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Sabine Zumpe

The University of Queensland, s.zumpe@business.uq.edu.au

D. Ihme

diana.ihme@notes.upb.de

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INFORMATION SYSTEMS MATURITY IN E-BUSINESS ORGANIZATIONS

Zumpe, Sabine, University of Queensland, Business School, 4072 Brisbane, Australia,
s.zumpe@business.uq.edu.au

Ihme, Diana, University of Paderborn, Warburger Straße 100, 33098 Paderborn, Germany,
diana.ihme@notes.upb.de

Abstract

E-Business Information Systems (eBIS) are Information Systems (IS) that support organizations to realize their e-Business strategy resulting in various benefits. Therefore those systems strongly focus on fulfilment of the e-business requirements.

In order to realise the expected benefits, organizations need to turn to their eBIS and measure the maturity of those systems. In doing so, they need to identify the status of those systems with regards to their suitability to support the e-Business strategy, while also identifying required IS improvements. In our research we aim to develop a maturity model, particularly dedicated to the area of e-Business Information Systems, which can be used easily and objectively to measure of the current maturity of any Information System that supports e-Business. This research-in-progress paper presents initial results of our research.

Keywords: Electronic Business, Maturity Model, e-Business Information System.

1 INTRODUCTION

The Electronic Business (e-Business) paradigm has penetrated our society and is now recognised as the information revolution (Evans and Wurster 2000). It is characterized by very large and time consuming investments in information technology (IT) in order to implement the e-Business vision (Kaplan and Sawhney 2000). While these investments are sometimes fruitful and result in significant revenue gains for the organizations, many fail completely or simply fail to justify the amount invested. One of the main factors responsible for this significant level of failure are the speed with which e-Business has been adopted and the competition in the market which increase rapidly as new players enter e-Business. This increased competition gives some companies little choice but to jump into e-Business in order to avoid missing out on the potential benefits and to avoid being “left out” of the maturing market. This rapid adoption and perceived lack of time has led to a situation in which companies investing large amounts of money in their e-Business initiatives largely ignore the status and capability of the Information Systems (IS) that are to support the proposed e-Business implementations. Such Information Systems, ones that strongly focus on fulfilment of the e-Business requirements, are referred to as e-Business Information Systems (eBIS). In order to realise the expected e-Business benefits, organizations need to turn to their eBIS and measure the maturity of those systems. In doing so, they need to identify the status of those systems with regards to their suitability to support the e-Business strategy, while also identifying required IS improvements.

Accordingly, our research aims to develop a maturity model, particularly dedicated to the area of e-Business Information Systems, which can be used easily and objectively to measure of the current maturity of any Information System that supports e-Business. This research-in-progress paper presents initial results of our work, in particular the description of the present e-Business situation that companies are facing and the efforts that have been taken to establish maturity models for this area. This discussion clearly shows the necessity to develop a maturity model for eBIS. The main elements of such a model are presented in this paper.

2 THEORY

E-Business Characteristics

The 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 talks about e-Commerce as the “...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 economics in general. An extensive literature study shows that e-Business and e-Commerce do not have a common accepted definition. This apparent confusion is a sign of a research area that is still emerging and maturing, and one that involves different research domains, as marketing, computer science, or strategic management (Wilkins et al. 2000). There is also a strong discussion about the differentiation of e-Business from e-Commerce, with many publications using the two terms interchangeably and some arguing 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. 2000). For the purposes of this research, however, we will adopt the meaning of e-Commerce in its widest sense, one in which e-Commerce is equivalent to e-Business (Turban 2006).

Summarizing the definitions of e-Business, and in accordance with the Organization for Economic Co-operation and Development, five major characteristics can be concluded (OECD 1999):

1. use of information and communication systems to standardize, automate, and integrate transactions
2. transformation of marketplaces and creation of new industries
3. increased connection and interactivity of and between the business partners over electronic networks
4. alteration of the relative importance of time and resources
5. catalytic effects of inter- and intra-organizational transactions

These five characteristics of e-business systems may lead to various benefits - potential of operating more efficiently, creating new and better business processes, reaching more customers, targeting the “right” customers, reducing costs and optimising the entire supply chain are just some of those (Porter 2001). However, many of these promised effects did not materialise in organizations which adopted e-Business but this does not mean that e-Business is just a trend. Indeed, in many companies the e-Business participation evolved as a strategic success factor (Lumpkin *et al.* 2002). In addition, according to PORTER (2001), the main question for organizations is not *whether* to deploy Internet technologies but *how* to deploy them. Therefore, PORTER (2001) argues that the potential benefits are attainable in *all* organizations, as long as e-Business is properly planned for and properly deployed and supported. Information Systems support the fulfilment of these challenges and are understood to be the foundation of e-Business (van de Walle 2002). Hence, we argue that ensuring the right maturity level, and being able to measure the maturity level of Information Systems, is one of the key eBIS success drivers.

Maturity Models

Early maturity model approaches in the field of Information Systems emerged from the area of software engineering - targeting the need to measure and control processes more closely (Humphrey 1989). The assessment of a software development process' maturity can allow predictions as to the software product's final quality. The first model in the software development field was the Maturity Model (CMM) of Carnegie Mellon University (Paulk *et al.* 1993), which is to this day still the best-known maturity model. It was originally developed to assist the U.S. Department of Defense (DoD) in software acquisition. It takes contractor performance as a factor for determination of contracts with the DoD. In this case the model became a guide for software process improvement; potential DoD contractors realized the need to align their development processes with the CMM to acquire new contracts successfully (Herbsleb *et al.* 1997). Furthermore, non-governmental organizations apply the model to assess internal improvements of their software development processes. Nowadays, the model is frequently perceived as a requirement for software development companies, in order to assure their ability to fulfill customers' requirements.

Models based on the CMM usually encompass five maturity levels and mostly associate a higher level with a higher maturity and a better performing organization. However, this can be a misleading interpretation. Organizations should strive for a particular maturity level in relation to their organizational strategies and objectives, rather than simply for the sake of reaching a higher maturity level in a maturity model (Crawford 2001). The final decision, whether or not an organization is more mature than another, cannot be derived from a maturity model assessment solely. Instead, the identification of the implications and likely consequences of its current maturity level provide the real value to organizations. Subsequently, these are turned into strategies targeting the identified shortcomings and weaknesses (Crawford 2001).

GOLDENSON and GIBSON identified five potential values for organizations implementing a maturity model in general (Goldenson and Gibson 2003):

1. Cost Value
As errors occurring in production processes can be eliminated, costs of production processes as well as average costs to fix a defect decrease.
2. Schedule Value
Improvements in schedule predictability and reductions in required time for processes are possible.
3. Quality Value
By standardization of processes, architectures and services improvements in quality are achieved which result from a reduction of defects at different points in the process or in the product.
4. Customer Satisfaction Value
As improvements in quality and reduction of production and delivery time are possible, customer satisfaction increases.
5. Return on Investment Value
The efforts of an assessment are put into perspective by the achieved benefits from improvements in processes after applying a maturity model. In general, the benefits exceed the investment.

These potential values can be generated in various application areas and maturity models already exist for multiple fields of business. Starting with models to measure the maturity of software development projects, maturity models have been conceived for many domains such as knowledge management (Berztiss 2002, Maybury 2002), business process management (Rosemann and de Bruin 2005), as well as information technology and project management (Estay-Niculcar and Pastor-Collado 2002). Upcoming maturity models seem to be a reflection of trends and tides in business science.

Models focusing on the research area of e-Business were developed to measure the progression of e-Business maturity. Those models include, for example, the E-Commerce Maturity Model by KPMG, the Commitment-Implementation Matrix Model, the E-Commerce Levels, the E-Business Lifecycle Model, and the Internet Commerce Maturity Model (Prananto *et al.* 2001). An Australian research project also made efforts to measure e-Business progression among Small and Medium sized organizations in Australia (Prananto *et al.* 2003; 2004). The maturity model, termed Stages of Growth for e-Business (SOGe) Model, consists of six levels of e-Business maturity. The model provides verbose natural language descriptions of goals for every maturity level. Following these descriptions organizations are able to examine their achieved maturity stage by comparing the current situation of the organization to the described levels of maturity. The model assists organizations in recognizing their current capabilities as well as in planning future e-Business initiatives in general (Prananto *et al.* 2003; 2004).

In general, the foci of existing e-Business maturity models are strategic and managerial questions rather than the maturity of the enabling Information System. The models describe the current state and position of an organization in relation to their e-Business activities. The e-Business activities, however, depend heavily on the capability of the underlying Information System. As the areas of e-Business and Information Systems are so tightly interleaved, we argue that a more detailed investigation of eBIS will foster an improved understanding of an organization's maturity. Although the SOGe model targets some of the concerns raised here, its results cannot be used without considering issues surrounding strategy, staff, and skills as well (Prananto *et al.* 2003).

But why develop a model for eBIS maturity? Various models that deal with identification of IS maturity have already been published – can they not be used for the purposes of assessing eBIS maturity as well? After all, eBIS are a subset of Information Systems in general. We argue that while there should

be some overlap between maturity models for IS and for eBIS, the standard IS maturity models neglect some of the special processes and characteristics of e-Business Information Systems, since they primarily focus on technological issues. These more IS related models assess processes for engineering support, configuration and technology management or software requirements. Also, the assessment of maturity in such models is primarily criteria bases and focuses predominantly on subjective descriptions. The final assessment is derived by the comparison of the organization's current situation with the maturity levels proposed by the model (Prananto *et al.* 2004, 2003). However, given the absence of clearly and objectively traceable measures, companies are running the risk of misinterpretation of the maturity level, leading to expensive and false development strategies. In addition, the assessment of a company's maturity level, using the discussed models, predominantly depends on the background, experience and interpretation of the investigators, adding even more subjective influences to the final outcome. A clear distinction of the various stages would require quantifiable and mathematical factors, enabling an objective comparison between organizations, reducing subjectivity and subsequently increasing the credibility of maturity assessments. Consequently, these models do not provide the necessary measures that allow focusing on the characteristics eBIS and our research proposes the further development of a maturity model dedicated to the area of eBIS in particular.

3 METHODOLOGY

According to PALVIA *et al.* (2003) there exist a large number of methodologies that can be applied to Information Systems research. Depending on factors like the chosen topic, research questions and the intended audience, one or multiple methodologies can be chosen to substantiate the research.

For the first stage of this study a literature analysis and content analysis were conducted. The foci of these analyses were the characteristics and potentials of e-Business as well as the various maturity models in different fields. The examination of maturity models proved to be a challenge for researchers as there are a lot of maturity models, most of which are not fully published, not yet finished or poorly documented. The design of our eBIS maturity model follows the framework for the development of maturity models as recommended by ROSEMANN and deBRUIN (2005). The framework includes six successive phases: **I** Scope, **II** Design, **III** Populate, **IV** Test, **V** Deploy and **VI** Maintain (Fig. 1).



Figure 1 Development Framework for maturity models (Rosemann and deBruin 2005)

4 INTIAL RESULTS

A in depth literature analyses and content analysis identified six factors influencing the performance and the maturity of an e-Business Information System, thus developing a model for eBIS maturity (see Fig. 2). This section presents the factors. The factors are related to the characteristics of e-Business and represent different views of eBIS. These factors are independent of each other, measurable and sturdy against the dynamics of changes within the field.

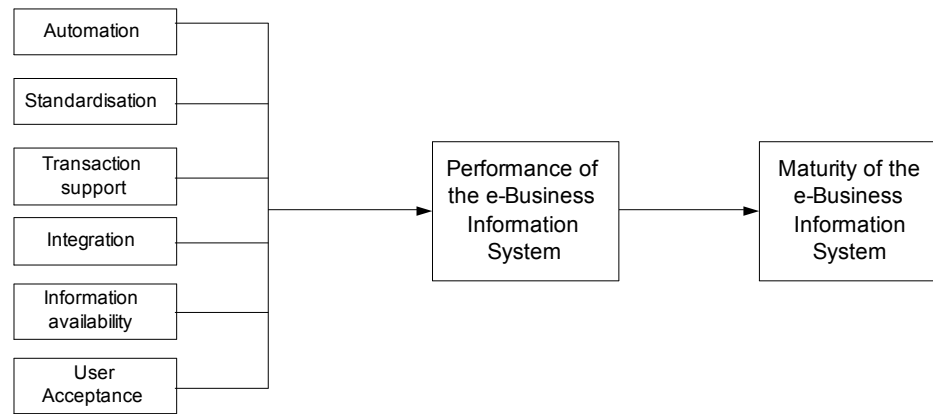


Figure 2 Initial e-Business Information System maturity model

level of automation

The level of automation describes to what extent the human component can be excluded from a process. As e-Business makes it possible to support processes by ICT, and automate them the level of automation becomes an important factor for the business processes. Automation aims at replacing human activities by an IS that results in the limitation of mistakes and in cost reduction. As the intervention of humans can not be excluded fully an automation level of 100% is only a theoretic assumption.

level of standardisation

This factor examines to what extent technical and economic standards are used by companies. We focus on standards that are promoted by special institutions established in a standardisation process. Standards are cable to increase the process quality and to enable communication as well as transactions between suppliers and customers. Summarizing standardisation supports information, communication and transaction processes.

level of transaction support

This factor examines in what way, to what extent and by what means internal and external transactions are supported by ICT. A transaction takes place when a product or service is transferred over an interface. Transaction can be spilt in a various number of different phases. In e-Business they follow similar rules than in the offline business and SCHMID and LINDEMANN (1998) introduce three phases of an e-Business transaction:

- **Information:** The objective of this phase is to inform about products and services that the customer may be willing to buy. Customers want to be informed about the suppliers of the products and services, their specifications, price and delivery conditions. The customer evaluates this information and selects one product or service.
- **Agreement:** In this phase the negotiations between the potential partners are the main objective. The conditions of the transaction are agreed upon and the contract is prepared.
- **Settlement:** In this phase the contract is fulfilled. The products or services are delivered and payment is executed.

E-Business aims to support all transaction phases. Most of the companies already support the first phase, for example they give information about their products or prices.

level of integration

This factor examines to what extent connections are implemented in a company. Integration means the capability to connect humans, tasks and information and aims at the holistic work of processes. It considers the integration of suppliers and customers as well as the connection of the different parts of the company. The pre-requisite for an integrated information process is an integrated database, for example the relevant data has to be defined, stored and used within the whole company. We can state therefore three aspects of integration: level of internal integration, level of external integration, and the level of data integration.

level of information availability

This factor examines to what extent the need for information can be fulfilled by the information already available. Information is manipulated data that is in some special way useful for the recipient. As e-Business is dependent on the flow of information (Yang and Papazoglou 2000) it is compulsory that the aspect of information collection, storage, and retrieval is regarded when measuring eBIS maturity. There also needs to be a balance between the date of information and the efforts that have to be made to guarantee up-to-date information.

level of user acceptance

The technical performance of an electronic system in the organization represents only one aspect of e-Business implementation. It is also important if and to what extent the system suits the needs of the users and their special tasks. This aspect is represented by the factor user acceptance. Numerous studies deal with the construct of user acceptance (for example Davis 1989, van der Heijden 2004, Mathieson 1991).

5 DISCUSSION

Our initial research results extend the existing knowledge about eBIS and introduce factors that influencing the performance and the maturity of such an IS. The factor approach with its measurable values enables a more precise measurement of e-Business Information System maturity. Maturity in our model can be measured in an objective manner and is no longer decided upon on the basis of descriptions. Hence, the maturity level can be specified by the result of an assessment process which depends on facts and figures. Knowing the present stage of maturity allows detailed planning of future steps in order to improve eBIS maturity. The limitations of the proposed approach result from the development status of the study. As research is still in progress and has so far concentrated on revealing the basic principles in measuring eBIS maturity, the validation of the chosen factors and the criteria within the factors, as well as the application of the model itself is still missing. For validating the factors and the criteria an empirical study will be conducted evaluating governmental and industrial eBIS. The results will be used to revise and to refine the model.

The significance of this research will be the development of the first objective eBIS maturity model and demonstration of the application and benefit of the model. The proposed model will make a contribution to the area of maturity models that have very successfully been used to evaluate organization's capabilities in a certain field, in this case, the field of eBIS. Additionally the outcome of future model deployment by companies or governmental agencies can lead to improved cost control, better preparation for future competition, better customer relationship management, and potentially higher profit.

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