

SERIE RESEARCH MEMORANDA

Measuring it core capabilities:
results from a confirmatory factor analysis

Hans van der Heijden

Research Memorandum 2000- 15

June 2000



**MEASURING IT CORE CAPABILITIES:
RESULTS FROM A CONFIRMATORY FACTOR ANALYSIS**

Hans van der Heijden

Vrije Universiteit Amsterdam

Faculty of Economics

Department of Information Systems, Marketing & Logistics

De Boelelaan 1105, Room 3A-24

1081 HV Amsterdam, The Netherlands

E-mail: hheijden@econ.vu.nl

Keywords: EL0302 Measuring IS Success, AF0402 Organising, AI0606 Factor analysis

Abstract

This paper reports on the theoretical development and empirical validation of a measurement instrument for three core capabilities of IT departments. The instrument is based on the work of Feeny & Willcocks (1998) and includes the capabilities “IS/IT governance”, “Business system thinking” and “Relationship building”. The sample consists of 472 respondents, mostly IT managers. Results demonstrate that the constructs are highly reliable (alpha coefficients > 0.8). A confirmatory factor analysis on the dataset suggests acceptable model fit on most measures. However, a respecification of the model in which “IS,/IT governance” is split into “Executive Relationship Building” and “IT Management” provides better measures of fit. Both the original and the revised model demonstrate highly significant factor loadings ($p = 0.000$). The paper concludes that core capabilities of IT departments are useful constructs to incorporate in future research. They are able to successfully predict behaviours that have relatively little overlap. Recommended further research includes the relationship between capabilities and governance structures, as well as further investigation into how IT core capabilities are formed and strengthened in organisations.

1. Introduction

It has frequently been argued that to be successful in IS development and implementation, the relationship of the IT department¹ with the rest of the business is of critical importance. Indeed, IS researchers have focused on numerous facets of this relationship, including the executive relationship with general management (e.g. Feeny et al., 1992), the alignment with business strategy (e.g. Reich & Benbasat, 1996), the IT governance structure to be used (Zmud, 1984), and the involvement of users in system development efforts (e.g. Ives & Olson, 1984).

A relatively new and promising approach to conceptualise how IT departments interact with the business environment is based on the core capability view of the firm (Hamel & Prahalad, 1994; Teece et al., 1997). In line with this perspective, Feeny & Willcocks (1998) have operationalised nine core capabilities for IT departments. Three of those deal specifically with the business environment: “IS/IT governance”, “business systems thinking”, and “relationship building”. However, no measurement instrument has yet been developed for these capabilities, and consequently their application in empirical work and the advancement of theory is hindered.

This paper extends the work of Feeny & Willcocks by developing measurement instruments for these three capabilities. The purpose of the research reported in this paper is twofold. We aim 1. to develop an instrument to measure these three core capabilities and 2. to empirically assess the psychometric features of these measures. We do so by testing the measurement in an e-commerce context.

The next sections of this paper discuss the theoretical antecedents of this study and the conceptual framework. The following section describes the research design. The subsequent

¹ We use the term “IT department” loosely in this paper to denote a group of individuals, internal to the firm, providing IT resources and services to the business.

section presents the results, and the final sections discuss the implications of our findings and conclusions.

2. Theoretical antecedents

The core capability perspective on organisations, also associated with the competencies perspective or the resource-based view of the firm, is a new approach to diagnose and assess the relationship between business and IT. From the core capabilities point of view, organisations build a number of core capabilities with which future environmental challenges are to be met (Prahalad & Hamel, 1990; Hamel & Prahalad, 1994). Capabilities include organisation-specific routines, processes, skills and resources. They need to be built, through learning processes, and cannot be readily bought. In the short run, they are not imitable in other settings and replicable by competitors. Through this property, capabilities enable a firm to achieve sustainable competitive advantage in the market (Teece et al., 1997).

The core capabilities perspective has been very influential in the field of strategic management, although it has been subject to criticism. Williamson (1991, 1999) mentions the obscure and **tautological** definition of a core capability (= “a capability which is core”) and the lack of sufficient operationalisation of the concept. To overcome these limitations, he suggests further research be directed towards further measurement and operationalisation of capabilities.

Little IS research has been carried out within the capabilities perspective, but a prominent exception is the work of Feeny & Willcocks (1998, 1999). Based on a body of empirical evidence (reported in Feeny et al., 1992), the authors develop a view of the IS function based on core capabilities. The IS function, in their framework, faces challenges in the environments of “business”, “technology”, “service” and “governance”. To deal with the challenges in these environments, IS functions develop nine distinct core capabilities. These are depicted in Table 1.

Nr	Core capability	Description
1	IS/IT Governance	Integrating IS/IT effort with business purpose and activity
2	Business Systems Thinking	Envisioning the business process which technology makes possible
3	Relationship Building	Getting the business constructively engaged in IS/IT issues
4	Designing technical architecture	Creating the coherent blueprint for a technical platform which responds to present and future business needs
5	Making technology work	Rapidly achieving technical progress – by one means or another
6	Informed buying	Managing the IS/IT sourcing strategy which meets the interests of the business
7	Contract facilitation	Ensuring the success of existing contracts for IS/IT services
8	Contract monitoring	“Protecting the business”’s contractual position, current and future
9	Vendor development	Identifying the potential value of IS/IT service suppliers

Table 1 Nine core capabilities of the IS function (Feeny & Willcocks, 1998:357-359)

Three of these capabilities cover the relationship of the IT department with the rest of the business. “IS/IT governance” refers to the executive relationship between IT management and business management. “Business system thinking” is concerned with the business knowledge and understanding of the IT department. “Relationship building” refers to the relationships between business employees and IT employees.

Feeny & Willcocks attach a short list of behaviours to each of the capabilities. Our measurement instrument is based on the perceived occurrence of these behaviours. In other words, we propose to measure a capability by asking respondents to what extent the IT department performs the three to four behaviours that are associated with the capability. A strong manifestation of the capability implies substantial occurrence of each of these behaviours.

Figure 1 represents the model for the measurement instrument. The capabilities are represented as unobserved (latent) variables, that become manifest by their influence on certain behaviours. These will now be discussed in more detail.

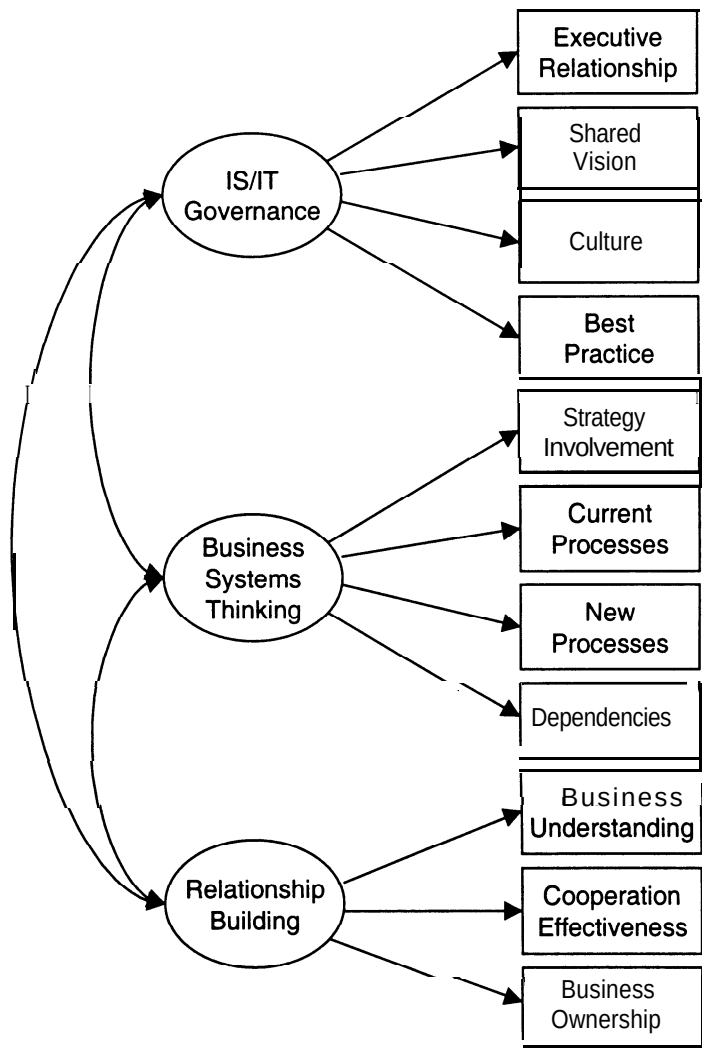


Figure 1 IT capabilities model (adapted from Feeny & Willcocks, 1998)

IS/IT Governance

IS/IT governance is “the capability to integrate IS/IT effort with business purpose and activity” (Feeny & Willcocks, 1998:357). The ability to deal with interdependencies that arise between the business and the IS function falls into this category. Being a management capability, it is typically developed between the MIS manager or CIO and the general manager or CEO (see also Jarvenpaa & Ives, 1991; Feeny et al., 1992), but also between the CIO and the management of the other business departments.

Four behaviours reflect this capability (Feeny & Willcocks, 1998). The first factor refers to the *quality of the executive relationship* between the CIO and the other executives. High performance CIOs build and develop good quality relationships with their peer executives in the firm.

Another behaviour associated with this capability is the ability to arrive at *shared objectives* and visions. Reich & Benbasat (1996) examine the linkage between business objectives and information technology objectives. They identify an intellectual and a social dimension of linkage. The intellectual dimension refers to the factual similarity between IT plans and business plans. The social dimension refers to whether IS and business executives understand each other’s objectives and plans. Besides shared understanding, IT vision congruence is argued to be an important measure for linkage.

Fostering an appropriate *culture* in the IT department is a third behaviour associated with IS/IT governance. As Ward & Peppard (1996) observe, there is often a cultural gap between IT departments and business departments. This gap is often fostered by “hard” elements (power and control structures), but also by rituals, routines, stories and myths and symbols that set the IT department apart from the other departments. Therefore, strong IS/IT governance capabilities are associated with cultural alignment between IT and business departments.

Feeny & Willcocks also associate the behaviour of incorporating *best practices* in management with this capability. Best practices, a broad term originating from the Total Quality Management movement (see e.g. Camp, 1994), is usually defined as the acquisition and implementation of (management) processes with superior performance on a continuous basis. Thus, the search for continuous improvement of processes is associated with strong IS/IT governance capability.

Business systems thinking

Business systems thinking is the capability “to envision the business processes which technology makes possible” (Feeny & Willcocks, 1998:357). This capability refers to the degree to which the IT department is able to identify itself with the business processes that it is serving. Four behaviours are said to be associated with this capability: involvement in business strategy, occupation with IT implications on processes, new processes made possible by IT and an eye for dependencies.

The first factor influenced by this capability is the degree to which the IT department is involved in the formulation of *business strategy*. Although intended strategies are not realised strategies (cf. Mintzberg, 1994; see also Chan et al. 1997), the degree of involvement in the process of business strategy formulation is clearly a sign of participation in the general orientation of the business.

On a more operational level, business systems thinking is exposed by a clear interest of the IT department in the relationship between IT and the business processes. It is useful to distinguish between the capabilities of IT to improve *existing processes* and the *new processes* made possible by IT (see in particular Davenport & Short, 1990; Davenport, 1993). IT departments demonstrate their business systems thinking capabilities by pro-actively occupying themselves with these themes, and when necessary, acting upon the insights that they arrive at.

Finally, IT departments that endorse business systems thinking monitor *dependencies* that arise through business use of IT. For example, one department may be ignorant of useful data which is captured into an information system by another department. An IT department may be in the best position to signal and reveal such dependencies.

Building relationships

Relationship building is the capability concerned with “getting the business constructively engaged in IS/IT issues” (Feeny & Willcocks, 1998:357). This capability refers to the degree to which the IT department is capable of sustaining effective working relationships with the business employees. The possession of strong capabilities in this area affects the user’s understanding of IT potential, the effectiveness of the co-operation, and the establishment of business ownership for all IT projects.

A first factor which is affected by strong relationship building capabilities is the degree to which the users get an *understanding* of the potential of IT. Possession and use of communicative skills determines to a large degree the extent to which this understanding can be achieved.

The building relationships capability also influences the *co-operation* of the IT department with the rest of the business in specific projects or task forces, for example in the context of software development projects. There is empirical evidence that group processes within teams are significant predictors for team performance in requirement determination (Guinan et al., 1998). Promoting user involvement by introducing business people in the software development team is an effective strategy and a sign of strong relationship building capabilities.

A third and final factor associated with strong relationship building capabilities refers to the degree to which the business takes *ownership* of the projects that the IT department executes. Ownership is typically facilitated when 1. there are clear benefits of the IT projects for users,

and 2. when these benefits can be clearly communicated to them. For this reason, we expected degree of ownership to be affected by strong relationship building capabilities.

3. Research design

Application

To assess the construct reliability and validity of these capabilities, we looked for a specific application area where the relationship of the IT department with the rest of the business would be of non-negligible importance. We chose an e-commerce context for two reasons. First, the development of e-commerce systems requires the involvement of almost every functional part of the organisation (Turban et al., 2000:326). Co-operation with the marketing department is necessary to develop the commercial features of the front-end. Co-operation with the operations department is required to help fulfil incoming electronic orders. Co-operation with the accounting department is necessary to adhere to accounting requirements for e-commerce. Effective co-operation with these and other functional units is important to achieve a working e-commerce solution. Indeed, Earl (2000) observes that the complexity and status of the CIO's job have risen with the advent of e-commerce. Second, more pragmatically, we felt that the subject of e-commerce would raise more interest from the field and consequently would result in a higher response rate.

Method

Survey research followed by Confirmatory Factor Analysis (CFA) was adopted to address the research hypotheses developed in the previous sections. In such an approach, the three capabilities are modelled as latent constructs, and the behaviours that are affected by these capabilities are the manifest measures of the latent constructs (Bollen, 1989).

The 11 behaviours discussed above were translated into statements to which the respondent could wholly disagree or wholly agree on a 5-point Likert scale. We also asked for the organisational position of the respondent, the size of their IT department in terms of headcount and the sector their business was operating in. The questionnaire is published in the appendix of this paper.

For this research project we co-operated with a commercial company that develops and maintains an online survey engine. Using this tool the questionnaire was programmed and subsequently published on the Internet. The tool uses a cookie-based approach to prohibit the submission of multiple answers from the same client machine. The tool was developed in such a way that the respondents could view the aggregated results of the survey instantly after submitting their answers. This incentive was communicated in the introductory paragraphs of the questionnaire. We did not include other incentives for participation.

To obtain an adequate sample for our project we co-operated with the commercial survey company as well as the local (Dutch) branch of an international IT magazine. Both companies maintained online communities. The first online community consisted of 600 Dutch IS executives. The second community consisted of the online subscribers to the Dutch version of the IT magazine. This community consisted of 10 000 subscribers. We invited both communities to participate in the research through e-mail messages. In the e-mail a link was embedded that pointed to the Internet page where the online survey was located. Although technically possible, we did not personalise the E-mail (for example “Dear Mrs. Smith of Company X”) so as to keep in spirit with the anonymity of the research.

Results

The study remained online from April 10, 2000 to May 7, 2000. In total, 472 individuals from the communities responded to our survey. 60% of this group responded in the first two days. 95% of the respondents responded in the first ten days. We did not send reminder e-mails,

because our project partners believed this would have compromised their commercial interests.

We deleted all missing values respondents using list-wise deletion, resulting in a data set of 420 responses. Figure 2, 3 and 4 provide details of the respondents, and show the position of the respondent, the size of their IT departments, and the sector they work in respectively.

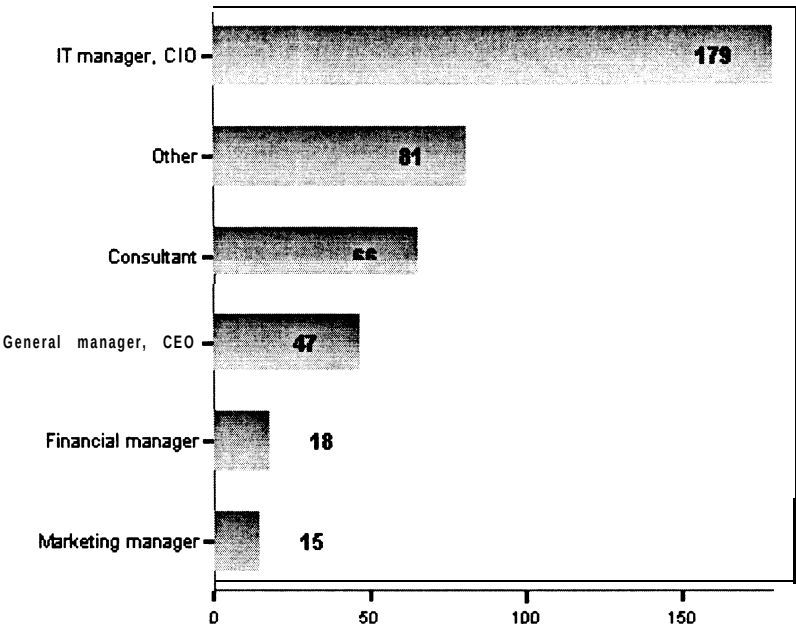


Figure 2 Position of respondents (n = 420, 14 missing)

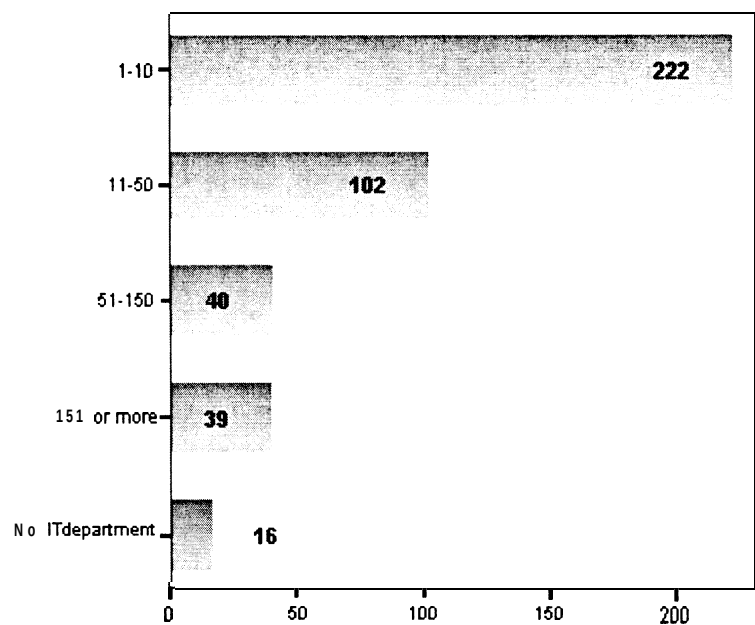


Figure 3 Number of employees in IT department (n=420, 1 missing)

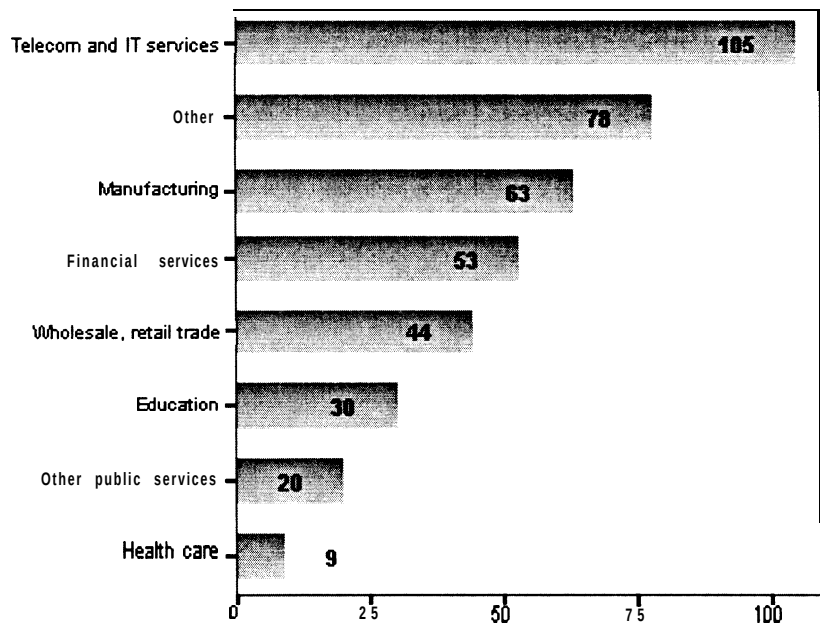


Figure 4 Sector of respondent's business (n=420, 18 missing)

4. Data Analysis

Reliability

Cronbach Alpha is commonly used as a measure to assess the reliability of the three constructs (Nunally, 1967). “IS/IT governance” has an alpha of 0.83, “Business thinking” has an alpha of 0.87, and “Relationship building” has an alpha of 0.83’. These are well above the threshold values of 0.60 for exploratory research and 0.80 for confirmatory research (Hair et al., 1998), implying that the constructs are reliably measured with the behaviours from Feeny & Willcocks (1998). Considering the fact that these items have little overlap and that alpha’s tend to be higher when the overlap between items is larger, these high reliability scores are quite impressive.

Validity

To examine the validity of the constructs, we examined the fit measures of a confirmatory factor analysis (CFA) with maximum likelihood estimation using Amos 4.01 (Arbuckle & Wothke, 1999). For replication purposes, the covariance matrix of the latent variables is added as an appendix to this paper.

The values on generally accepted measures of fit are in Table 2. Throughout the paper, we use 0.05 as the threshold level for statistical significance.

² There were negligible differences (<.01) between the sample with and the sample without missing data.

<i>Absolute fit measures</i>	Level of acceptable fit (cf. Hair et al., 1998)	Value
Chi-Square statistic	Non significant	199.83 (df. 41), p = 0.000
Goodness-of-fit index (GFI)	Close to 1	0.92
RMSEA	< 0.08	0.096 (+/- 0.013)
<i>Incremental fit measures</i>		
Tucker-Lewis index (or NNFI)	> 0.90	0.93
Normed fit index (NFI)	> 0.90	0.93
Adjusted goodness-of-fit index (AGFI)	> 0.80	0.87
<i>Parsimonious fit measures</i>		
Normed chi-square	Between 1 and 2/3 or 5 ³	4,87

Table 2 Measures of fit for original model

³ Acceptable upper bound for **normed** chi-square is controversial (Hair et al., 1998)

The chi-square test is highly significant at $p = 0.000$. However, fit measure based on chi-square tests are sample size dependent and favour complex models over simpler ones, and therefore, are considered inappropriate for sample sizes larger than 200 (Long, 1983; Hair et al., 1998). All other measures of fit are acceptable, except for the RMSEA, whose lower bound confidence interval is just above the threshold level of 0.08 (Browne & Cudeck, 1993). Therefore, we can conclude with a certain degree of validity that the model is a plausible representation of the data.

Figure 5 shows the standardised factor loadings and the squared multiple correlations. All factor loadings are highly significant ($p = 0.000$).

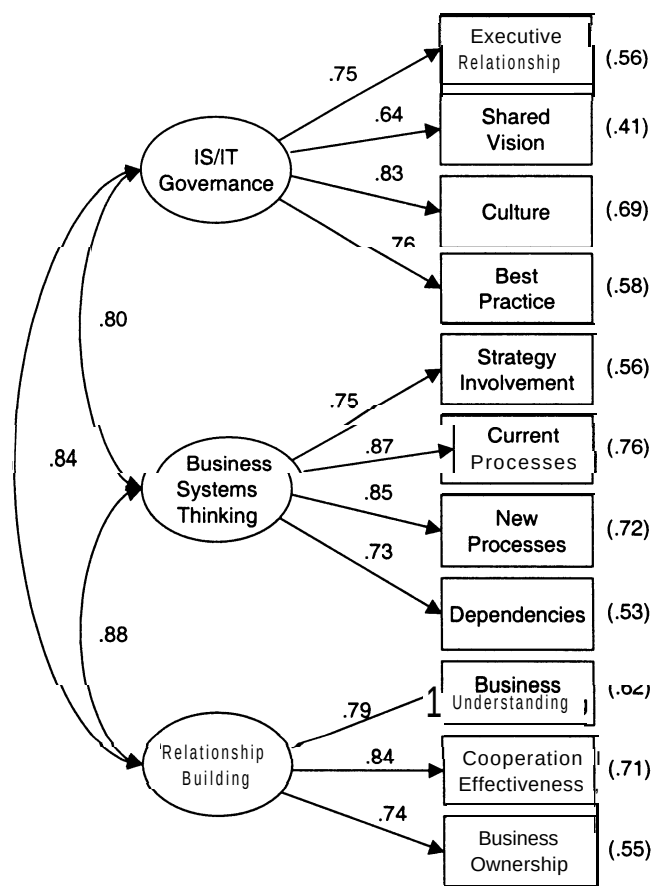


Figure 5 Standardised regression weights (squared multiple correlations) for original model

Competing one, two and four factor models

Because misspecification is possible, we specified a number of competing models to represent the data. In the first place, we tested the assumption that one or more of the capabilities are in reality manifestations of another capability. In that case, a one factor model or two factor model may be a better representation of the data. To test this assumption, we analysed four other models:

Model 2: One capability: (IS/IT governance + Business thinking + Relationship Building)

Model 3: IS/IT governance and combined (Business thinking + Relationship building)

Model 4: Combined (IS/IT governance + Business thinking) + Relationship Building

Model 5: Business thinking and combined (IS/IT governance + Relationship building)

There is also a possibility that more capabilities may influence the behaviours than the three we have identified. In particular, “IS/IT governance” may actually incorporate two capabilities: “Executive relationship building” (outward executive skills) and “IT management” (inward executive skills). To test this assumption, we specified a sixth model that included “executive relationship building”. This capability took the manifest variables “executive relationship” and “vision” from “IS/IT governance”.

Table 3 below provides the measures of fit for the competing six models.

Model	1 (original)	2	3	4	5	6
Chi Square (df, significance)	199.83 (41, p = 0.000)	360.16 (44, p = 0.000)	254.91 (43, p = 0.000)	328.88 (43, p = 0.000)	279.99 (43, p = 0.000)	141.63 (38, p = 0.000)
Goodness of Fit	0.92	0.86	0.90	0.87	0.89	0.942
Adjusted Goodness of Fit	0.87	0.79	0.84	0.80	0.82	0.90
RMSEA	0.096	0.131	0.108	0.126	0.115	0.081
Tucker-Lewis Index	0.93	0.86	0.90	0.87	0.89	0.95
Normed Fit Index	0.93	0.88	0.91	0.89	0.90	0.95
Parsimonious Goodness-of-Fit	0.57	0.57	0.58	0.57	0.58	0.54
Parsimonious Normed Fit Index	0.69	0.70	0.71	0.69	0.71	0.66

Table 3 Measures of fit for competing models

Clearly, a one or two factor model does not fit the data well. The models perform worse on the overall fit indexes and only slightly better at the parsimonious-adjusted indexes. Furthermore, all RMSEA point estimates and their 90% confidence intervals (not shown in table) exceed the 0.08 threshold.

The four factor model on the other hand performs better than our original model. In particular, the adjusted goodness of fit index (AGFI) rises to a more acceptable level of 0.90. Furthermore, the RMSEA point estimate decreases to the more acceptable level of 0.081. The parsimony-adjusted fit indices decrease, but only slightly. This appears to confirm that the

“IS/IT governance” capability is in fact an aggregation of two capabilities. In terms of reliability, Cronbach alpha coefficients are 0.74 for “executive relationship building” and 0.83 for “IT management”.

Figure 3 shows the standardised factor loadings and the square multiple correlations for the revised model. Again, all factor loadings were highly significant at $p = 0.000$.

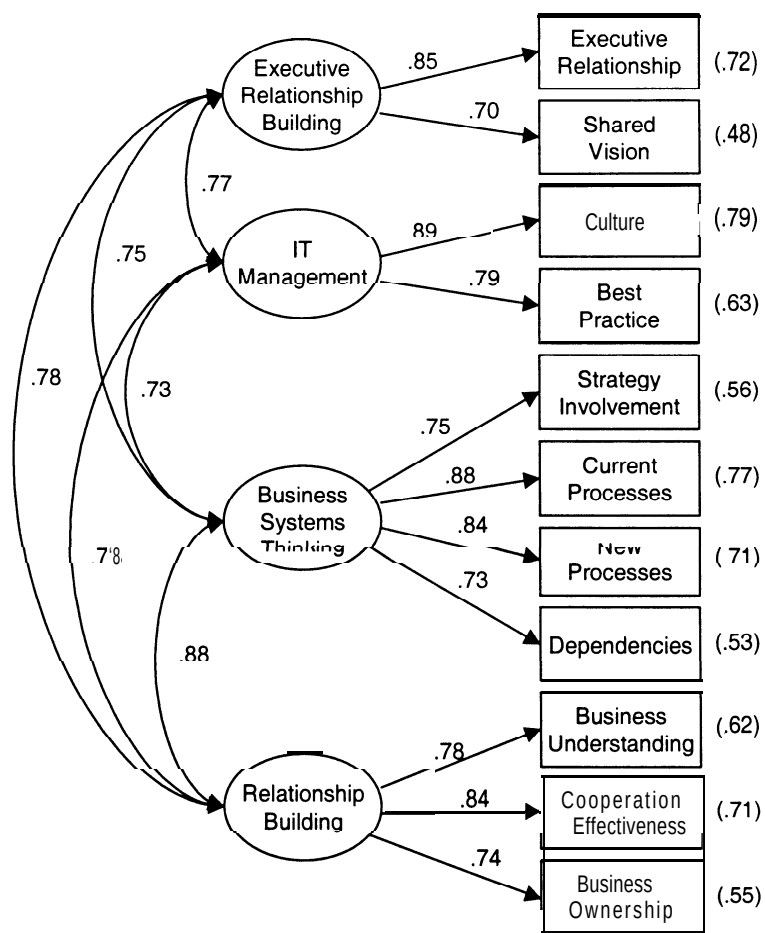


Figure 6 Standardised regression weights (squared multiple correlations) for revised model

5. Discussion of findings and research implications

In this research project we aimed to empirically assess the measurement of three capabilities of IT departments in relation to their business environment. We have done so by treating capabilities as latent, unobserved construct that manifest themselves through their influence

on directly observable variables. A confirmatory factor analysis on the data indicated acceptable fit and highly significant loadings. A post hoc respecification in which we included an extra capability (termed “executive relationship building”) revealed a slightly better fit to the data.

We believe this work contributes to the body of knowledge in IS research. We have extended work on IS core capabilities by developing and testing a measurement instrument for three capabilities. The validation of the instrument suggests that two capabilities “business systems thinking” and “relationship building” are reliable and valid measures. Other researchers are encouraged to use these measures in their own research.

The “IS/IT governance” capability appears to be an aggregation of two capabilities, “Executive relationship building” and “IT management”. These measures require further validation with an independent data set. We suggest the inclusion of additional measurement items related to outward executive relationship building and inward IT management, to reduce measurement error and avoid identification issues in subsequent research.

Feeny & Willcocks derive six other capabilities, three related to vendor management and three related to technical management. These capabilities await further operationalisation, and future research could be directed towards the development of measurement instruments of these capabilities. Our field would then have a portfolio of measurable capabilities for IT departments alike, on which to base further research.

Our work is subject to a number of limitations. In the first place, respecification of theoretical models to improve the fit to data should be appreciated in the context of theory building, not theory testing. We cannot test the revised model with our data set. We can only suggest the new model to further stronger theory in this area. Future research would have to develop and validate the measurement of the newly formed capabilities. In particular, the number of items for the new capabilities (two) is too small at this stage. Besides identification issues in structural equation models, measurement error may occur.

In the second place, we have specifically asked the respondents for the performance of their IT departments in the area of e-commerce. Strictly speaking, we cannot generalise our findings to include other types of information systems. Moreover, the study was carried out with Dutch respondents. There is a possibility that the results may not be transported well to other socio-cultural contexts such as those found in North-American or Australasian countries. Therefore, we recommend this study to be replicated in other culture settings and with other application foci. This would improve the **generalisability** of the theory.

In the third place, many respondents have an IT background and the majority have executive IT positions. Therefore, the data may be biased in that we have measured more the self-perceptions of the IT department rather than the perceptions of business departments. Interpretations should be read with these limitations in mind.

6. Conclusions

Our research has confirmed that core capabilities influence a variety of behaviours of IT departments. **Although** these behaviours have little overlap at first sight, they share common, “core” capabilities. In other words, perceived exposed behaviours of an IT department can be successfully “imploded” into a reduced set of variables. Therefore, capabilities present themselves as a suitable unit of analysis to synthesise work on the behaviour of IT departments. Prior studies on the behaviour and performance of IT departments are somewhat fragmented, and a unifying unit of analysis may provide an opportunity for stronger theory, based on cumulative empirical results.

Theory development based on capabilities could proceed in at least two directions. In the first place, the manifestations of certain capabilities could be theoretically associated with established dependent variables in IS research. Candidates include IS effectiveness variables, such as User Information Satisfaction (Bailey & Pierson, 1983; Ives et al., 1983), Strategic Impact (e.g. Chan et al., 1997) and SERVQUAL applied to IT (Pitt et al., 1995).

Particularly fruitful may be the relationship between capabilities and the governance structure of the IT department: fully centralised, fully decentralised or a hybrid form. The literature suggests that organisational context variables such as size and type of strategy predict the IS governance solution (e.g. Zmud, 1984). However, recent findings support the theory that perceived IT capabilities on the business unit level matter, indeed, may generate “deviant” governance structures (Brown, 1997). We would suggest that decentralised IT functions are associated with stronger “business thinking” capabilities, centralised IT functions with weaker capabilities (cf. Brown, 1997, pp. 86-87).

A second area of future research is the way in which capabilities are created and developed. Capabilities are argued to arise dynamically (Teece et al., 1999), following organisational learning processes. Qualitative research could investigate how the capabilities of IT departments are formed and strengthened. Since core capabilities that provide competitive advantage are 1. scarcely available in the market, and 2. not readily redeployable in other organisational settings, these characteristics of capabilities are particularly worth investigating.

Acknowledgements

The author would like to thank Mark Smeeke and Marco Gianotten at Giarte Media Group for their cooperation during this project, and Maarten Gelderman for useful comments on an earlier draft of this paper.

Appendix I: Survey

This survey below is a literal translation from the original in Dutch. The original survey instrument is available from the author.

Respondents were asked to express their opinion on eleven statements using a 5-Likert scale (wholly disagree . . . wholly agree).

1. *IS/IT Governance capability* (n = 420, Cronbach Alpha = 0.83)

1. In the context of e-commerce the IT department of our organisation maintains close relationships with business management
2. The vision of our IT-management on the role of e-commerce is similar to the vision of business management
3. The IT-department actively develops a culture in which e-commerce skills are stimulated
4. The IT-department is actively occupied with the implementation of best practices in the area of e-commerce

2. *Business systems thinking capability* (n = 420, Cronbach Alpha = 0,87)

1. With respect to e-commerce our IT department is closely involved in the formulation of the organisational strategy
2. Our IT department is actively engaged in the impact of e-commerce on our business processes
3. Our IT department is actively occupied with new business processes made possible by e-commerce
4. Our IT department guards the dependencies that arise because multiple departments are affected by e-commerce

3. *Relationship building capability* (n=420, Cronbach Alpha = 0.83)

1. Our IT department ensures that the business has a good understanding of the possibilities of e-commerce
2. With respect to e-commerce our IT department ensures that IT employees and the business co-operate effectively

3. Our IT department ensures ownership of the business with respect to her e-commerce activities

About the respondent:

1. Which position do you **fulfil**?

IT manager or CIO / Financial manager / Marketing manager / General manager or CEO / Consultant /

Something else: [textbox]

2. How many persons (internal and external) are located within your IT department?

No IT-department / 1-10 / 11-50 / 50-150 / 150 or more

3. In what sector do you operate?

Financial services / Telecom and IT services / Manufacturing / Retail, Wholesale trade / Education /

Health care / Other public services / Other, [text field]

Appendix II: Covariance matrix used for analysis

	<i>v1.1</i>	<i>v1.2</i>	<i>v1.3</i>	<i>v1.4</i>	<i>v2.1</i>	<i>v2.2</i>	<i>v2.3</i>	<i>v2.4</i>	<i>v3.1</i>	<i>v3.2</i>	<i>v3.3</i>
<i>v1.1</i>	1,583										
<i>v1.2</i>	0,831	1,255									
<i>v1.3</i>	0,905	0,694	1,566								
<i>v1.4</i>	0,747	0,595	1,038	1,379							
<i>v2.1</i>	0,918	0,724	0,885	0,784	1,681						
<i>v2.2</i>	0,909	0,583	0,828	0,740	1,087	1,595					
<i>v2.3</i>	0,794	0,579	0,860	0,742	0,980	1,243	1,602				
<i>v2.4</i>	0,673	0,499	0,668	0,621	0,790	0,912	0,919	1,412			
<i>v3.1</i>	0,719	0,526	0,893	0,652	0,824	0,841	0,847	0,800	1,361		
<i>v3.2</i>	0,832	0,581	0,799	0,666	0,821	0,846	0,828	0,831	0,879	1,261	
<i>v3.3</i>	0,762	0,514	0,715	0,618	0,766	0,923	0,851	0,838	0,772	0,863	1,476

References

- Arbuckle, J.L., & W. Wothke, *AMOS 4.0 User's Guide*, SmallWaters Corporation, 1999
- Bollen, K.A., *Structural equations with latent variables*, John Wiley & Sons, New York, 1989
- Brown, C., Examining the emergence of hybrid IS governance solutions: evidence from a single case site, *Information Systems Research*, 8, 1, March 1997, pp. 69-94
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equating models* (pp. 136-159). Newbury Park, CA: Sage.
- Camp, R.C., *Business process benchmarking: finding and implementing best practices*, ASQC Quality Press, Milwaukee, 1995
- Chan, Y.E., S.L. Huff, D.W. Barclay & D.G. Copeland, Business strategic orientation, information systems strategic orientation, and strategic alignment, *Information Systems Research*, 8, 2, June 1997, pp. 125-150
- Davenport, T., *Process innovation: r-e-engineering work through information technology*, Harvard Business School Press, Cambridge, MA, 1993
- Davenport, T. & J.E. Short, The new industrial engineering: information technology and business process redesign, *Sloan Management Review*, 31, 4, Summer 1990, pp. 121-127
- DeLone, W.H. & E.R. McLean, Information systems success: the quest for the dependent variable, *Information Systems Research*, 3, 1, March 1992, pp. 60-95
- Doll, W.J., T.S. Raghunathan, J.S. Lim & Y.P. Gupta, A confirmatory factor analysis of the user information satisfaction instrument, *Information Systems Research*, pp. 177-190
- Earl, M.J., Comment on: Are CIOs obsolete?, *Harvard Business Review*, March-April 2000, p. 60

- Feeny, D.F., B.R. Edwards & K.M. Simpson, Understanding the CEO/CIO relationship, *MIS Quarterly*, December 1992, pp. 435-448
- Feeny, D.F. & L.P. Willcocks, Redesigning the IS function around core capabilities, *Long Range Planning*, 31(3), 1998, pp. 354-367
- Feeny, D.F. & L.P. Willcocks, Rethinking capabilities and skills in the information systems function, in: W.L. Currie & R. Galliers (eds), *Rethinking management information systems*, Oxford University Press, 1999, pp. 444-473
- Guinan, P.J., J.G. Coopridge & S. Faraj, Enabling software development team performance during requirements definition: a behavioural vs. technical approach, *Information Systems Research*, 9, 2, June 1998, pp. 101-125
- Hair, J.F., R.E. Anderson, R.L. Tatham, W.C. Black, *Multivariate data analysis*, 5th edition, Prentice-Hall, Upper Saddle River, NJ, 1998
- Hamel, G. & C. Prahalad, *Competing for the future*, Harvard Business Press, Boston, 1994
- Ives, B. & M.H. Olson, User involvement and MIS success: a review of research, *Management Science*, Vol. 30, No. 5, May 1984, pp. 586-603
- Jarvenpaa, S.L. & B. Ives, Executive involvement and participation in the management of information technology, *MIS Quarterly*, June 1991, pp. 205-227
- Long, J.S., *Confirmatory factor analysis: a preface to LISREL*, Sage Publications, Beverly-Hills, CA, 1983
- Nunnally, J., *Psychometric theory*, McGraw-Hill, 1967
- Pitt, L.F., R.T. Watson & C.B. Kavan, Service quality: a measure of information systems effectiveness, *MIS Quarterly*, June 1995, pp. 173-236
- Prahalad, C. & G. Hamel, The core competence of the corporation, *Harvard Business Review*, 68:3, 1990, pp. 79-91

- Reich, B.H. & I. Benbasat, Measuring the linkage between business and information technology objectives, *MIS Quarterly*, March 1996, pp. 55-81
- Teece, D.J., G. Pisano & A. Shuen, Dynamic capabilities and strategic management, *Strategic Management Journal*, 18:7, 1997, pp. 509-533
- Turban, E., J. Lee, D. King & H.M. Chung, *Electronic commerce: a managerial perspective*, Prentice-Hall, NJ, 2000
- Van Dyke, T.P., L.A. Kappelman & V.R. Prybutok, Measuring information systems service quality: concerns on the use of the SERVQUAL questionnaire, *MIS Quarterly*, June 1997, pp. 195-208
- Ward, J. & J. Peppard, Reconciling the IT/business relationship: a troubled marriage in need of guidance, *Journal of Strategic Information Systems*, 5, 1996, pp. 37-65
- Williamson, O.E., Strategising, economising, and economic organisation, *Strategic Management Journal*, 12, 1991, pp. 75-94
- Williamson, O.E., Strategy research: governance and competence perspectives, *Strategic Management Journal*, 20, 1999, pp. 1087-1108