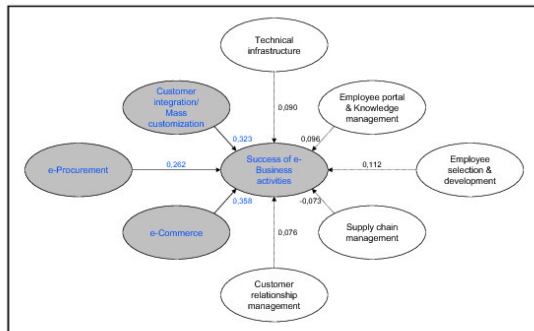Michael Haenlein (Autor)

An Exploratory Investigation of E-Business Success Factors Using Partial Least Squares Analysis

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Chapter 1: Introduction

1.1 Definition of relevant terms: e-Commerce vs. e-Business

Since the Internet was born in the early 60s and became viable and widely available for business use in the mid 90s (Urbaczewski *et al.* 2002), more and more companies have taken advantage of the tremendous decrease of information transferring cost, which this medium offers them. As every value chain activity has both a physical and an information processing component (Porter *et al.* 1985), the Internet has the potential to influence all processes of a company. Therefore, an increasing number of managers have embarked on the quest for potential uses of Internet-technology in their own business environment during recent years – a development "not dissimilar to the Australian gold rush several hundred years ago" (Evans 2001, p. 18).

One of the most widely known applications in this context is certainly e-Commerce, which can be defined as the use of computer networks to conduct business – basically the buying and selling of goods, services and information – electronically with one's suppliers, customers and competitors, or among customers (Urbaczewski *et al.* 2002). Although the basic idea behind this application is not new, as since the invention of the telephone by Bell in 1876 countless business deals have been conducted "electronically" over telephone networks (Li 2003), e-Commerce differs as it requires the use of "the Internet-platform and in particular the web" (Chaudhury *et al.* 2002, p. 6). Additionally it can, in a broader sense, even include other business activities, besides buying and selling, in which the electronic communication medium plays a central role, such as "the communication of information, the management of payment, the negotiating and trading of financial instruments, and the management of transport" (Heng 2003, p. 104) – these extra activities bringing it more in line with another central term in this context, namely e-Business.

While the definition of e-Commerce as stated above can be considered as accepted in the academic world, the question of what is included in e-Business and what is not is far more ambiguous. Generally speaking the "term e-Business is being used to encompass both commercial and non-commercial activities on the net" (Li 2003, p. 2) and, as most authors agree that "doing business electronically is not merely buying and selling on the Internet" (Heng 2003, p. 114), e-Commerce is only a subset of e-Business (Chaudhury *et al.* 2002, p. 31; Evans 2001). For example Deitel *et al.* state that "the terms e-Business and e-Commerce, often confused with one another, are different. [… While] e-Commerce involves exchanges among customers, business partners and the vendor […] e-Business is composed of these same elements, but also includes operations that are handled within the business itself" (Deitel *et al.* 2001, p. 8). Also, Chaudhury and Kuilboer stress that "while e-Commerce […] focuses on conducting basic transactions with customers and suppliers online, e-Business encompasses all the activities of a company that make e-Commerce possible" (Chaudhury *et al.* 2002, p. 30). In my thesis I use the definition of Evans, which follows the same line of thinking, and defines e-Business as "the electronic integration of all operations within a business that link with customers, suppliers, partners, and employees", including components such as "marketing, order entry, lead identification, stock tracking, order fulfillment, distribution, and sales support" (Evans 2001, p. 11) – applications which have two components in common: a web interface and the network communication infrastructure (Evans 2001).

1.2 Objectives of the thesis and research questions to be answered

The high prominence of e-Commerce and e-Business during the last years, mainly evoked by the rise and fall of an inestimable number of Internet start-ups all over the world, has lead to a discussion about the potential effects which the Internet might have on the overall economic environment. On the one hand some authors state that "electronic commerce […] increasingly will help to shape modern society as a whole" (OECD 1999, p. 143) and that "the web marketplace has introduced an entirely different economic model for many enterprises" (Noyce 2002, p. 89) by making information about a transaction often more valuable than the transaction itself. In light of the potential effects the Internet may have on companies (e.g. reduction of time and transaction cost, increased inter-dependency among businesses, Heng 2003) and the whole economy (e.g. deflationary effects, increase in national

output, Heng 2003), some researchers even hold the view that not adopting an e-Business model will place companies "in precarious and less competitive positions" and that "survival may require enormous investments in IT to enable them to become e-Business ready" (Chen *et al.* 2002, p. 376), together with changes such as the re-engineering of management processes and structures (Chen *et al.* 2002).

On the other hand, another group of scientists still question whether the Internet, which is "an enabling technology – a powerful set of tools that can be used, wisely or unwisely, in almost any industry and as part of almost any strategy" (Porter 2001, p. 64), really changes everything and renders all the old rules about companies and competition obsolete. Where, for example, e-Commerce is concerned, one can hold the view that "traditional commerce and e-Commerce in reality do not differ in their practices, i.e. buying and selling goods or services" (Evans 2001, p. 18) and that it is only part of a general trend towards non-store shopping, that includes also catalog and television home shopping (Wood 2001). Also the work of Eggert (2002) gives an indication that the effects of e-Business might be less substantial than they may seem at first glance. Based on a survey of 315 clients of a German retail-bank he showed that there is no substantial difference between traditional banking relationships and relationships which are primarily carried out using online tools. This point of view is also reflected in the editorial policy of some leading business journals. David W. Steward, former editor of the Journal of Marketing, for example stated: "The Internet bubble is barely visible in the content of the journal. I believe this says something positive about the journal and its review process, as well as the field of marketing. […] It is important for the most influential journal in a field to remain above the hype and faddishness that often characterize the popular business press and many consulting practices. The credibility of the journal and the discipline rests on the ability to distinguish the important and general phenomena from the trivial." (Stewart 2002, p. 1).

The controversy about the potential ways in which the Internet might shape the existing business environment makes it obvious that it is no magic wand introducing a completely new era of business, but that there may be significant advantages for any company when using it as a supporting tool. It is, therefore, not surprising that during the last years several researchers have tried to identify which e-Business tools, such as e-Commerce, customer relationship management or e-Procurement, may improve company performance and which

factors drive success in e-Business (e.g. Amit *et al.* 2001; Böing 2001; Ellram *et al.* 2002; Keeney 1999; Strauss *et al.* 2002; Wilson *et al.* 2002). However, apart from one exception (Strauss *et al.* 2002), all these articles share the limitation of only focusing on the analysis of single, isolated concepts, without taking the potential effects of other concepts into account. Consequently, even though there is information available about success factors of certain e-Business concepts (e.g. factors influencing success of e-Commerce, Ranganathan *et al.* 2002), it is still rather unclear which of these concepts have any significant impact on company success, when taking the effect of other concepts into account. Therefore, the first objective of my thesis is to make a contribution in that context by trying to answer the question:

Which e-Business concepts have a significant influence on company success when taking the effect of other concepts into account?

Searching for potential relationships between managerial actions, such as the implementation of e-Business concepts, and company success has long been one of the most important research topics in the study of organizations (March *et al.* 1997). Starting with articles by Daniel (1961) and Rockart (1979), the analysis of performance as a dependent variable has been of increasing interest to researchers and became very popular between the mid 70s and mid 80s, due to various articles published dealing with an analysis of the PIMS database (Buzzell *et al.* 1975; Ramanujam *et al.* 1984; Schoeffler *et al.* 1974). However, especially during recent years, some have also raised their voices against this approach and highlighted several issues and limitations associated with it (March *et al.* 1997; Nicolai *et al.* 2002). But today most authors agree that (empirical) success factor analysis can never replace an individual strategy formulation process in a company, but can give useful insights concerning the improvement of operational effectiveness.

Above all, the (apparently) contradictory results of several studies, which have been identified in various meta-analyses (see, for example, Szymanski *et al.* 1993 for an analysis of the market share/ profitability relationship; Van der Werf *et al.* 1997 for potential first-mover advantages), were sometimes used as an argument against success factor analysis (Nicolai *et al.* 2002). Yet, this reasoning is only convincing at first sight, as these meta-analyses agree that contradicting results are more due to operational weaknesses in the

empirical research process, than a result of general problems associated with success factor analysis. Particularly the operationalization and validation of constructs has often been criticized as a limitation of studies in that field (Pearce *et al.* 1987; Szymanski *et al.* 1993; Van der Werf *et al.* 1997). However, this does not come as a surprise given that, for example, since the 80s marketing scholars have already been raising their voice against the lack of construct validation in the marketing discipline (Churchill 1979; Jacoby 1978). Therefore, this point is also of special interest for information systems research. Even though more and more authors have started to put emphasis on construct validation during the last few years (e.g. Palmer 2002; Raghunathan *et al.* 1999; Torkzadeh *et al.* 2002), a recent literature review of Boudreau *et al.* shows that "the field has still not reached the point where validation is the rule rather than the exception" (Boudreau *et al.* 2001, p. 11). Consequently, the second objective of my thesis is to provide some additional insights into the question:

Which indicators should be used to operationalize e-Business concepts such as e-Commerce, mass customization and e-Procurement?

My answer to these research questions is based on a mail survey, which I carried out among 83 companies in Germany between February and April 2003. Due to the low number of responses, resulting from a response rate of approximately 7%, it was necessary to apply statistical techniques especially suited to small sample research. Additionally, because of the absence of validated operationalizations for the key constructs included in the model, my study must be seen as being exploratory in nature. Consequently, I applied statistical techniques especially suited for (exploratory) statistical analysis based on small sample sizes. These methods include imputation techniques (particularly nearest neighbor hot deck imputation) to deal with the problem of missing values, partial least squares analysis for the estimation of the structural equation model, statistical power analysis to determine an appropriate significance criterion for statistical testing, and forward stepwise regression to identify potential interaction effects between different variables in the model. As the majority of these approaches go beyond methods normally applied in empirical research, the third objective of my thesis is to give a brief introduction to their history and application as well as the pitfalls associated with using them. This is especially valuable as at least some of them (e.g. statistical power analysis) have been primarily discussed in a mathematical and psychological environment up to now and not made their way into research articles dealing

with business issues (see, e.g. Baroudi *et al.* 1989, for an analysis of statistical power in MIS research) – maybe partly due to the fact that there is a lack of easy to understand literature covering these topics. Consequently, this thesis also intends to cover the question:

Which statistical techniques can and should be applied when dealing with (exploratory) statistical analysis based on small sample sizes?

To summarize, my thesis intends to answer the following three research questions:

1. Which e-Business concepts have a significant influence on company success when taking the effect of other concepts into account?
2. Which indicators should be used to operationalize e-Business concepts such as e-Commerce, mass customization and e-Procurement?
3. Which statistical techniques can and should be applied when dealing with (exploratory) statistical analysis based on small sample sizes?

1.3 Approach and structure of the thesis

In the next chapter (chapter 2) I give an introduction into the history of success factor analysis in general (chapter 2.1) and in e-Business in particular (chapter 2.2). In this context I also review and comment on critical arguments which have been raised against this approach (March *et al.* 1997; Nicolai *et al.* 2002). The purpose of this chapter is to show which findings can be generated by analyzing performance as a dependent variable and to identify research opportunities in the context of success factor analysis in e-Business which serve as a motivation for the first research question stated above.

Chapter 3 shows the design of the survey instrument, which served as a basis for the mail survey. For this I first define my research model, consisting of eight interdependent (high-level e-Business concepts), one dependent (success of e-Business activities) and 16 moderating variables (chapter 3.1), building on the work of Schoder, Strauss and Welchering (Schoder *et al.* 1998), as well as Strauss and Schoder (Strauss *et al.* 2000; Strauss *et al.* 2002). I then review relevant literature in e-Business in order to operationalize each component of the model and to compose the questionnaire (chapter 3.2).

Chapter 4 gives a brief introduction into techniques that can be used to increase response rate in a mail survey and focuses on how I carried out data collection (chapter 4.1). I then review literature on structural equation modeling, with a special emphasis on the distinction between formative and reflective indicators, and discuss the communalities and differences between covariance- (e.g. LISREL) and variance-based (e.g. PLS) structural equation modeling techniques (chapter 4.2) in order to chose an appropriate technique for data analysis.

Chapter 5 deals with an analysis of responses received and data treatment. I first calculate response rate and test for the existence of response bias in the raw database (chapter 5.1). Next I present a review of different techniques to deal with missing values and apply a nearest neighbor hot deck imputation to the dataset (chapter 5.2).

In chapter 6, I estimate the research model defined in chapter 3.1 by performing a partial least squares analysis. For this I first give an introduction into construct validation in general and its application in the case of formative indicators in particular, before I analyze the (formative) indicators for each construct by examining their variance inflation factor (chapter 6.1). I then review literature on statistical power analysis to determine an appropriate significance criterion for statistical testing (chapter 6.2). After that, I estimate the model using partial least squares analysis and determine standard errors for the estimated values by bootstrapping in order to test the significance of each path (chapter 6.3). As a final point, I introduce forward stepwise regression as a technique to test for potential interaction effects between different e-Business concepts.

Finally, in chapter 7, I interpret and discuss the results of the statistical analysis (chapter 7.1) and highlight some limitations of my work and areas of further research (chapter 7.2). The thesis finishes with a summary in chapter 8.