to reject the corresponding hypothesis (H2.a).

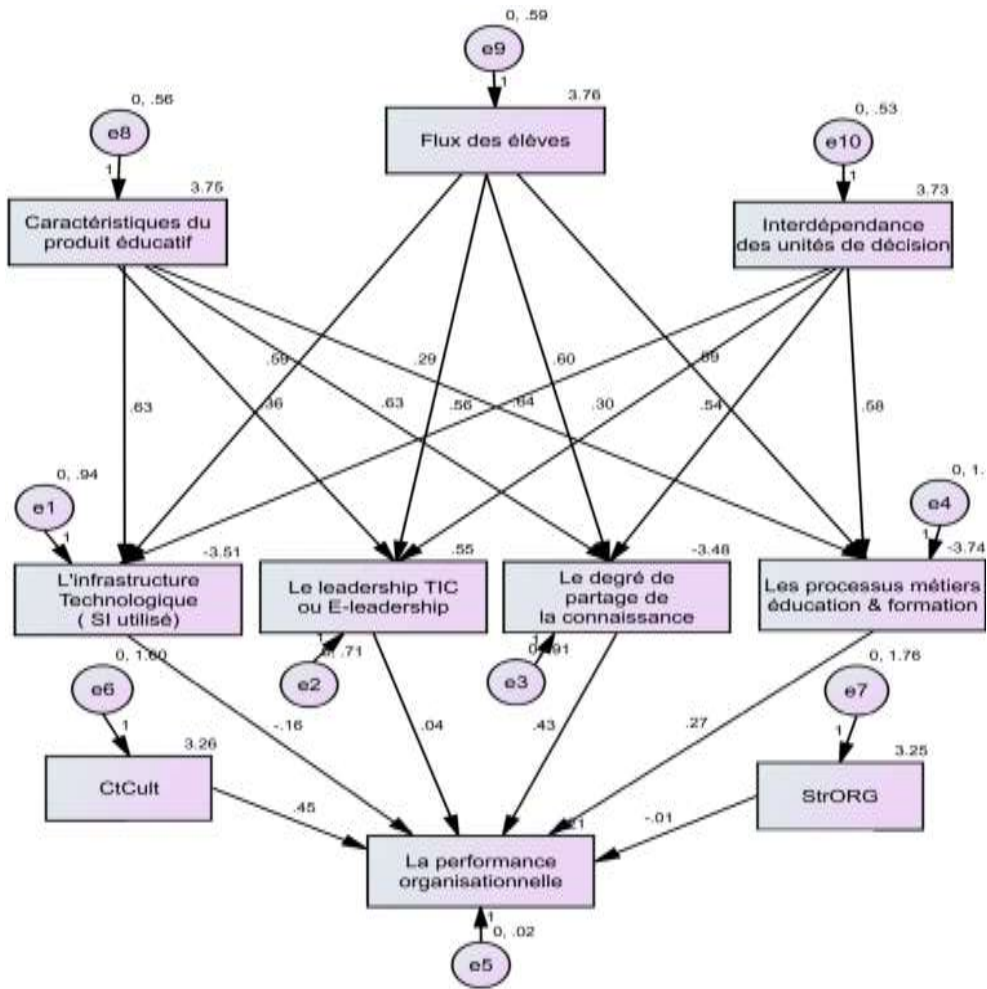


Figure 15 : Testing the global model in AMOS 24

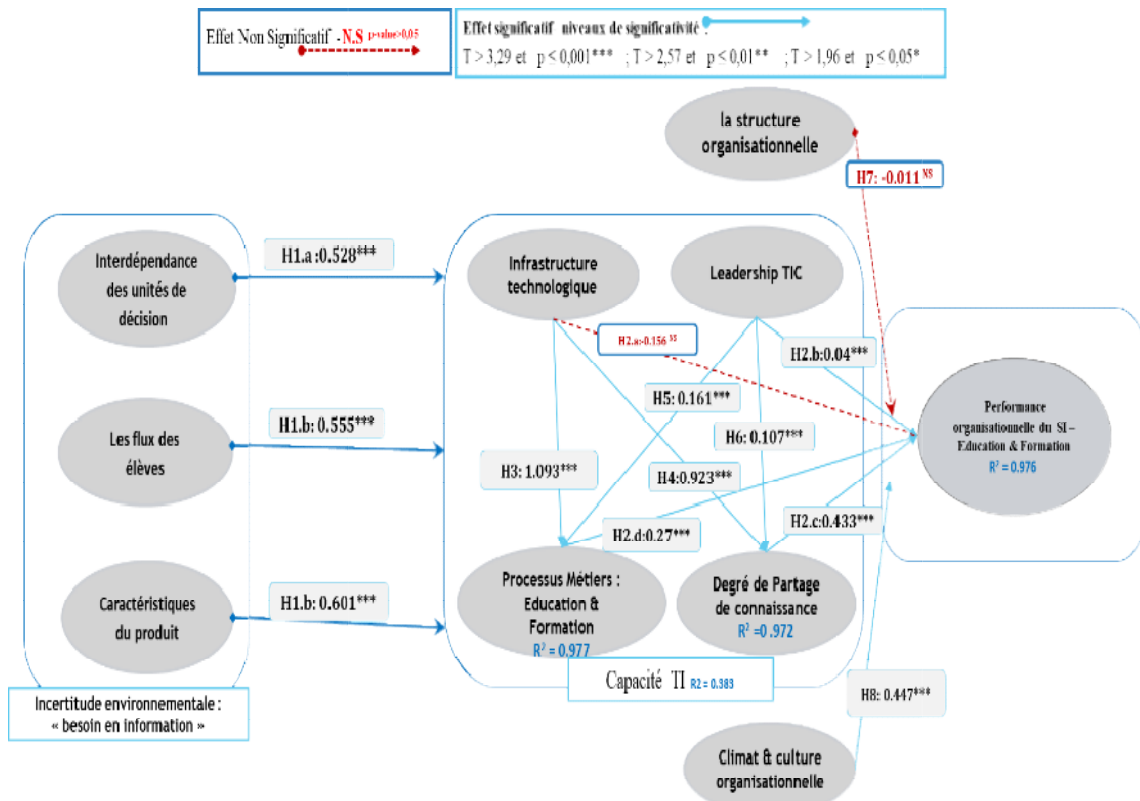


Figure 16 : Final search model estimated by MES-LISREL

This can be explained by the mandatory nature of the use of these technological platforms. Secondly, the menu effort at the level of developing an aligned organic organizational structure showed a very low level of moderation compared to the other construct of the organizational dimension). The relationship test displays correlation coefficients that allow us to reject this hypothesis, H7. On the basis of these adjustments, the results of the global model test are schematically presented as follows (Figure 16): The diagram below illustrates the results of estimating the coefficients of determination (R<sup>2</sup>) of the various endogenous latent variables. The R<sup>2</sup> value reflects the percentage of variation in the response variable explained by its relationship with the predictor variables. According to the results, the variance explained by our main construct "IT capacity" is 38%, while that of the model's dependent variable is 97%, which is a good indicator of the predictive power of our model. We also note that the R<sup>2</sup> for the two endogenous latent variables, IT intangible resources component, captures more than 97% of the total variance. This result allows us to assert that the greater the interest in formalizing business processes and improving the degree of knowledge sharing between the various players, the stronger the reinforcement of IT resources within the SE. In short, these results reflect the central role of IT capacity in the process of improving the organizational performance of the Moroccan ES.

#### 4. Interpretation and discussion of results

What conclusion might we draw from this reflection on the expected results of this study on IT capability?

§ The informational effects derive primarily from IT's ability to collect, store, process and disseminate information, thereby increasing value (IT is likely to influence not only each activity, in its physical and informational component, but also the way in which links between activities are exploited, both within and outside the SE);

§ The study showed that IT capability development can have a significant impact on IT ownership;

- The role of ICT leadership ( DSI - CRSI - CPSI ) : Creating a suitable and practical climate for the development of IT resources within the sector; Improving relations between users and IT specialists; Improving the efficiency and effectiveness of achievements This confirms the important role of intangible resources and the fact that IT capacity is very much linked to the organization (Reix et al., 2011) ;
- What's more, SE managers see technology as an essential support to the success of the sector's strategy, and expect it to have a strong impact on organizational performance;
- Climate and organizational culture are two indispensable conditions for improving the effectiveness of activities linked to technology and IS management. his result is consistent with the literature, which has posited environmental uncertainty as an antecedent variable of IT capacity. (Bouglet, 2002; Galbraith, 2014; Lugan, 2013; Mnif, 2010; Reix et al., 2011; Tribondeau, 2013)

- § The appropriation of the research model was such that managers chose it to lead their next decentralization of administrative decision-making, thus providing an important test for the model., vu The very purpose of this study makes it necessary to consider more local levels of analysis
- § The empowerment of business divisions and their active involvement in all national projects relating to their area of competence;
- § The appropriate guidance and involvement of RAET management and provincial departments, to ensure that the necessary interest is given to information systems and their optimal use

#### CONCLUSION

- In conclusion, we would like to highlight some of the managerial theoretical contributions made:
- § Originality of our methodological approach: we carried out our empirical study using a sequential process, conducting a deductive qualitative exploratory study as a preamble to a quantitative empirical study using the MES. This research methodology enabled us to ascertain the perceptions of local managers, in particular school directors, and to clarify the different points of view regarding educational IS performance.
- § An articulation of theoretical models: the fusion of two reference models (Galbraith's informational model of organizations (1979) and Anandhi Bharadwaj's IT capacity model (2000)) proved relevant insofar as it enabled us to grasp the diversity and nature of the resources developed through the use of technologies.
- § The approach adopted is a new tool in the hands of researchers: an instrument for observing complex phenomena: making the most of feedback from experience to gain a better understanding of the complex phenomenon of IT capabilities (Our particular position as a researcher and member of the organization...);
- § The estimated model also presents a tool for legitimizing IT capability through its impact on organizational performance within the SE (a matrix to help select best practices linked to IS performance management and steering);
- § The result of an assessment can generate a common desire to develop IS. In this last respect, IS evaluation can be seen as one of the contributions of a change management approach.

However, we have concentrated our quantitative surveys on a limited area: the Tangier-Tetouan-Al-Hoceima regions. However, we stipulate that the results obtained could serve as a basis for extrapolation to a wider field. As a result, conducting a survey with a sample covering all the regions of the kingdom is a rather delicate affair, requiring substantial material resources, immense effort and a large time margin - all of which are currently beyond our reach. For this reason, it would be impossible to plan a sample that would reach schools scattered across all Moroccan regions, and we have been content to target the provincial directorates and schools belonging to the Tangier-Tetouan-Al-Hoceima RAET.

In addition, we targeted only one actor among the school staff who use IS in the education sector, namely the head teacher, while other actors (censors, general supervisors, teachers, other educational administration staff) and other aspects relating to the concept of good IS governance were omitted. We chose to conduct a single case study representing a single public administrative organization, which therefore precludes extending the results to other similar public services. Consequently, in order to satisfy the generalization objective, it is necessary to test the research model adopted in another E-government context belonging to public organizations in other administrative sectors. The ambiguity of the concepts studied, the need to reveal the perceptions of the players involved (particularly the heads of provincial IS centers and CRSI managers), and the objective of identifying practices in the day-to-day work of school heads, which is difficult to quantify, lead us to question the relevance of extending our research by carrying out qualitative studies on other public organizations producing in a highly complex context, in order to verify and deepen certain questions raised at the end of our interventions and with the aim of generalizing our results. Taking into account and introducing new variables to the model tested, e.g.: indirect and unintended effects of IT - SI control variable. However, the notion of control is not present in the model, even though it is essential according to the main challenges of decentralization. Fully aware of the challenges posed by this work, which is far from complete, we feel it is necessary to look into possible ways of integrating such an approach into the "job" of the central ISD, the "CRSI" and the "CPSI" of the decentralized administrations responsible for managing education, while taking into account both their specificities and their heterogeneity.

In conclusion, it now seems clear that the search for a direct link between investment in TI and organizational performance is not a satisfactory approach, either because of its difficulties or its limited explanatory power. Approaches in terms of coherence, complementarity and appropriateness nevertheless seem more promising. (Bounfour & Epinette, 2006; De Vaujany, 2009).

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