

An empirical investigation of competency factors affecting e-business success in European SMEs

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Abstract

In the last decade there was growing interest in strategic management literature about factors that influence a company's ability to use IT. There is general consensus that knowledge and competency are necessary in developing an IT capability, but there is very little understanding of what the necessary competencies are, and how they influence IS usage in different contexts. The small and medium-sized enterprise context is particularly interesting for two reasons: it constitutes a major part of the economy and it has been relatively unsuccessful in exploiting e-business.

We explored the relationship between e-business competency and its success in European SMEs. A literature review was used to determine factors representing e-business competency, and develop hypotheses, which were tested using data collected from 339 SMEs in Europe. Our results provide evidence on the importance of certain e-business competencies on e-business success, and have implications for both research and practice in the field of SMEs.

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1. Introduction

Small and medium sized enterprises (SMEs) are a major part of the industrial economies. Their survival and growth has therefore been a prominent issue, and considerable research has been initiated to determine e-business diffusion in SMEs. It has been assumed that success of e-business in the SME segment will increase a country's competitiveness, and that successful adoption and use of e-business technology are crucial for survival [12]. However, several studies have indicated that SMEs are sometimes unable to adopt and use e-business technology successfully. A number of studies have emphasized lack of e-business competency (see, e.g.

[28,34]) as the major cause of this. Such competency is viewed as important not only for understanding the implications of e-business but also for developing the capabilities needed to perform well [23]. However, we have found no published systematic empirical work that identifies critical competencies for the successful adoption and use of e-business in SMEs.

A number of researchers have emphasized the role of competencies for achieving and sustaining competitive advantage (see, e.g. [46]). The majority of these contributions have taken a resource-based perspective of the firm. Understanding and leveraging resources and competencies in the organization are essential for effective strategic management [17]. E-business usually implies a rethinking of business models, the network, and system infrastructure. Therefore, only businesses with access to significant e-business competency can expect to succeed with their efforts [10].

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Resources and core competency are important in the successful utilization of new technology. SMEs, in general, have less financial and human resources than large enterprises (e.g. [9]). Firm size can affect several crucial organizational processes [47], and research dealing only with large corporations may create a bias in conclusions about IT [25]. The way that small firms deal with adoption and implementation issues can differ substantially [13]. Limited financial and IS resources create greater risks in small firms [9]. Forrest [21] found that resource scarcity led small businesses to co-operate more closely with others (e.g. suppliers, customers and partners).

There are many different definitions of e-business and there also are related terms such as Internet business, Internet commerce, network economy, and electronic commerce. We adopted a relatively broad definition of e-business: the conduct of business with the assistance of telecommunication and telecommunications-based tools [8].

Definitions of SMEs also vary. The North American Industry Classification System uses measures such as: number of employees and total turnover, depending on the industry. The European Union (EU) has created a uniform definition: independent companies with fewer than 250 employees and having either a turnover of less than 40 million euro or total assets of less than 27 million euro [18]. Independent enterprises are ones that are not owned by another enterprise or several enterprises having 25% or more of the capital or voting rights. This definition has been adopted, with modifications, by most member states and some non-EU countries. Since our research was conducted as part of an EU program, we adopted this definition.

We addressed the following research question: *Which competencies are critical for SMEs to realize the potential value of e-business?* To answer this question we first synthesized e-business competency from a literature review and several rounds of interviews with SME managers. These e-business competencies

were subsequently operationalized into a survey instrument. We then surveyed 339 SME managers from three European countries. Finally, we performed a statistical analysis of the data to identify important areas of e-business competency significantly related to e-business success.

2. The research model

Our examination of the literature showed that little has been published on the possible relationship between competency and successful use of e-business in SMEs. We therefore broadened our scope to IT and IS/IT competency. We included studies that focused on the business manager, since several studies pointed to the importance of him or her in achieving successful implementation of strategies and technologies (e.g. [35]). Furthermore, we based our approach on the assumption that we could increase the understanding of e-business competency in SMEs by applying theories and findings from studies of larger businesses. The sources were mainly from literature on IT competency and IT in general, and relatively few sources focused specifically on e-business technology. Moreover, of the studies of IT competency, relatively few focused on competencies needed in an inter-organizational settings between e-business partners.

We identified several streams of research. Key contributions came from Bharadwaj et al. [3], Bassellier et al. [2], Heijden [26], Feeny and Willcocks [19], Sambamurthy and Zmud [43], Lee et al. [33] and Peppard et al. [40]. These studies provided the basis for establishing our model of IS competency. Table 1 presents an overview of definitions and scope of IS competency.

Most of the literature dealt with the resource-based view. We adopted this and therefore see competencies as the source of e-business capabilities. Fig. 1 depicts the research model. Competency dimensions, such as strategy and vision competency, IT-business process

Table 1
Definitions and scope of competency in key IS competency studies

Definitions and scope of competency	Reference
IT/IS core capabilities: organization-specific routines, processes, skills and resources	[27,19]
Capabilities, skills and tacit know-how that an organization develops over time that enable it to acquire, deploy, and leverage its IT investments	[43]
Critical IT capabilities as organizational capability in the resource based view	[3]
IT related explicit and tacit knowledge	[2]
Critical knowledge and skills requirements for IS professionals	[33]
All aspects of the management of information, including assessing the role of information in an industry, the exploration of the impact of technology, the identification of competitive opportunities	[40]

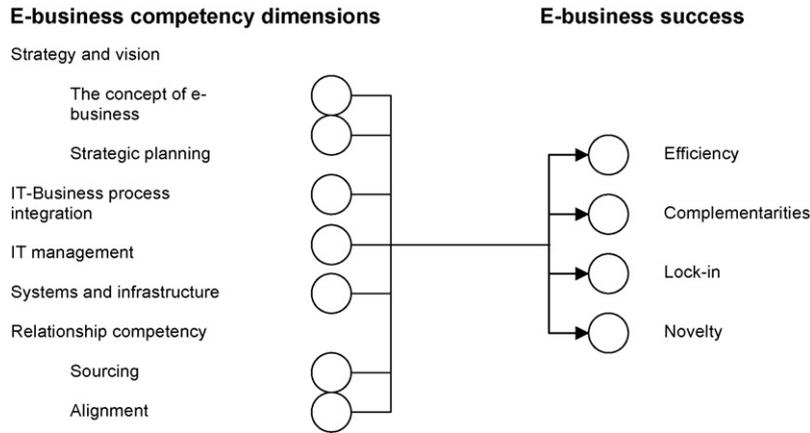


Fig. 1. The research model.

integration and IT management, are proposed to influence the success of e-business investments in SMEs.

3. E-business success

There are several research streams that explore e-business success. One views e-business technologies as special IT investments and claims that the success of e-business can be derived from studies of them. Existing IS success models, based on studies of IT-investments, are adapted to fit Internet technologies. For instance, Molla and Licker [38] adapted the original DeLone and McLean [14] model of IS success to measure e-commerce success, while DeLone and McLean [15] updated their model by including e-commerce success measures.

Another stream of work used the metrics to describe success in e-commerce in net-enabled or net-enhanced organizations [45]. In these, e-commerce metrics measured operationalizations of different dimensions of e-commerce success and antecedents to its success. In two special issues of Information Systems Research (June and September 2002) several researchers used a wide spectrum of different research methods to elicit possible measures at different levels of analysis.

A third stream of research on e-business success and related measures emanated from the work of Amit and Zott [1], who reviewed theories within the entrepreneurship and strategic management literature to explore theoretical foundations of value creation in e-business. Other initiatives also exist; for instance, Keeney [31] and Torkzadeh and Dhillon [49] took a grounded, bottom-up approach and developed an understanding of e-commerce success based on interviews with Internet

shoppers. Some studies have also shown a positive correlation between effects from e-business and reductions in transaction costs [24], increased market efficiency [44], and perceptions of information support and competitive advantage [41].

These research streams all shared the idea that e-business technologies represented something new and resulted in new forms of business that were not previously practical or possible. Still, most studies applied or adapted ideas about IT-investments without changing them to account for the inter-organizational nature of e-business. One clear exception is that of Amit and Zott who argued that no single theory in the literature fully explained the value creation potential of e-business. They argued that of all IT-investments, Internet technologies had the highest potential for value creation through linking companies, suppliers, and customers in new and innovative ways. They argued that value creation can be understood more fully by using the business model (defined as the content, structure, and governance of transactions designed to create value through the exploitation of business opportunities) as the level of analysis. Four dimensions of value were identified: efficiency, complementarities, lock-in, and novelty. We adopted these and made them our dependent variables, as shown in Fig. 1. *Efficiency* or transaction efficiency is the cost per transaction, where costs are broadly defined. *Complementarities* refer to the value potential of product and service combinations made possible by cooperating actors. *Lock-in* refers to the value resulting from the cost experienced when switching to another vendor (thus motivating customers to remain with the current business partners). *Novelty* describes how e-businesses can create value through innovations in the way that business is conducted (for example by web-based auctions and reverse markets).

4. E-business competency dimensions

There have been many approaches to describing competency and capability, leading to confusion in the use of these terms. There is not a general agreement on the distinction between them (e.g. see the discussion in [16]). We use the term competency as defined by Peppard and Ward, and use the term capability as a meta-level construct referring to the strategic application of competencies.

Most past studies have used multi-stage research frameworks with qualitative methods, like Delphi panels, focus groups, and interviews. The strongest empirical support was found by Bharadwaj et al. who used structural equation modeling techniques to verify the IT capability construct empirically. However, their work did not emphasize the relationship competency in the e-business setting, and the dimensions had an intra-organizational focus. The only empirical validation of competency in the e-business context was by Heijden [27], who validated a measurement instrument for three of the dimensions of Feeny and Willcocks in an e-business context.

None of the studies on IT competency were on SMEs, generally implying a ‘large company’ bias. We conjectured that they probably did not appropriately describe IT competency in SMEs. Likewise, only Heijden had extended IT competency constructs to the e-business context. We therefore decided to contrast the content of the studies and look for extensions relevant for an SME and e-business context.

We decided to contrast the dimensions of competency in the literature to identify a common framework. The items of each dimension were clustered into appropriate dimensions for our study. We considered the clusters and the items in terms of their significance for SMEs and e-business. Discussion with colleagues and open-ended interviews with eight SME leaders were the methodology used in this process. Table 2 shows how our competency dimensions related to dimensions in the literature. Black cells represent a significant and major overlap between two terms. Gray cells indicate that the identified overlap between two terms was minor.

Most of the IS competency literature acknowledged the role of business strategy competency. The strategy and vision dimension explicitly recognized the importance of understanding the strategic potential of IT and e-business and the ability to perform strategic planning. Bharadwaj et al. and Feeny and Willcocks termed this dimension “Business IT strategic thinking”. Elements of this were also implicitly contained in two of the dimensions of both Peppard et al. and Bassellier et al.,

and one of the dimensions of Sambamurthy and Zmud and Feeny and Willcocks. Several empirical studies had documented the important role of strategic vision for SME adoption of e-business [23].

In our review, this dimension consisted of two sub-dimensions. First, the company’s ability to envision the strategic potential of new e-business technology in its marketplace. It involved understanding the concept of e-business, and it reflected the maturity of the enterprises’ understanding of e-business and its new potential and threats in the business domain. Second, it also included the ability to understand and use strategic planning methods needed to develop an e-business strategy; this describes how e-business will be put into action. We therefore hypothesized:

H1_{a-d}. Competency in e-business strategy is positively associated with e-business success in terms of (a) efficiency, (b) complementarities, (c) lock-in and (d) novelty.

H2_{a-d}. Competency in e-business strategic planning is positively associated with e-business success in terms of (a) efficiency, (b) complementarities, (c) lock-in and (d) novelty.

The IS literature offered broad support for the notion that a company’s ability to realize potential benefits of new technology was affected by its ability to organize business processes that leveraged its potential (e.g. [30]). More specifically, empirical studies in IS economics have shown that, among Fortune 500 companies, productivity gains from utilizing new technologies are higher in companies that organize themselves in ways that leverage the potential of the new technology [5]. In a European study of 441 Spanish SMEs, Dans [11] found a similar correlation between IT-investments and productivity for SMEs that was partly attributed to organizational redesign.

The most fundamental challenge to SMEs may lie in changing the mindset of the organization. Several authors (e.g. [32]) have argued that adoption of e-business fundamentally altered internal procedures in SMEs. We define competencies in IT-business process integration as their ability to integrate IT and business knowledge to devise new business processes. Thus, we hypothesized:

H3_{a-d}. Competency in IT-business process integration is positively associated with e-business success in terms of (a) efficiency, (b) complementarities, (c) lock-in and (d) novelty.

IT project management, and planning for control and standards were explicitly covered in all literature

Table 2
The relation between the conceptual model and the major sources

	Strategy and vision	IT-business process integration	IT management	Systems and infrastructure	Sourcing and alignment
Bharadwaj et al. [3]					
IT business partnerships					
External IT linkages					
Business IT strategic thinking					
IT business process integration					
IT management					
IT Infrastructure					
Basselier et al. [2]					
Explicit IT Knowledge					
Technology					
Applications					
Systems Development					
Management of IT					
Access to IT knowledge					
Tacit IT Knowledge					
Experience					
Cognition					
Van der Heijden[27]; Feeny and Willcocks [19]					
Business IT Strategic Thinking(BIS)					
IT management(ITM)					
Business Systems Thinking(BST)					
Relationship Building(RB)					
Architecture Planning(AP)					
Making Technology Work(MTW)					
Informed Buying(IB)					
Contract Facilitation(CF)					
Contract Monitoring(CM)					
Vendor Development(VD)					
Sambamurthy and Zmud [43]					
Business Development					
External Networks					
Line Technology Leadership					
Process Adaptiveness					
IT Planning					
IT Infrastructure					
Data Center Utility					
Lee and Trauth [33]					
Technical Specialties Knowledge					
Technology Management Knowledge					
Business Functional Knowledge					
Interpersonal and Management Skills					
Peppard et al. [40]					
Formulate Strategy					
Design Processes and Information					
Exploit and Monitor					
Define Supply Resources					
Develop Supply Resources					
Develop, Implement and Operate Sol.					

sources on IT competency. The work of Bharadwaj et al. clearly demonstrated the empirical significance of IT management. SMEs generally have an ad hoc approach to IT management, and therefore seldom have a defined IT budget or an explicit IT plan or

strategy, and investments in technology were more often driven by the owner than by any formal cost-benefit or strategic analysis [11]. To test the importance of the IT management dimension, we hypothesized:

H4_{a-d}. Competency in IT management is positively associated with e-business success in terms of (a) efficiency, (b) complementarities, (c) lock-in and (d) novelty.

We defined competency in systems and infrastructure as knowledge of the data, network, and processing architectures that supported the enterprise applications and services. Systems and infrastructure influence the gamut of business opportunities available to firms applying IT in their business strategies. Competency in systems and infrastructure was covered in several sources, including the empirical study of Bharadwaj et al. Successful use of e-business technologies involved both finding technology with a strategic potential and having a technological and managerial infrastructure that could implement and support it. As a result, companies need competency in available e-business solutions as well as to recognize the importance of having or creating internal structures that can utilize the new solutions. We therefore hypothesized:

H5_{a-d}. Competency in systems and infrastructure is positively associated with e-business success in terms of (a) efficiency, (b) complementarities, (c) lock-in and (d) novelty.

We included relationship competencies as our final dimension. A core premise of the network economy is that business networks that effectively source and coordinate resources and capabilities would be highly competitive (e.g. [48]). Therefore, effective communication and interaction, both internal and with business partners, would be important for e-business success. Our literature review identified two dimensions of relationship competency: sourcing and alignment. These were present in the work of Bharadwaj et al., where they were called “IT-business partnerships” and “External linkages”, and implicitly contained in other sources.

We defined *competency in sourcing* as the ability to secure access to relevant competencies either inside or outside the company. MacGregor [36] argued that electronic business forced organizations to reassess their boundaries and focus their attention on inter-organizational issues. A number of empirical studies have documented this (see, e.g. [37]).

We defined *competency in alignment* as the ability to combine and use available competencies. For example, sourcing could take place through activities that either create access to competencies through recruitment, training, or contractual arrangements, or through outsourcing of activities. When the need for and access

to competencies are defined by sourcing arrangements, competencies in alignment will influence how well accessible competencies are combined and activated. Normally, alignment is regarded as an intra-organizational activity (an IT-business partnership); but when companies cooperate and form alliances, alignment takes on an inter-organizational dimension. As a result, competency in alignment will have both an internal and an external perspective. In our model, sourcing and alignment represent meta- or secondary-competencies that involve acquiring, combining and using the primary types of e-business competency to which the company has access. The primary types of e-business competency are *necessary* for e-business success but not *sufficient* by themselves. The company must also be able to acquire, combine and use these competencies in support of their visions and strategies.

Few of the studies explicitly described competency in sourcing. Most studies pointed to the importance of flexible systems and IT infrastructure with key business partners without recognizing the importance of competencies in managing these relationships. In the network economy, businesses that are able to form effective partnerships will be more agile [42] and competitive. This is particularly important for SMEs, which have scarce resources and limited ability to exploit business opportunities. Sourcing and alignment competencies will enable small businesses to take advantage of e-business opportunities and take part in business network partnerships. We therefore hypothesized:

H6_{a-d}. Competency in sourcing is positively associated with e-business success in terms of (a) efficiency, (b) complementarities, (c) lock-in and (d) novelty.

H7_{a-d}. Competency in alignment is positively associated with e-business success in terms of (a) efficiency, (b) complementarities, (c) lock-in and (d) novelty.

5. Survey methodology

5.1. Operationalization of constructs

The competency variables were based on the relevant literature. We contrasted the dimensions of competency reported in previous studies and based our measures on common dimensions identified in our review. In such models the indicators are believed to form the latent construct, and correlations between the indicators are not necessarily present. Table 2 shows how our measures emerged from the literature and how the competency constructs related to the specific competency items described in these sources.

The measure of e-business success, was based on that of Amit and Zott with four reflective measurement models, where the four dimensions of success were believed to cause changes. All indicators were measured on a seven point Likert-type scale using integers from 1 to 7 representing responses of ‘totally disagree’ to ‘totally agree’ with a ‘not applicable’ response option for most indicators. Open-ended interviews with eight SME managers and two related consultants provided an additional reality check of our model and a test of the relevance, wording, and response format of the indicators. The outcome of this process led to the questionnaire as shown in [Appendix B](#).

5.2. Data collection

We conducted a cross-sectional study of SMEs in three industries: tourism, transportation, and food and beverages in Spain, Finland, and Norway. Since our research was part of an EU-program, there were practical reasons in the choice of industries and countries: we followed the EU definition of SMEs, excluding companies with less than four employees. A random sample of SME executives was created from company databases in the three countries. These executives were phoned and asked if they would confirm that their company used web pages, e-mail, or e-commerce systems for business purposes; if so, they were then invited to take part in the survey. In each country, the executives were surveyed by an assistant speaking the local language; he or she entered the replies into a common web-based questionnaire. For practical purposes we set a cut-off of 40 replies from each industry in each country, resulting in 360 SMEs with 21 discarded for cause, leaving 339 SMEs for further analysis. All respondents used at least one of the eight e-business systems surveyed in addition to e-mail. Each company had at least a web presence where individual customers or companies could find information about products and services. [Appendix C](#) shows the distribution of the different e-business systems in the sample along with descriptive statistics for e-business competency and success variables. The descriptive statistics show sufficient variability and distributional properties of our data.

5.3. Data analysis

Partial least squares analysis (PLS) was chosen as the most appropriate technique in analyzing our model. PLS is a confirmatory, second-generation multivariate analysis technique that is well suited for complex predictive

models. PLS has several advantages that makes it well suited for our study: the ability to handle reflective and formative indicators and robustness with respect to departure from multivariate normality as well as the ability to handle the multicollinearity [22] found in some competency variables of our model. Moreover, as with multiple regression, PLS focuses on the model’s ability to predict rather than just explaining the variability of the dependent variable, making it most useful in situations where the theory is still being developed [6]. In PLS the predictive ability of constructs is optimized and the performance of the individual scale items is reported. In reporting the results from these analyses we start with the measurement models.

Formative items represent measures that affect the construct under study [4]. Changes in the construct are therefore not expected to cause any changes in the indicators (see [29]). As a result, items within a formative scale are not expected to correlate. Tests of convergent and discriminant validity based on the inter-correlations between items are therefore not relevant for evaluating the psychometric properties of formative items. Instead, item weights are used to indicate how relevant each item is in measuring its latent construct. The results are reported in [Table 3](#). One item in the scale for the concept of Alignment was deleted because of an unexpected negative sign. A new analysis of the reduced model showed no further problems.

The reflective items are believed to be caused by the latent constructs they are intended to measure. Inter-correlations between the items are therefore expected. The psychometric properties of the reflective items were examined by analyzing their internal consistency in terms of their convergent and discriminant validity. Convergent validity was estimated based on the item loadings, and a loading of above 0.70 is recommended as this indicated that at least half of the variance in each item could be accounted for by the latent construct [39]. For all dimensions of e-business success the items had sufficient convergent validity in terms of their squared loadings (see [Table 4](#)). In addition, average variance extracted (AVE) was also calculated. It represents the ability of the indicators in a block of explaining the latent construct. All constructs with reflective items had AVE above the recommended level of 0.5 [20], as shown in [Table 4](#).

AVE can also reflect discriminant validity if the square root of the AVE of one construct is greater than the variance shared between this construct and other constructs in the model. All of the constructs with reflective items had square root of the AVE that was higher than the correlation with other latent constructs,

Table 3
Descriptive statistics—competency factors, formative indicators

	Mean	Standard deviation	Weight	<i>t</i> -Stat.
Strategy and vision (formative)				
Knowledge of e-business technologies' value to business	4.11	1.73	0.45	3.70
Knowledge of how competitors' use IT	4.25	1.71	0.28	2.16
In general, e-business is well understood	4.33	1.71	0.42	4.16
Knowledge of strategic planning	4.27	1.63	0.43	2.31
A developed set of strategic planning techniques	3.65	1.64	0.64	4.07
In general, strategic planning is well understood	4.24	1.60	0.03	0.16
IT and business process integration (formative)				
Is actively working with the impact of e-business	3.63	1.83	0.83	12.29
Good at reorganizing work to utilize new IT	4.10	1.59	0.26	2.96
IT management (formative)				
IT resources are effectively managed	4.15	1.63	0.36	2.36
Good at achieving anticipated benefits from IT	4.08	1.53	0.73	5.43
Systems and infrastructure (formative)				
Infrastructure is very flexible	4.31	1.61	0.53	4.40
IT makes it possible to effectively cooperate electronically	4.55	1.60	0.61	5.15
Sourcing (formative)				
Knowledge on outsourcing to business partners	4.38	1.74	0.90	9.85
Knowledge on how to use competencies in partners	4.43	1.42	0.19	1.41
Alignment (formative)				
Managers agree on how IT contributes to business	4.72	1.55	0.19	0.96
Effective exchange of ideas between business and IT	4.34	1.72	0.67	3.58
Company good at using its competencies	4.74	1.45	–	–
Good at using competencies in partners	4.32	1.42	0.38	2.52

indicating sufficient discriminant validity. The correlations between latent variables measured with reflective items are shown in Table 5.

The structural model was tested with the estimated path coefficients and their standard errors, along with

the R^2 value, which reflects the predictive ability of the model and the dependent variables' ability to explain the dependent variable.

In conducting the structural analyses and hypotheses tests we used PLS-graph version 3.0. The significance

Table 4
Descriptive statistics—e-business success, reflective indicators

	Mean	Standard deviation	Loading	<i>t</i> -Stat.
E-business efficiency (reflective)				
Composite reliability 0.86; AVE 0.67				
Reduced costs by electronic order taking	3.7	1.9	0.84	45
Able to deliver faster	3.8	1.9	0.85	68
Reduced costs in communication with suppliers/customers	4.2	1.8	0.77	21
E-business complementarities (reflective)				
Composite reliability 0.90; AVE 0.75				
Products/services complement those from suppliers	3.8	1.8	0.85	40
Suppliers/customers can complement our products/services	4.0	1.7	0.90	83
Our supply chain is strongly integrated with our partners	3.6	1.8	0.86	51
E-business lock-in (reflective)				
Composite reliability 0.85; AVE 0.74				
Our efforts have made it more expensive to replace us	3.0	1.7	0.83	31
Our products/services are more tailored to customers' needs	3.8	1.8	0.89	54
E-business novelty (reflective)				
Composite reliability 0.87; AVE 0.76				
Our company is a pioneer in utilizing e-business	2.9	1.9	0.85	35
We are cooperating with customers/suppliers in new ways	3.8	1.8	0.89	62

Table 5
Correlations of latent variables

	SV	SP	PI	IM	SI	A	S	EE	EC	EL	EN
Strategic vision (SV)	1.00										
Strategic planning (SP)	0.57	1.00									
Business IT process integration (PI)	0.66	0.53	1.00								
IT management (IM)	0.58	0.57	0.58	1.00							
Systems and infrastructure (SI)	0.49	0.39	0.52	0.64	1.00						
Alignment (A)	0.52	0.52	0.55	0.62	0.57	1.00					
Sourcing (S)	0.61	0.49	0.57	0.51	0.47	0.51	1.00				
E-business efficiency (EE)	0.50	0.36	0.56	0.44	0.43	0.42	0.40	1.00			
E-business complementarities (EC)	0.55	0.41	0.61	0.48	0.49	0.40	0.45	0.66	1.00		
E-business lock-in (EL)	0.44	0.32	0.48	0.35	0.40	0.27	0.37	0.57	0.66	1.00	
E-business novelty (EN)	0.47	0.39	0.55	0.43	0.46	0.36	0.43	0.57	0.67	0.71	1.00

of each path in the structural model was estimated using the bootstrap re-sampling method with 200 re-samples. Our sample size of 339 exceeded the minimum recommended sample size of the greater of either 10 times the number of indicators in the scale with the largest number of formative indicators, or 10 times the largest number of structural paths directed at a particular dependent construct in the structural model [7].

6. Results of hypothesis testing

Together, the significant hypotheses explained a substantial amount of the variance in the dependent variables: e-business efficiency ($R^2 = 0.36$), e-business complementarities ($R^2 = 0.44$), e-business lock-in ($R^2 = 0.28$), and e-business novelty ($R^2 = 0.36$). See Table 6 and Fig. 2 for an overview of the hypotheses

Table 6
Results of hypotheses tests

Hypothesis	Competency dimension	Hypothesized relationship	E-business success dimension	Path loading	P-value	Support
H1 _a	Concept of e-business	Positive	Efficiency	0.17	0.03	×
H1 _b			Complementarities	0.20	0.001	×
H1 _c			Lock-in	0.18	0.01	×
H1 _d			Novelty	0.08	0.15	
H2 _a	Strategic planning	Positive	Efficiency	−0.02	0.39	
H2 _b			Complementarities	0.02	0.36	
H2 _c			Lock-in	0.04	0.30	
H2 _d			Novelty	0.08	0.13	
H3 _a	IT-business process	Positive	Efficiency	0.33	0.000	×
H3 _b			Complementarities	0.35	0.000	×
H3 _c			Lock-in	0.30	0.000	×
H3 _d			Novelty	0.33	0.000	×
H4 _a	IT-management	Positive	Efficiency	0.05	0.28	
H4 _b			Complementarities	0.04	0.31	
H4 _c			Lock-in	−0.01	0.45	
H4 _d			Novelty	0.00	0.49	
H5 _a	Systems and infrastructure	Positive	Efficiency	0.11	0.07	
H5 _b			Complementarities	0.19	0.005	×
H5 _c			Lock-in	0.16	0.02	×
H5 _d			Novelty	0.22	0.002	×
H6 _a	Sourcing	Positive	Efficiency	0.02	0.42	
H6 _b			Complementarities	0.04	0.27	
H6 _c			Lock-in	0.06	0.18	
H6 _d			Novelty	0.09	0.12	
H7 _a	Alignment	Positive	Efficiency	0.05	0.24	
H7 _b			Complementarities	−0.06	0.19	
H7 _c			Lock-in	−0.12	0.05	
H7 _d			Novelty	−0.08	0.14	

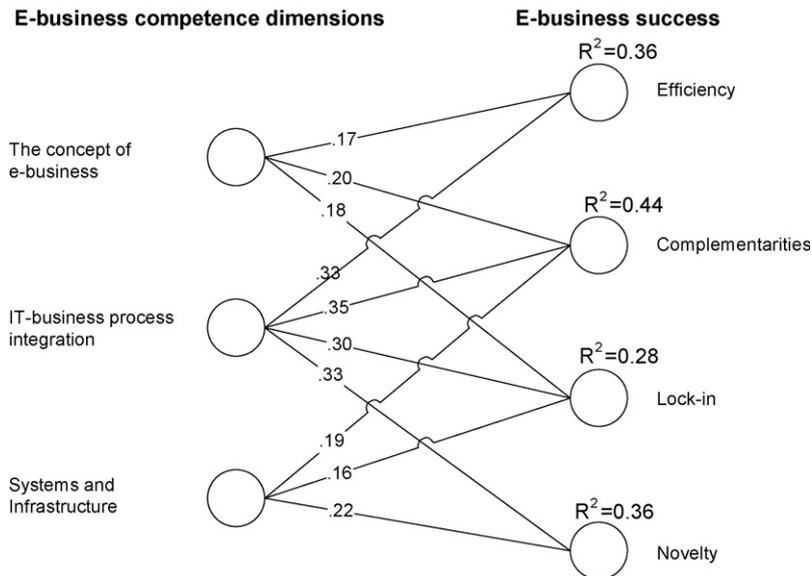


Fig. 2. Structural model showing significant paths and path coefficients between competency constructs and success constructs.

testing and explained variance of the research model. Hypothesis $H1_{a-d}$ stated that e-business success would be positively predicted by competencies in e-business strategy; this was supported for e-business efficiency, complementarities and lock-in but not for e-business novelty. Hypothesis $H2_{a-d}$ posited a positive relationship between competency in strategic planning and the four dimensions of e-business success. None of these hypotheses was empirically supported. Hypothesis $H3_{a-d}$ stated that e-business success would be positively predicted by competency in IT-business process integration. This was supported for all dimensions of e-business success. Hypothesis $H4_{a-d}$ stated that competency in IT-management would be a positive predictor for e-business success. None of these hypotheses received empirical support. Hypothesis $H5_{a-d}$ posited a positive relationship between competency in systems and infrastructure and e-business success which was partially supported for e-business complementarities, lock-in, and novelty. Hypothesis $H6_{a-d}$ stated that competency in sourcing would be a positive predictor of e-business success in terms of efficiency, complementarities, lock-in, and novelty. None received empirical support. Finally, hypothesis $H7_{a-d}$ posited a positive relationship between competency in alignment and e-business success, which was not supported for any of the dimensions of e-business success. An unexpected negative significant result occurred for e-business lock-in, where competency in alignment was found to be negatively related to lock-in.

7. Discussion and implications

We examined the competencies that affect e-business success in European SMEs. We used a research model that was developed from prior literature on IT competency, interview data, and survey data from 339 SMEs in Europe. In order to integrate the large number of formative indicators from previous studies, data analyses were conducted with PLS-graph 3.0.

7.1. E-business competencies in SMEs

The empirical analysis identified three competencies, *e-business strategy*, *IT-business process integration*, and *systems- and infrastructure-associated* with e-business success. Building an IS capability depends on various types of competency. The empirical analysis showed that these three competencies are important for e-business capability and success in SMEs. Competencies in strategic planning and IT-management, however, were not found to be significant predictors.

Organizations must understand how they can derive and leverage value through developing their IT capability. Our study has moved forward by empirically identifying types of competency that result in e-business capabilities that increase the likelihood of e-business success for SMEs.

Our results show that a set of general IS competencies can predict the success of e-business, made possible by a variety of technologies. These findings have practical

implications for SME managers and policy makers in programs directed at the SME segment. SME managers face resource constraints and need to know which types of competency have the greatest potential for increasing the IS capability. Highly relevant actions should be to initiate and/or participate in competency networks and to mobilize industry associations to run programs to increase e-business competency in member organizations. Public policy makers are important for stimulating programs for SMEs.

7.2. *E-business success*

E-business success in terms of efficiency, complementarities, lock-in and novelty were significantly and substantially explained by competencies in e-business strategy, IT and business process integration, and systems and infrastructure. On average these competencies explained a substantial portion of the variance in success factors (36%). The results showed that the type and extent of competency in SMEs were important determinants for success.

A possible weakness in this study relates to the measurement of e-business success, which was measured at the individual SME level. It is likely that success in e-business networks is heterogeneously distributed between partners, and that success for the e-business relationship as a whole is different from success for each participant. As a result, related competencies could also differ. Conclusions regarding

competency that increases alliance success should therefore be based on analyses of more than one business partner.

7.3. *Relationship competency*

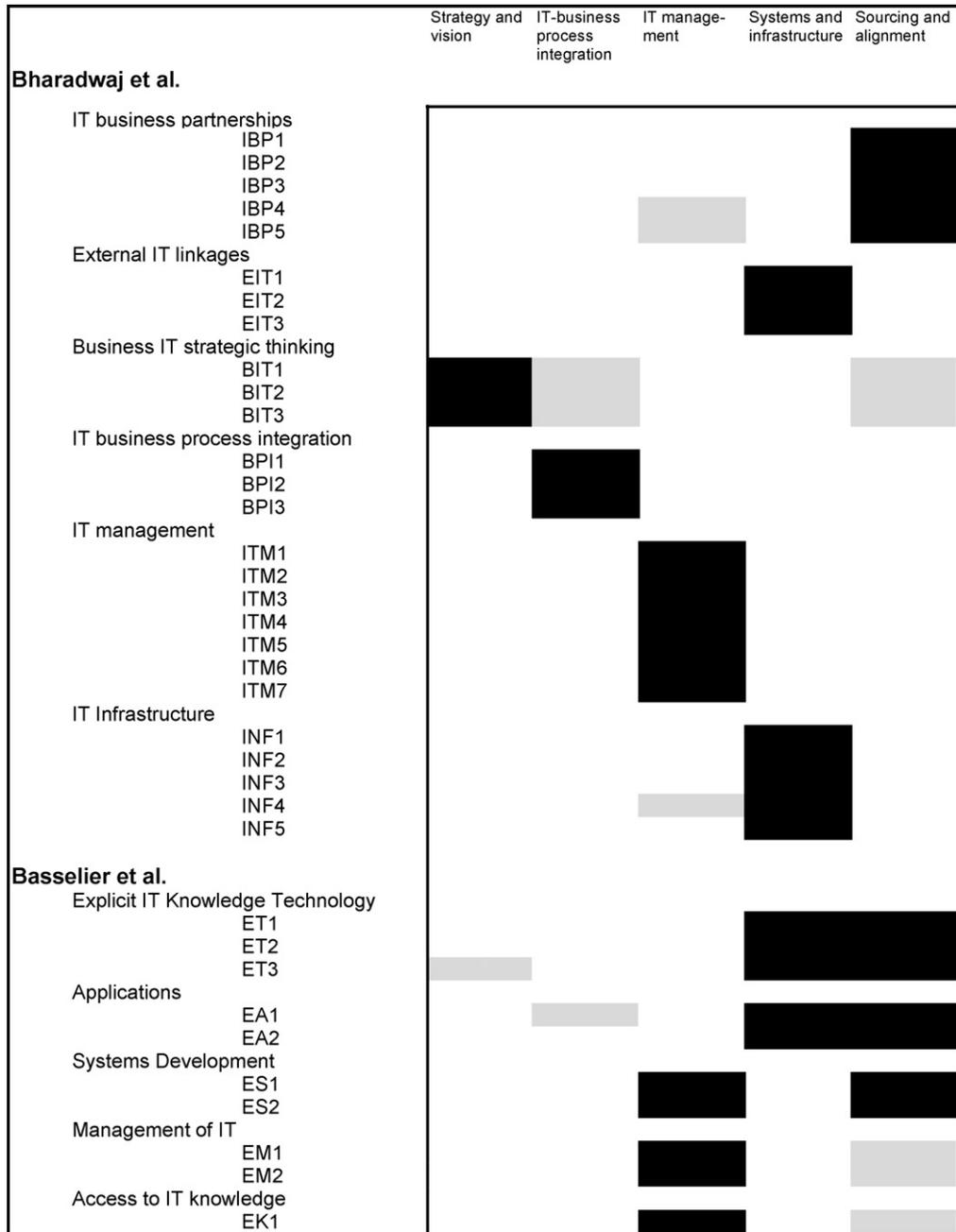
Interestingly, competencies in sourcing and alignment were not found to have a positive influence on e-business success. The data indicate that a possible negative relationship existed between competency in alignment and e-business success in terms of lock-in effects. No negative relationships were found for other dimensions of e-business success.

E-business represents new ways of conducting business, where electronic networks of companies to a large extent make e-business an inter-organizational activity. The performance of the inter-organizational alliance and ability of the partners to create value in such networks would therefore depend on their relationship competency. With better knowledge of how to influence their business networks, SMEs could increase their influence and their outcome of such relationships.

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Appendix A. The relation between the conceptual model and the major sources



Appendix B (Continued)

irrelevant, please indicate so by answering “not applicable”. Please indicate how well you agree with the proposition by answering a number between 1: totally disagree and up to 7: totally agree.

Strategy and Vision

The concept of e-business

- | | | | | | | | | |
|--|-------------------------|---|---|---|---|---|----------------------|--------------------------|
| 9. Our company has a high level of knowledge of how e-business technologies can be of value to our business | <i>totally disagree</i> | | | | | | <i>totally agree</i> | <i>N/A</i> |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 10. Our company has a high level of knowledge of how our main competitor(s) use IT to support similar business areas | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 11. In general, e-business is well understood by my company | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |

Strategic planning

- | | | | | | | | | |
|---|-------------------------|---|---|---|---|---|----------------------|--------------------------|
| 12. Our company has a high level of knowledge of strategic planning | <i>totally disagree</i> | | | | | | <i>totally agree</i> | <i>N/A</i> |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 13. Our company has a well developed set of strategic planning techniques | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 14. In general, strategic planning is well understood by our company | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |

Sourcing and Alignment

Sourcing competencies

- | | | | | | | | | |
|---|-------------------------|---|---|---|---|---|----------------------|--------------------------|
| 15. Our company has a high level of knowledge on outsourcing of activities to other companies | <i>totally disagree</i> | | | | | | <i>totally agree</i> | <i>N/A</i> |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 16. Our company has a high level of knowledge on how to use competencies in our business partners | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |

Alignment competencies

- | | | | | | | | | |
|--|-------------------------|---|---|---|---|---|----------------------|--------------------------|
| 17. In my company business and IT managers very much agree on how IT contributes to business value | <i>totally disagree</i> | | | | | | <i>totally agree</i> | <i>N/A</i> |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 18. In my company there is effective exchange of ideas between business people and IT people | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 19. In general, my company is good at using the competencies it already has | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 20. In general, my company is good at using competencies represented in our business partners | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |

IT-Business Process Integration

Competency in Process Integration

- | | | | | | | | | |
|---|-------------------------|---|---|---|---|---|----------------------|--------------------------|
| 21. My company is actively working with the impact of e-business on its business processes | <i>totally disagree</i> | | | | | | <i>totally agree</i> | <i>N/A</i> |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |
| 22. In general, my company is good at reorganizing work to utilize new information technology | 1 | 2 | 3 | 4 | 5 | 6 | 7 | <input type="checkbox"/> |

Management of IT

- | | | | | | | | | |
|-----------------------------------|--|--|--|--|--|--|--|--|
| 23. My company's IT resources are | | | | | | | | |
|-----------------------------------|--|--|--|--|--|--|--|--|

Appendix B (Continued)

effectively managed	1	2	3	4	5	6	7	<input type="checkbox"/>
24. My company is good at achieving the anticipated benefits from IT investments	1	2	3	4	5	6	7	<input type="checkbox"/>
Systems and Infrastructure								
25. The systems infrastructure is very flexible in relation to my company's future needs	1	2	3	4	5	6	7	<input type="checkbox"/>
26. The IT systems make it possible for my company to effectively cooperate electronically with business partners	1	2	3	4	5	6	7	<input type="checkbox"/>

In the last section we would like you to assess your company's experiences with the effects of its e-business efforts. We ask you to give your evaluation of what you feel has come out of your company's e-business efforts.

E-business success

Efficiency

	<i>totally disagree</i>						<i>totally agree</i>	<i>N/A</i>
27. Our e-business efforts have reduced costs by electronic order taking over the Internet	1	2	3	4	5	6	7	<input type="checkbox"/>
28. Our e-business efforts have made us able to deliver faster	1	2	3	4	5	6	7	<input type="checkbox"/>
29. Our e-business efforts have reduced costs in communication with suppliers and customers	1	2	3	4	5	6	7	<input type="checkbox"/>

Complementarities

	<i>totally disagree</i>						<i>totally agree</i>	<i>N/A</i>
30. As a result of our e-business efforts our products or services complement products or services from other suppliers	1	2	3	4	5	6	7	<input type="checkbox"/>
31. Our e-business efforts make it possible for other suppliers to complement our products or services	1	2	3	4	5	6	7	<input type="checkbox"/>
32. Our e-business efforts have made our supply chain strongly integrated to our partners' supply chains	1	2	3	4	5	6	7	<input type="checkbox"/>

Lock-in

	<i>totally disagree</i>						<i>totally agree</i>	<i>N/A</i>
33. Our e-business efforts make it more expensive for our customers or suppliers to replace us	1	2	3	4	5	6	7	<input type="checkbox"/>
34. Our e-business efforts have made our products and services more tailored to our customers' needs	1	2	3	4	5	6	7	<input type="checkbox"/>

Novelty

	<i>totally disagree</i>						<i>totally agree</i>	<i>N/A</i>
35. Our e-business efforts have made our company a pioneer in utilizing e-commerce solutions	1	2	3	4	5	6	7	<input type="checkbox"/>
36. Our e-business efforts have made us cooperating with our customers or suppliers in new and innovative ways	1	2	3	4	5	6	7	<input type="checkbox"/>

General

37. In general, my company has experienced very positive effects from its e-business efforts	1	2	3	4	5	6	7	<input type="checkbox"/>
--	---	---	---	---	---	---	---	--------------------------

Appendix B (Continued)**Other/Control**

Leader vs. Follower

	<i>totally disagree</i>					<i>totally agree</i>		N/A
	1	2	3	4	5	6	7	
38. There is a dominating customer or supplier who dictates our e-business efforts								<input type="checkbox"/>
39. Our company is good at implementing changes in its organization	1	2	3	4	5	6	7	<input type="checkbox"/>
40. Overall, my company has a high level of competency for utilizing e-business technology	1	2	3	4	5	6	7	<input type="checkbox"/>

Appendix C. Descriptive statistics

E-business systems used	Number of SMEs	Percent
Web pages with information to individual customers about products and services (Q4a)	256	75.5
Web pages where individual customers can make orders (Q4b)	134	39.5
Web pages where companies can find information about products and services (Q4c)	270	79.6
Systems for electronic sales of products and services to other companies (Q4d)	51	15
EDI solutions on the Internet (Q4e)	73	21.5
Systems where suppliers can find information about our demand and supply (Q4f)	62	18.3
Systems that integrate supply chains (V4g)	36	10.6
Other (Q4h)	102	30.1

	Statistic			Skewness		Kurtosis	
	N	Mean	Standard deviation	Statistic	Standard error	Statistic	Standard error
Q9	330	4.1	1.7	-0.06	0.13	-0.88	0.27
Q10	330	4.3	1.7	-0.20	0.13	-0.80	0.27
Q11	336	4.3	1.7	-0.23	0.13	-0.80	0.26
Q12	332	4.3	1.6	-0.17	0.13	-0.56	0.27
Q13	325	3.7	1.6	0.20	0.14	-0.65	0.27
Q14	332	4.2	1.6	-0.14	0.13	-0.65	0.27
Q15	321	4.4	1.7	-0.26	0.14	-0.84	0.27
Q16	327	4.4	1.4	-0.10	0.14	-0.30	0.27
Q17	309	4.7	1.5	-0.49	0.14	-0.22	0.28
Q18	299	4.3	1.7	-0.29	0.14	-0.76	0.28
Q19	330	4.7	1.5	-0.45	0.13	-0.10	0.27
Q20	325	4.3	1.4	-0.18	0.14	-0.33	0.27
Q21	328	3.6	1.8	0.10	0.14	-1.05	0.27
Q22	326	4.1	1.6	-0.15	0.14	-0.69	0.27
Q23	318	4.2	1.6	-0.18	0.14	-0.66	0.27
Q24	318	4.1	1.5	-0.31	0.14	-0.48	0.27
Q25	324	4.3	1.6	-0.39	0.14	-0.51	0.27
Q26	330	4.6	1.6	-0.42	0.14	-0.49	0.27
Q27	261	3.7	1.9	0.13	0.15	-1.14	0.30
Q28	258	3.8	1.9	-0.07	0.15	-1.15	0.30
Q29	303	4.2	1.8	-0.25	0.14	-0.86	0.28
Q30	274	3.8	1.8	-0.08	0.15	-0.92	0.29
Q31	283	4.0	1.7	-0.23	0.15	-0.83	0.29
Q32	286	3.6	1.8	0.10	0.14	-0.98	0.29
Q33	287	3.0	1.7	0.48	0.14	-0.86	0.29
Q34	299	3.8	1.8	-0.06	0.14	-1.09	0.28
Q35	309	2.9	1.8	0.68	0.14	-0.62	0.28
Q36	307	3.8	1.8	-0.02	0.14	-0.98	0.28
Q37	314	4.2	1.7	-0.25	0.14	-0.75	0.27

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