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E-BUSINESS MATURITY: CONSTRAINTS ASSOCIATED WITH THEIR EVOLUTION

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To compete effectively in the e-business world, an organization must structurally transform its internal foundation. This structural change requires an organization to develop an innovative e-business strategy, focusing on speed to market and breakthrough execution. Despite the recognition and care that in recent years has been dedicated to e-business, there remains a need for continuing research efforts that seek to better understand constraints on the evolution of an organization to a state that can take advantage of e-business possibilities. There is a special need for this when considering small and medium enterprises, or businesses in developing countries. To minimize risk exposure from e-business initiatives, it is imperative for an organization to identify potential constraints on e-business evolution. In this setting, we develop a research model that involves e-business constraints and e-business maturity. We classify the constraints into the categories of environment constraints, organizational constraints, and technological constraints. Our results indicate that there are constraints that can be more or less problematic, depending on the stage of maturity. The results are also quite different in large organizations versus Small and Medium Enterprises.

Keywords: e-business; e-commerce; maturity models; stages of growth; constraints

1. INTRODUCTION

E-business is a term developed by IBM in the 1990s for commercial purposes (Li 2007). Despite many definitions of e-business, it can simply be described as “all electronically mediated information exchanges, both within an organization as well as with external stakeholders, supporting the range of business processes” (Chaffey 2002). While interest in e-business wound down during the “dot-com crash” because of the overexpectation of investors, e-business still continues to grow (Li 2007) and is evermore a way of doing business. E-business is a much broader concept than e-commerce or even Information Systems (IS). E-commerce focuses on using the Internet to carry out business transactions over the Internet; IS strategy focuses on using IS to support business processes. However, e-business aims to transform business processes to perform well in the networked economy.

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E-business allows organizations to improve their efficiency through “speed of light” value creation from collaboration both internally and externally to reach potential customers globally at low cost (Leibold, Probst, and Gilbert 2005). In addition, a new Internet-based business model may generate additional revenue (Farhoodmand 2005). New demand can also be created using a Value Innovation process (Mauborgue and Kim 2005) in which e-business could be an enabler. Therefore, the potential for e-business to generate business value is huge. As more people and businesses are connected to the Internet, the potential of e-business becomes ever more significant. It is important for organizations to be players in this e-business world. This is especially an issue in the context of small- and medium-sized enterprises, and in developing countries (Raven and Huang 2009; Jones et al. 2011).

To maximize potential for a shift toward e-business to produce positive results, business leaders must appreciate the transformational stages, the key interdependencies and interrelationships, and the impacts that they could have independently (or in combination) on eventual outcomes. This requires a thorough understanding of all the factors—human, technological, process, and organizational—that are involved in the change cycle (Duffy 2001).

As such, it is an imperative for an organization to identify potential constraints to e-business in order to minimize the risk exposure from its e-business initiatives. Achieving a high-level e-business maturity is desirable, meaning that e-business would be deeply embedded in all aspects of the organization as well as within relationships with all of the business partners. However, not all that is desirable is easily constructed. It is sometimes necessary to move forward in stages due to all kinds of constraints, both internal and external to the organization. We contend that the measurement of constraints is essential if organizations are to supersede them, and thereby evolve through several stages. Knowledge of the threats that exist can help organizations use their strengths to address them.

In this work we identify possible constraints, formulated as hypotheses. The data for testing the hypotheses were collected from large and small Portuguese firms. Results of the hypothesis testing are reported, followed by a discussion of the findings.

2. THEORETICAL BACKGROUND

2.1. E-Business Characteristics

Understanding of the e-business paradigm varies among academics and practitioners. According to Alter (2002), e-business is “the practice of performing and coordinating critical business processes such as designing products, obtaining supplies, manufacturing, selling, fulfilling orders, and providing services through the extensive use of computer and communication technologies and computerised data.” Drucker (2002), however, described e-commerce as an “explosive emergence of the Internet as a major world-wide distribution channel for jobs and services,” which, in the end, results in changes in markets and industry structure as well as in economies in general. An extensive literature review shows that e-business and e-commerce do not have commonly accepted definitions (see, for example, Holsapple and Singh 2000). What we have is an area of practice and research that continues to emerge and mature, and one that involves different research domains, such as marketing, computer science, and strategic management (Wilkins, Swatman, and Castleman 2000). There is spirited discussion about the differentiation of e-business from e-commerce, with many publications using the two terms interchangeably, while others argue that there

are fundamental differences. Technically, e-commerce is a subset of e-business, one that concentrates purely on the buying and selling processes in organizations (Jones et al. 2006).

Quite aside from definitional issues, there are several characteristics commonly found on effective e-business sites (Lientz and Rea 2000):

- Transactions flow seamlessly across departments. Traditional processes have barriers and boundaries between departments requiring a handoff of the transactions.
- Exception transactions, workarounds, and shadow systems in departments are greatly reduced or eliminated. Traditional business processes tend to have many of these.
- There is a focus on providing the Web visitor with information. Traditional business focuses on doing the transaction with less information.
- Policies and procedures are more formalized in e-business. Many traditional processes rely on informal procedures that depend on critical employees with business knowledge.
- In e-business there is a greater dependence on systems and technology than in most traditional businesses. The traditional business systems must be highly scalable to deliver good response times during peak loads of work.

2.2. Maturity Models

Since the introduction of computer technology into organizations in the 1960s, there have been numerous attempts to develop models of IS maturity (Nolan 1973, 1979; Gibson and Nolan 1974; McFarlan, McKenney, and Pyburn 1983; Earl 1983; Bhatuta 1988; Hirschheim, Klein, and Lyytinen 1996; Galliers and Sutherland 1991; Auer 1995; Zachman, Inmon, and Geiger 1997; Khandelwal and Ferguson 1999). All of these models are premised on the idea that organizations pass through stages of maturity with respect to the way they use and manage IS to support and facilitate business activities, processes, and operations.

The maturity models take the view that the planning process, development/adoption, use, and management of IS organizations evolve through a learning process that can move through stages of maturity. If these stages (and their associated features) can be identified, they could then be used to develop a plan for the IS and provide guidelines for action, characterized by orderly progression through several stages from the current culture of the organization (Singh 1993).

Maturity models are one of the widespread areas of investigation in the field of improving organizational performance. They identify organizational strengths and weaknesses as well as providing benchmarking information. New maturity models, better adapted to the realities of e-business, have been developed by researchers and practitioners. Recent research on growth stages and e-business has shown the usefulness of these models in describing an organization's position in terms of e-business development and its possible development in the future (Earl 2000; Prananto, McKay, and Marshall. 2001; Rayport and Jaworski 2002; Rao, Metts, and Monge 2003).

In Morais, Gonçalves, and Pires (2007), a comparative framework is used to evaluate e-business stages of growth models. This comparative framework contains eight elements (Jones, Muir, and Beynon-Davies 2006): perspective, development, emphasis, verification, barriers, focus, source, and stages. Eight models were compared via the framework: KPMG (1997), Grant's Model (Grant 1999), McKay's Model (McKay, Prananto, and Marshall 2000), Earl's Model (Earl 2000), SOGe (Piranto et al. 2001), Rayport and Jaworsky's

Model (2002), Rao's Model (2003), and Chan and Swatman's Model (2004). The conclusions of this evaluation are that all of the identified models have a linear development; only one model is specifically for Small and Medium Enterprises (SMEs); the focus is mainly e-business; the source is academia; and none of the models considers constraints on development and strategic development within the framework; but it is obvious that enterprise growth is inhibited by barriers to development, such as limited skills and finance.

3. RESEARCH METHOD

The aim of this study is to develop a conceptual framework that identifies and assesses the constraints associated with e-business evolution. Adopting a positivist theoretical perspective, we meet this aim through a quantitative survey method.

3.1. Research Model and Hypotheses

Based on literature review, we synthesize a research model that encompasses e-business constraints and e-business maturity. Figure 1 graphically portrays relationships among the model's variables (dimensions).

Being an early, exploratory study, the focus is on primary associations. A single stage model is adopted, directly relating dependent variables with independent variables without any intermediate variables. As preludes to hypothesis development, we examine e-business maturity and e-business constraints. We identify a set of constraints and structure them into three classes: environment constraints, organizational constraints, and technological constraints.

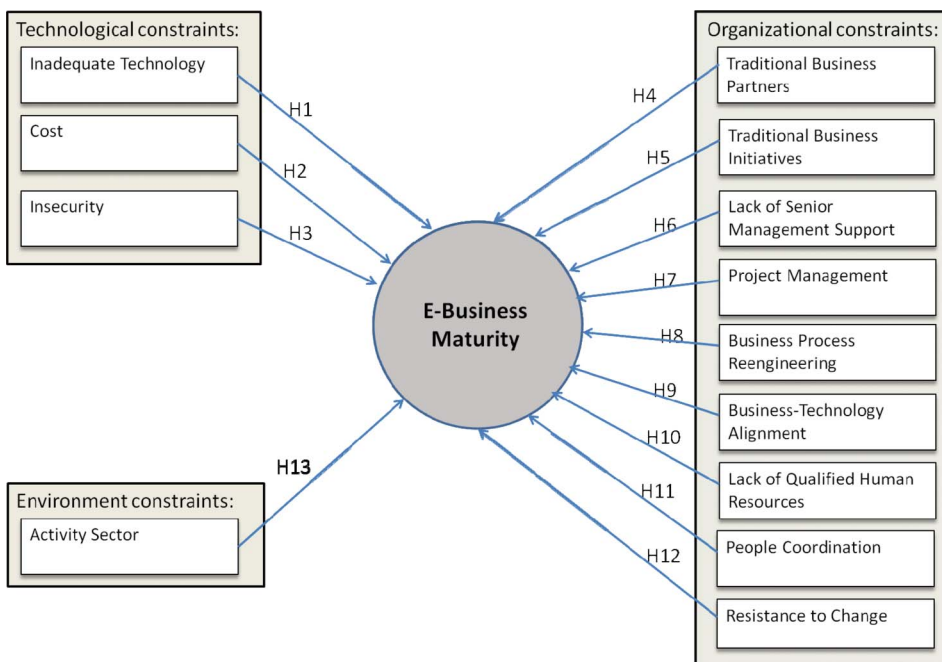


Figure 1 Research model (color figure available online).

constraints. We believe other constraints may well exist. However, consideration of such is beyond the scope of this exploratory study. We test the hypotheses to validate major constraints on e-business maturity.

Inadequate technology. Among the constraints that affect the e-business maturity of an organization, there is the existence (or nonexistence) of technology in the organization. According to Gouveia and Gaio (2004) one of the characteristics of the information society is the intensive use of Information and Communication Technologies, which assumes a mediating role. Because technology is a driver of e-business (Bakry and Bakry 2001), inadequate technology can constrain the development of e-business initiatives. One can explain this type of constraint based on evidence that development is, in fact, hampered by inadequate technology. That is, when extant technology does not support or complement tools needed for a desired e-business initiative, then the level of e-business maturity is insufficient for implementing it. However, we do not know whether the severity of this constraint is uniform across all maturity stages. To further explore this constraint, we posit the following null and alternative hypotheses:

- H0. *The constraint "Inadequate technology" is the same for all e-business maturity stages.*
 H1. *There are at least two stages of maturity with significantly different averages.*

Cost of e-business. Contemporary history has been permanently marked by technological advances. The development of information technologies, including the Internet and everything that relates to hardware and software, has changed the traditional paradigm for understanding and participating in economic activities. Investments in IS involve considerable intangible costs that are difficult to identify and/or measure. This issue becomes even more complex when we try to evaluate, from a financial and/or market-valuation perspective, all of the benefits of investments in IS (Serrano and Caldeira 2001). Because cost/benefit analysis can be problematic, the cost of technology can be enormous (Fink and Neumann 2009; Kwahk and Lee 2008), and firms' resources are limited, it follows that e-business cost could be a constraint on the ability to attain a desired stage of e-business maturity. However, we do not know whether the severity of this constraint is uniform across all maturity stages. To further explore this constraint, we posit the following null and alternative hypotheses:

- H0. *The constraint "Cost" is the same for all e-business maturity stages.*
 H2. *There are at least two stages of maturity with significantly different averages.*

Uncertainty related to insecurity. A critical success factor in any e-business initiative is adequate security (Borandi 2009; Cheolho and Sanghoon 2009). The complexity of risks affecting today's information technology-enabled businesses has increased significantly. As technology is an interfacing point for the exchange of information/data with entities and people, there is a need to build controls in the technological components and at each of these interfacing points to ensure that the sensitive business information/data are handled appropriately.

Key dimensions of e-business security include integrity, nonrepudiation, authenticity, confidentiality, privacy, and availability (Laudon and Traver 2006). Uncertainty about such

security aspects, as well as lack of trust in virtual relationships, may affect the success of e-business (Mouratidis and Softa 2010; Jones et al. 2009). Hence, the need to gauge the information security risks acting on the IT and business operations has become paramount (Atyam 2010). It follows that uncertainty about security could constrain the ability to attain a desired stage of e-business maturity. However, we do not know whether the severity of this constraint is uniform across all maturity stages. To further explore this matter, we posit the following null and alternative hypotheses:

H0. *The constraint "Insecurity" is the same for all e-business maturity stages.*

H3. *There are at least two stages of maturity with significantly different averages.*

Conflicts with traditional partners. Business partners can be simultaneously cooperative and competitive. In supply chains of partner firms, each can have very substantial powers, perhaps with divergent individual goals, yet ideally united in the joint creation of value. One of the first steps in the evolution of e-business is to improve relations with key partners in traditional business (Eisenmann 2007). If the traditional business partners do not adhere to new ways of doing business, be it co-opetition or cooperative value creation, partner conflicts could be a constraint to the development of e-business. However, we do not know whether the existence or importance of this constraint is uniform across all maturity stages. Accordingly, we posit the following exploratory hypothesis (in null and alternative forms):

H0. *The constraint "Conflicts with traditional business partners" is the same for all e-business maturity stages.*

H4. *There are at least two stages of maturity with significantly different averages.*

Conflicts with traditional business initiatives. According to Porter (2001), a successful company in the real world should take advantage of its brand and its other assets to become stronger in the digital world. In defining a strategy based on e-business, it is essential to define how the firm will manage conflict between its online business and its offline (or traditional) business. This definition will prevent undue competition between the firm's new channel (online) and those already established for the same group of customers (cannibalization effect). Thus, the existence of conflicts between these two channels may be a constraint to the development of e-business, because it inhibits a needed stage of e-business maturity. However, we do not know whether the severity of this constraint is uniform across all maturity stages. To further explore this constraint, we posit the following pair of null and alternative hypotheses:

H0. *The constraint "Conflicts with traditional business initiatives" is the same for all e-business maturity stages.*

H5. *There are at least two stages of maturity with significantly different averages.*

Lack of senior management support. A major problem that has caused failure of many initiatives in e-commerce is the apparent lack of support from top management, and a lack of general understanding of the fundamental characteristics that constitute an environment of success for e-commerce (Schmid, Stanoevska-Slabeva, and Tschammer 2001). The support of top management is generally accepted as being critical to the success of e-business. This is because the leaders of a firm are main decision makers when it

comes to allocating key resources (Scupola 2009; Martin and Matlay 2003). In Basco and Rodriguez (2009), we find a positive association between a participatory leadership style and e-business performance.

Thus, the degrees of openness and resource allocation that management exhibits toward e-business initiatives are reflective of a firm's stage of e-business maturity. However, we do not know whether the severity of this management support constraint is uniform across all maturity stages. To further explore this issue, we posit the following pair of null and alternative hypotheses:

H0. *The constraint "Lack of senior management support" is the same for all e-business maturity stages.*

H6. *There are at least two stages of maturity with significantly different averages.*

Project management. Project management has is a key activity in any organization, whether its goals are economic, financial, social, or political. Integral facets of any project include human and/or material resources, cost, time available, and activities developed. The dependencies among these need to be managed as efficiently and effectively as possible. E-business projects, as with all other projects of a firm, need to be assessed and monitored (Grembergen and Amenlinckx 2002; Riggins and Sabyasachi 2007). It follows that a firm's stage of e-business maturity is constrained by the degree of its project management ability. However, we do not know whether the extent of this constraint is uniform across all maturity stages. To further explore this issue, we posit the following null and alternative hypotheses:

H0. *The constraint "Project management" is the same for all e-business maturity stages.*

H7. *There are at least two stages of maturity with significantly different averages.*

Business process reengineering. In the dynamic and connected world in which organizations are embedded, changes appear to be increasingly complex, characterized by increasing demands for speed, quality, low cost, flexibility, and customer satisfaction. In this context, to ensure high levels of business competitiveness, companies must act quickly and flexibly in a pro-active way. They must innovate their services, processes, and use of technology. They must focus on customer needs and the marketplace. The reengineering of business processes promotes the realization of competitive advantage and creates value by improving the firm's processes, using the full potential of systems technologies to improve its performance. It follows that a firm's stage of e-business maturity is constrained by the degree of its process reengineering. However, we do not know whether the extent of this constraint is uniform across all maturity stages. To examine this issue, we posit the following exploratory hypothesis, stated in null and alternative forms as follows:

H0. *The constraint "Business process reengineering" is the same for all e-business maturity stages.*

H8. *There are at least two stages of maturity with significantly different averages.*

Alignment between technology and business. The evolution of technologies and their requirements is requiring the development of a firm's resources in ways

that ensure greater alignment between business needs of the business and what the technological infrastructure can provide (Kearns and Lederer 2003; Zilber 2008). According to Organization for Economic Co-operation and Development (OECD) (1999), the alignment between IS and the business plan is necessary to achieve the objectives of a business and to capitalize on the use of IS—helping to ensure that investments in IS are correctly used to support these objectives, thus increasing competitiveness through the use of IS. It follows that a firm's stage of e-business maturity is constrained by the degree to which its technology strategy/practices are aligned with its business strategy/practices. However, we do not know whether the extent of this constraint is uniform across all maturity stages. To examine this, we posit the following null and alternative hypotheses:

- H0. *The constraint "Alignment between technology and business" is the same for all e-business maturity stages.*
 H9. *There are at least two stages of maturity with significantly different averages.*

Lack of qualified human resources. Appropriate human resources are an essential organization asset. Existence of competition for skilled human resources goes hand-in-hand with the knowledge economy. However, this tends to exacerbate inequalities between developed and developing countries; many students, having completed their training, migrate and do not return to their countries of origin. According to the OECD report (1999), lack of qualified human resources is a barrier to the development of e-business. It follows that a firm's stage of e-business maturity is constrained by the extent and suitability of its human resources. However, we do not know whether this constraint is uniform across all maturity stages. To explore this, we investigate the following null and alternative hypotheses:

- H0. *The constraint "Lack of qualified human resources" is the same for all e-business maturity stages.*
 H10. *There are at least two stages of maturity with significantly different averages.*

People coordination. A business model is a mediated construction between technology and business (Calia, Guerrini, and Moura 2007). We suggest that poor coordination of activities between leaders in these two areas may be a constraint on the development of e-business in the organization. All else being equal, greater competence in this coordination is indicative of greater e-business maturity. Such coordination facilitates a firm's entrepreneurial capacity for designing, launching, and managing e-business initiatives. It follows that the level of competence in people coordination constrains a firm's e-business maturity. However, we do not know whether the extent of this constraint is uniform across all maturity stages. To examine this issue, we posit the following exploratory hypothesis, stated in null and alternative forms:

- H0. *The constraint "People coordination" is the same for all e-business maturity stages.*
 H11. *There are at least two stages of maturity with significantly different averages.*

Resistance to change. There are many studies that describe, analyze, and help understand the phenomenon of organizational change (Holt et al. 2007). Review of these studies shows that a key issue is an attitude of resisting change. This attitude considered as being natural and inevitable (Kurtz and Duncan 1998), and has been popularized as

a major barrier to the implementation of change processes (Braver 1995). It follows that resistance to change can be a substantial impediment to implementing e-business innovation, even if it represents growth and development. In this context, managers should be prepared to manage resistance to change (Fine 1986; Agboola and Salawu 2011). Such preparation is as sign of e-business maturity. However, we do not know whether the extent of this constraint is uniform across all maturity stages. We posit the following exploratory hypothesis, stated in null and alternative forms, as a starting point for studying this issue:

H0. *The constraint “Resistance to change” is the same for all e-business maturity stages.*

H12. *There are at least two stages of maturity with significantly different averages.*

Activity sector. According to Porter (2001), each firm belongs to a generic value chain of the industry in which it operates, and may seek to focus on one or more positions in the chain. The focal position is one where the firm believes it can create more value than its competitors. Additionally, the firm continues to adhere to its model of the structure of the business in which it operates. There is evidence that characteristics of each activity sector influence the adoption of e-business (Fillis, Johannson, and Wagner 2004; Beynon-Davies 2010), with benefits accruing to companies that find better ways to use e-business. It follows that the nature of the activity sector in which a firm operates may constrain its e-business maturity. However, we do not know whether the extent of this constraint is uniform across all activity sectors. To examine this issue, we posit the following exploratory hypothesis, stated in null and alternative forms:

H0. *The e-business maturity is the same for all activity sectors.*

H13. *There are at least two activity sectors with significantly different averages.*

3.2. Data Collection

A questionnaire was developed to collect data relevant to testing the hypotheses. Prior to distribution, a series of pilot tests were conducted with a group of 10 IS directors in diverse enterprises and a group of five PhD students. The test participants were asked to complete the questionnaire and then to evaluate the questionnaire and make suggestions. After the questionnaire had been finalized, it was administered to the 1000 managing directors of the largest (according to the amount of business) Portuguese enterprises, or best companies operating in Portugal. Most of these companies are multinational corporations. Information about the enterprises was given by the National Institute of Statistics of Portugal (2007).

We chose the questionnaire method of data collection, rather than interviews, for reasons of time and cost. There are other studies that address related issues, namely case studies (Gibbs, Kraemer, and Dedrick 2003), and they lead to results consistent with what we find.

A total of 1000 letters of invitation to participate in completing the questionnaire were sent by post or e-mail to 1000 companies. This presentation letter referred specified the website, the login, and the password a recipient could use to participate in the survey. Each enterprise had a unique login and password to access the questionnaire, guaranteeing that

an enterprise would answer no more than once. The presentation letters of the questionnaire were distributed in November 2007.

Within the cut-off date, set at three weeks after the survey was distributed, there were 208 returned questionnaires. Of the 208 responses, 70 were incomplete (32 did not answer about their maturity stage and 38 did not answer about constraints associated with each maturity stage), prompting their removal from the sample, as this might increase the error and bias of the survey. Effectively, 138 usable responses are included in the sample for further analysis, representing a response rate of 13.8%. This is well above the typical response rate of 5%–10% for a postal survey (Alreck and Settle 1985; Barnett 1991).

The same questionnaire was administered in April 2009 to the 500 Portuguese SMEs identified by Exame (2008), which had collected data about these SMEs from 2005 to 2008. There were 52 valid responses, a 10.8% response rate, as six invitations turned out to be undeliverable. We collected data from both large firms and SMEs in order to test the research model (and hypotheses) at enterprises of different scales. This also allows comparison of results of across the two classes.

Sample demographics are depicted in Table 1. For large enterprises, 50% of respondents are directors, 7.3% are general managers, 5.5% are administrators, 14.6% are executives, and 22.6% have other functions in the enterprise. In the majority of cases respondents are responsible for the IS department. In the sample, we have 40% with less than 250 employees, a condition in Portugal to be an SME. However, this only happens when the amount of business is less than 50.000.000 Euros and the assets are also less than 43.000.000 Euros. Within the sample of large enterprises, none are SMEs.

For the sample of SMEs, the highest percentage of respondents is for directors (44%), just as in large enterprises, followed by respondents who have another function other than those listed (27%), respondents who are executives (15%), administrators (8%), and general managers of the firm (6%). A majority of respondents who answered “Other” as a function are responsible for the department of IS within the organization. In all, the functional distribution pattern is similar in one group compared to the other.

As for education, patterns are similar when comparing large companies with SMEs, with the majority for each having at least a bachelor degree.

Table 1 Sample demographics—Large Enterprises (LE) and Small and Medium Enterprises (SME).

Function									
Director (%)		General manager (%)		Administrator (%)		Executive (%)		Other (%)	
LE	SME	LE	SME	LE	SME	LE	SME	LE	SME
50.00%	44.00%	7.30%	6%	5.50%	8%	14.60%	15%	22.60%	27%
Education Level									
Higher Education (%)		Postgraduate (%)				Secondary School (%)			
LE	SME	LE	SME	LE	SME	LE	SME	LE	SME
57.60%	56%	29.70%		27%		12.70%		17%	
Number of employees									
1–50 (%)		51–250 (%)		251–500 (%)		501–1000 (%)		1000+ (%)	
LE	SME	LE	SME	LE	SME	LE	SME	LE	SME
11.90%	23.10%	28.10%	63.50%	18.80%	3.80%	23.10%	9.60%	18.10%	0.00%

As one would expect, large enterprises are skewed toward many employees, while SMEs exhibit a reverse pattern. The percentage of SMEs with fewer than 250 employees is nearly 90%, while large enterprises with more than 50 employees form nearly 90%.

Respondents belong to eight industry sectors: Manufacturing, Information and Communication Activities, Retail and Wholesale, Financial Services, Commerce of Vehicles, Civil Construction, Transport, and Other.

3.3. Measurement Development

The instrument includes a five-part questionnaire. The first four parts include nominal and ordinal scales. The remaining part includes seven-point Likert-like scales, ranging from “not problematic” (1) to “very problematic” (7). The first and second parts are used to collect basic information about respondents’ characteristics (including occupation, education, and seniority in the organization) and organizations’ characteristics (including activity sector, amount of business, and number of employees). The third part is used to obtain characterizations of the organizations’ IS traits. The fourth part is used to gather data about e-business evolution between 2005 and 2007, in the case of the large-organization sample, and between 2005 and 2008, in the case of the SME sample. The questionnaire’s fifth part was developed based on the constructs of organizational, technological, and environmental constraints.

4. RESULTS

4.1. Hypotheses Testing

For the sample of large Portuguese enterprises, univariate analysis of variance (ANOVA) is applied to test the main and interaction effects on e-business maturity. Because a requirement of ANOVA is homogeneity of the variance of dependent variable between groups, the appropriateness of the univariate technique is tested by Levene statistics. This test indicates that the sample does not violate the assumption, except for the activity sector variable (H13) ($F = 2.482$, $p = 0.02 < 0.05$) (Maroco 2003).

Results of a two-way ANOVA are shown in Table 2. They reveal that all null hypotheses are rejected at statistically significant levels, with two exceptions: we do not find evidence that means for “cost” and “insecurity” constraints vary across stages of e-business maturity. With H2 and H3 not having been confirmed, we can say that the cost of e-business solutions and their security are constant concerns regardless of a firm’s stage of e-business maturity.

For H13 the Kruskal-Wallis test is used, as the assumptions needed for ANOVA are not satisfied. The test results, for each of the years (2005 - Chi-squared = 15.56, $p = 0.029$; 2006 - Chi-squared = 14.213, $p = 0.048$; 2007 - Chi-squared = 16.454, $p = 0.021$), lead us to conclude that there are at least two activity sectors with significantly different averages.

In the case of the sample of SMEs, the conditions for the use of ANOVA (normality and homogeneity) are not met. The Kruskal-Wallis test is used to examine whether constraints are the same for all maturity stages. The test results are shown in Table 3.

Interestingly, in the case of large organizations, the constraints are greatest in the lower maturity stages. However, for SMEs, we do not find evidence that constraints are dependent on the maturity stage of e-business. In general, as is supported by the statistical results, the constraints appear to be uniformly problematic for SMEs. We cannot validate

Table 2 Results of ANOVA test.

Hypotheses	2005		2006		2007	
	F	p-value	F	p-value	F	p-value
H1	3.028	0.013	2.565	0.03	4.815	0.000
H2	1.042	0.396	1.529	0.185	1.475	0.202
H3	1.239	0.294	0.592	0.706	2.125	0.066
H4	5.071	0.000	7.33	0.000	8.57	0.000
H5	7.219	0.000	8.041	0.000	10.729	0.000
H6	3.708	0.004	5.391	0.000	4.767	0.000
H7	2.705	0.023	2.538	0.032	4.968	0.000
H8	4.558	0.001	5.631	0.000	6.273	0.000
H9	5.138	0.000	4.719	0.001	6.116	0.000
H10	3.451	0.006	2.515	0.033	3.661	0.004
H11	2.544	0.031	3.648	0.004	7.09	0.000
H12	2.826	0.019	3.731	0.003	3.661	0.004

Table 3 Results of the Kruskal-Wallis test for SMEs.

Hypotheses	2005		2006		2007		2008	
	Chi-Squared	p-value	Chi-Squared	p-value	Chi-Squared	p-value	Chi-Squared	p-value
H1	6.335	0.175	6.618	0.157	7.389	0.117	6.335	0.175
H2	3.113	0.539	2.119	0.714	4.563	0.335	5.940	0.204
H3	6.357	0.174	4.067	0.397	3.272	0.513	2.076	0.722
H4	5.263	0.261	1.288	0.863	3.527	0.474	0.676	0.954
H5	8.633	0.071	1.807	0.771	6.307	0.177	3.316	0.506
H6	5.319	0.256	1.064	0.900	3.066	0.547	8.974	0.062
H7	5.887	0.208	2.394	0.664	5.848	0.211	5.430	0.246
H8	4.800	0.308	1.734	0.785	4.153	0.386	3.093	0.542
H9	6.059	0.195	7.441	0.114	4.046	0.400	9.086	0.059
H10	3.709	0.447	3.207	0.524	3.486	0.480	4.237	0.375
H11	4.354	0.360	5.866	0.209	3.016	0.555	4.788	0.310
H12	2.112	0.715	7.324	0.120	2.861	0.581	3.881	0.422
H13	8.527	0.288	9.741	0.204	9.896	0.195	14.367	0.045

the hypotheses that there are at least two maturity stages with different means. The only commonalities shared by both large enterprises and SMEs are that the Cost of e-business and Insecurity constraints are always problematic in all stages of e-business maturity.

In order to explore the relationship between each constraint and maturity, we use the Spearman Correlation test. Both variables are ordinal. Maturity is an ordinal variable, with values from one to six (corresponding to the stage one to six). Constraint is an ordinal variable, with values from one to seven (corresponding to “not problematic” and to “very problematic,” respectively). The test results are shown in Tables 4 and 5, for large enterprises and SMEs, respectively.

For large companies there is, for each year, a significant correlation at 1% of all the constraints and maturity, except for the cost and insecurity, whose correlation is not significant. It should be noted that for the other constraints the correlation is statistically significant at 1% for all cases.

Table 4 Spearman Correlation test between each constraint and maturity (2005, 2006, and 2007) for large enterprises.

Constraint	Maturity 2005	Maturity 2006	Maturity 2007
Inadequate Technology			
Correlation coefficient	−,280(**)	−,274(**)	−,346(**)
Sig	,001	,001	,000
N	138	138	138
Cost			
Correlation coefficient	−,132	−,103	−,137
Sig	,122	,227	,109
N	138	138	138
Insecurity			
Correlation coefficient	−,139	−,126	−,176(*)
Sig	,104	,142	,039
N	138	138	138
Traditional Business Partners			
Correlation coefficient	−,365(**)	−,410(**)	−,450(**)
Sig	,000	,000	,000
N	138	138	138
Traditional Business Initiatives			
Correlation coefficient	−,447(**)	−,457(**)	−,496(**)
Sig	,000	,000	,000
N	138	138	138
Lack of Senior Management Support			
Correlation coefficient	−,288(**)	−,346(**)	−,332(**)
Sig	,001	,000	,000
N	138	138	138
Project Management			
Correlation coefficient	−,244(**)	−,260(**)	−,303(**)
Sig	,004	,002	,000
N	138	138	138
Business Process Reengineering			
Correlation coefficient	−,331(**)	−,375(**)	−,392(**)
Sig	,000	,000	,000
N	138	138	138
Business-Technology Alignment			
Correlation coefficient	−,342(**)	−,320(**)	−,363(**)
Sig	,000	,000	,000
N	138	138	138
Lack of Human Resources Qualified			
Correlation coefficient	−,284(**)	−,246(**)	−,255(**)
Sig	,001	,004	,003
N	138	138	138
People Coordination			
Correlation coefficient	−,241(**)	−,273(**)	−,312(**)
Sig	,004	,001	,000
N	138	138	138
Resistance to Change			
Correlation coefficient	−,270(**)	−,315(**)	−,376(**)
Sig	,001	,000	,000
N	138	138	138

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

Table 5 Spearman Correlation Test Between Each Constraint and Maturity (2005, 2006, 2007, and 2008) for SMEs.

	Maturity 2005	Maturity 2006	Maturity 2007	Maturity 2008
Inadequate Technology				
Correlation coefficient	−,250	−,268	−,347*	−,278*
Sig	,074	,055	,012	,046
N	52	52	52	52
Cost				
Correlation coefficient	−,013	−,006	−,220	−,203
Sig	,924	,095	,116	,149
N	52	52	52	52
Insecurity				
Correlation coefficient	−,145	−,186	−,182	−,103
Sig	,304	,186	,195	,468
N	52	52	52	52
Traditional Business Partners				
Correlation coefficient	−,054	−,039	−,070	−,099
Sig	,703	,782	,624	,485
N	52	52	52	52
Traditional Business Initiatives				
Correlation coefficient	−,121	−,123	−,303*	−,199
Sig	,384	,386	,029	,156
N	52	52	52	52
Lack of Senior Management Support				
Correlation coefficient	−,058	−,052	−,190	−,298*
Sig	,683	,717	,178	,032
N	52	52	52	52
Project Management				
Correlation coefficient	−,141	−,132	−,222	−,198
Sig	,319	,352	,113	,159
N	52	52	52	52
Business Process Reengineering				
Correlation coefficient	−,023	−,070	−,212	−,186
Sig	,871	,622	,131	,186
N	52	52	52	52
Business-Technology Alignment				
Correlation coefficient	−,098	−,146	−,244	−,295*
Sig	,490	,302	,081	,034
N	52	52	52	52
Lack of Human Resources Qualified				
Correlation coefficient	−,119	−,085	−,211	−,095
Sig	,400	,551	,133	,503
N	52	52	52	52
People Coordination				
Correlation coefficient	−,126	−,174	−,223	−,194
Sig	,374	,218	,111	,169
N	52	52	52	52
Resistance to Change				
Correlation coefficient	−,018	−,007	−,207	−,069
Sig	,898	,963	,142	,625
N	147	52	52	52

*Correlation is significant at the 0.05 level (2-tailed).

In the case of SMEs, results show that only since 2007 did there begin to be a significant correlation between e-business maturity and some constraints. This lack of constraints suggests that e-business in the SMEs examined was not at all substantial before that time. In 2007, constraints that have statistically significant correlations at a 5% level are inadequate technology and incompatibility between traditional business initiatives and e-business initiatives. In 2008, the constraints that have a significant correlation at 5% are inadequate technology, business-technology alignment, and lack of senior management support.

5. CONCLUSIONS AND DISCUSSION

With an increasingly global marketplace and economy, plus a higher degree of competition, organizations that want to survive the challenges of this new world must be able to adapt themselves quickly to fast-changing environments. This leads to a need for systems that can be adapted/adjusted at a comparable pace. It is important for an organization to recognize the impacts that e-business strategies and plans may have, and that these impacts will influence its customers, other stakeholders, and ultimately the success of the organization.

Despite the recognition and care dedicated to e-business in recent years, it has not yet reached a stage of high maturity (Dedrik, Xu, and Zhu 2008). This calls for research seeking to better understand what it is that hampers greater maturity, as a prelude to resolution. The results of this study contribute to such an understanding. We provide support for the research model presented in Figure 1, and for the hypotheses regarding directional linkage among the model's variables.

The ANOVA test indicates nothing about which of the pairs have different means. We are therefore interested in testing, a posteriori, which of the pairs have different means. These comparisons allow us to check which pairs have different means. ANOVA only allows us to conclude that there are at least two different means, but it does not say which, or how, the means are different. This type of question is resolved by multiple comparisons. After performing multiple comparisons we find that only the mean values for stages 1 and 2 and stages 5 and 6 are significantly different (in most cases with p-values less than 0.01), for an error probability of 1%.

Aware that the conceptual model proposed can be improved, there is the conviction not only that we have contributed with useful knowledge but that we have also contributed with a new approach to e-business. There is not a unique and correct or universal reason for the development of e-business. Even if it existed, it would be guaranteed to change over time, with the pressures of business, due to policy or due to technology itself. Organizations must continue to develop e-business in accordance with all its circumstantial factors (i.e., those aspects that influence and leverage the success of their decisions). This study examines circumstantial factors that could act as constraints to e-business development. Although a few hypotheses were not confirmed when applied to large organizations and none were confirmed for the sample of SMEs, this does not mean that the constraints are not problematic. On the contrary, the constraints are present throughout the evolutionary process of e-business.

We conclude with the sense of having contributed to the enrichment of knowledge in the field of e-business, and to having improved the study and practice of e-business organizations. Above all that, the study can give insights to organizations that have not undertaken this new way of doing business. As a suggestion for future research it would

be interesting to perform the same study by activity sectors, as there may be constraints intrinsic to certain activity sectors.

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APPENDIX

Respondent Identification

Job position in your company:

- Administrator
- General Manager
- Director
- Executive
- Other

If you answered other, please indicate which: _____

Academic Qualifications:

- Primary School
- Secondary School
- Higher Education
- Post graduation
- PhD

How many years have been with the company: _____

Company Characterization

Activity Sector _____

Number of company employees:

- 1 to 49
- 50 to 249
- 250 to 449
- 500 to 1000
- + 1000
- Do not know / No answer

Complete the following table, indicating for each of the years (2005, 2007 and 2007) the situation that best fits your company regarding the Electronic Business (development and coordination of key business processes through the use of intensive information and communication technologies and digital information

Figure A1 Questionnaire.

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E-Business Company Characterization			
	2005	2006	2007
There is no defined strategy for e-business company			
The electronic business begins to be considered important to business; however, there is not a strategy			
There is already a strategy for electronic business, which is centered on a technology perspective, with little influence of the business needs			
The development of electronic business begins to be more oriented to the business			
The development of e-business is now becoming more business-oriented			
The electronic business is deeply embedded in all aspects of the organization, as with all business partners			

Using a scale from 1 (no problem) to .7 (very problematic), classify the perceived difficulties in each of the years.

Constraints Associated With e-business evolution																								
	2005							2006							2007									
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7			
The existing technology is not the best fit for e-business																								
Cost of e-business solutions																								
Insecurity																								
Incompatibility with traditional business partners																								
Incompatibility between the traditional business initiatives and e-business initiatives																								
Lack of support from top management																								
E-business Project management																								
Business processes reengineering																								
Integration between technology and business																								
Lack of qualified human resources																								
Coordination between business and technology																								
Resistance to change																								

Figure A1 Continued.