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BUSINESS VALUE OF INFORMATION SYSTEMS:

A RESOURCE-BASED STUDY OF VALUE CREATION –

THE CASE OF HUNGARIAN E-TAILERS

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TABLE OF CONTENTS

List of Figures

List of Tables

1. Introduction

"You can see the computer age everywhere but in the productivity statistics."

Solow, 1987, p. 36

"If you can't measure it you can't manage it."

Datamonitor, 2004

1.1 Motivation and focus

I have put in the focus of my research – in the current paper, as well as during the past eight years – the capability of information technology (IT) to create business value. I am far from being alone in doing so; in their literature review, Melville, Kraemer and Gurbaxani [2004] give an overview of 202 scientific articles written in the English language specifically on business value creation by IT, while Melville and al's review article in question has been quoted over a thousand times [Google Scholar, 2012]. At the latest ICIS conference, one of the most important international scientific forums in the field of IT, a separate session was dedicated to the value and economics of information systems [ICIS, 2011]. Eric Brynjolfsson, one of the first researchers of IT value creation and Director of MIT Center for Digital Business, has dealt with the subject for nearly 20 years and still considers it exciting; he published two related articles in the first months of 2012.

As early as the beginning of the 2000s, a question already arose in me about how and within what period of time immense and complex, even multi-million-dollar or multi-billion-forint corporate IT investments could be recovered, if at all. In the United States, IT had a 30% share in corporate investment budgets in 1990, while it represented as high as nearly 40% in 2000, before the stock market crash [Bőgel, 2003]. According to the Gartner Group, a prestigious IT market research firm, worldwide IT spending ranged between 0.9% (power generation) and 5.7% (financial services) of revenue, depending on the industry, in 2009, while it was 3.6% on average in the region also including Europe [Potter – Smith – Guevara – Hall – Stegman, 2010].

Gartner also puts worldwide IT spending at over USD 2500 billion in 2012, signaling a 1.6% growth on the previous year despite corporate budget cuts [Gartner,

2012]. Domestic companies continue to upgrade their technologies as well; at the turn of the millennium, Hungarian firms spent 62% of their IT budgets – 44% in the case of budgets exceeding HUF 100 million – on investments and upgrades [Drótos – Szabó, 2001, p. 19]. These few statistical data selected with the purpose of illustration certainly arouse professionals' curiosity as to whether there is any value creation behind the figures.

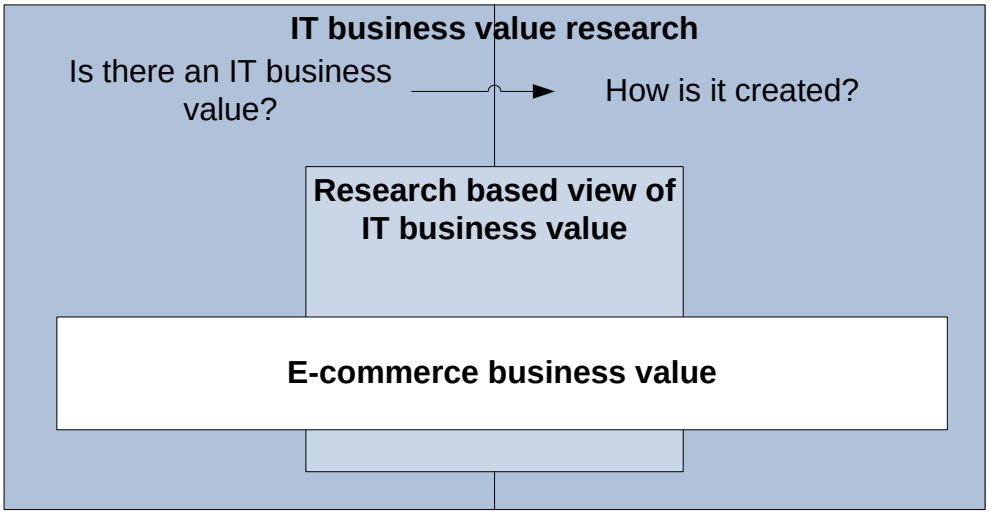
That said, it was not until recent years that the business sector had started to apply the traditional ROI approach to IT investments. Domestic studies have revealed that a mere 44% of corporate strategies cover the business aspects of IT, including e.g. the issue of applications providing a competitive edge or the cost-benefit analysis of proposed applications [Drótos – Szabó, 2001, p. 18]. While, according to a survey conducted in 2001, only 22% of companies used some kind of financial analysis to value corporate portal projects, five years later over 60% of businesses applied financial indicators to value IT investments and 47% used specifically the IRR. [Alter, 2007]. Although in the highly IT-intensive banking sector five out six banks already made net present value calculations for a preliminary assessment of IT investment options, ex post financial valuation did not happen in half the cases [Hitt – Frei – Harker, 1999].

Whereas, the corporate sector also badly needs to apply the business/financial approach at times, especially in the light of today's tight budgets. After all, as the Standish Group's [2009] study has demonstrated, only 32% of IT projects are successful, i.e. meet requirements in terms of deadlines, budgets and functionality, while 24% can be regarded as complete failures so that the system is terminated before it is even installed or completed. Meanwhile, again as found by the Standish Group's researchers, among the success criteria of IT projects the setting of clear business targets ranks third right after stakeholder involvement and support from top executives [quoted by Bőgel, 2003, p. 3]. In other words, according to one of the mottos of my paper, "if you can't measure it you can't manage it", or at least you will find it harder to manage. It is my personal opinion that the most important benefit of detailed ROI calculations to the company lies not necessarily in the actual calculated value but in the fact that the key value creation factors to which return responds the most sensitively are revealed and become clear to decision-makers, thus enabling project management to focus on them.

1.2 The focus of empirical research

The research literature of IT business value encompasses "any conceptual, theoretical, analytic, or empirical study that examines the organizational performance impacts of IT" [Melwille et al., 2004, p. 288], whether performance is formulated as sustainable competitive advantage or in terms of financial indicators. In the literature overview in the first part of my dissertation I will present the most important approaches and scientific results of this broader field of research (see the external layers of Figure 1). This accumulated knowledge was the basis on which I have built my research plans set out in the second part of the paper. As shown in Figure 1, I have narrowed down the area subject to empirical study both methodologically and terminologically, giving thorough consideration to both choices. I have selected the resource-based view (RBV) as the theoretical background of empirical study and corporate e-applications as its technological focus.

Figure 1. Research Topic in Perspective



The basic question of the resource-based view is which corporate resources (equipment and capabilities) can be the source of a competitive edge (also captured in terms of financial indicators) [see e.g. Barney, 1991; Grant, 1991 and Peteraf, 1993]. This approach serves as a widely accepted scientific basis for research on IT business value, its application being supported by the following arguments:

- Using the resource-based view, the existence and manner of IT business value creation, i.e. its extent and its process, can be studied in parallel.
- The RBV clearly connects corporate (IT) resources and the sustainable competitive advantage using a well-defined and financially measurable variable, namely the profit differential as measured against competitors.

- Using the criterion of sustainable competitive advantage makes IT resources comparable with each other and with other resources of the organization [Wade – Hulland, 2004, p. 109-110].
- While the RBV recognizes the mass-product nature of IT equipment, it also considers the ability of certain complementary human, management or other business resources conceivable to create a competitive advantage [Zhu – Kraemer, 2002].
- Empirical studies have shown evidence that the explanatory power of the resource-based view is greater than that of contingency theory in cases where the effects of strategy-, growth- or revenue-driven IT investments are analyzed [Wonseok – Pinsonneault, 2007].
- Last but not least, the RBV is one of the mainstream theories of IT business value creation and thus it serves as a "lingua franca" enabling the comparison of research findings.

The empirical research focuses on domestic e-commerce but e-commerce is only one of complex corporate IT applications and, of course, has not insignificant specialties. These features make e-commerce services an excellent subject of studies on value creation:

- Based on the historical trends of IT business value research, the current era is the age of outward-looking IT applications [Bőgel, 2009a], i.e. the Internet [Applegate – McFarlan – McKenney, 1996].
- Research on the trends of IT specialized literature suggests that the latest large wave was about e-commerce [Baskerville – Myers, 2009]. Although the number of studies on e-commerce peaked around the turn of the millennium, it has remained high to date and thus a great number of market actors can now be observed. Also, a longer time series data are available for more robust quantitative research. E-commerce has continued to be a key area of research for Erik Brynjolffson, MIT's number one researcher of IT business value [MIT, 2012].
- Liang, You and Liu's [2010] meta-analysis based on an overview of 42 empirical IT business value studies has concluded that it is primarily outward-looking technological resources that impact financial performance.

- E-commerce is an essential element of the corporate IT portfolio, which is clearly demonstrated by the fact that the use of e-commerce has a 17% share in the ICT (information and communication technology) component of the European e-Business Readiness Index [Castaings – Tarantola, 2008, p. 10.].
- In 2010, close to 27% of Hungarian company websites made purchase and sale transactions possible for their customers; that figure was only 14% in 2007 [KSH, 2008 és 2011]. 16% of the net sales revenues of businesses covered by the KSH's (Central Statistical Office) data collection in 2009 came from e-commerce, including 6.3% via the Internet [KSH, 2011]. Online retail sales amounted to HUF 99 billion in 2009; HUF 133 billion in 2010; and as high as HUF 155 billion in 2012, excluding tourism and financial/insurance services [GKIeNET, 2010, 2011, 2012]. Thus, market trends seem to clearly indicate that e-commerce is a noteworthy segment of the Hungarian economy in every respect. In addition, the industry (retail trade of IT and telecommunications equipment) selected as the subject of study is among the most popular segments of the domestic e-market [Kis, 2009].
- It remains an open question whether the corporate use of e-commerce can serve as (sustainable) competitive advantage or whether it is driven by no more than strategic necessity – or whether perhaps neither is the case. A similarly undecided issue is whether electronic commerce offers benefits to smaller businesses (e.g. through the exploitation of the phenomenon known as long tail[1]) or whether larger companies can also capitalize on it (via network effects and the creation of intangible assets).
- Finally, and again not least, the outward-looking nature of e-commerce makes it an ideal subject of large-sample research based on publicly available data [Bőgel, 2011]. For a large part of B2C, e-commerce capabilities can be directly observed through their web pages, and databases related to infrastructure or popularity are also readily and publicly available.

In addition to the theoretical-methodological framework, the selected sample also delineates my research from a geographical and sectoral aspect. My interest, the availability of data and the unexplored state of the subject have motivated me to scrutinize Hungarian businesses. In selecting the industry, I aimed to choose one of

[1] Long tail here refers to a special feature of Internet-based commerce whereby it is able to create an effective distribution channel for products that can be sold in very small quantities but are available in a very wide variety [first: Anderson, 2004].

those sectors which are commonly known to be e-commerce-intensive but are less researched. That was how I came to opt for the retail trade of IT and telecommunications equipment (abbreviated as ICT retail trade, where ICT stands for information and communications technology).

Besides, the period of time under review is also an important characteristic of my research: I have primarily focused on the financial years 2009-2010. Non-food retail sales dropped by 8.7% in 2009 compared to the previous year [MTI, 2010, based on KSH]. Therefore this period can also be exciting since I have been able to examine the effect of e-commerce in a pessimistic, basically recessive economic environment, which can also shed new light on the importance of technology: Has e-commerce technology helped retail trade companies survive in the Hungarian market in the years following the financial crisis?

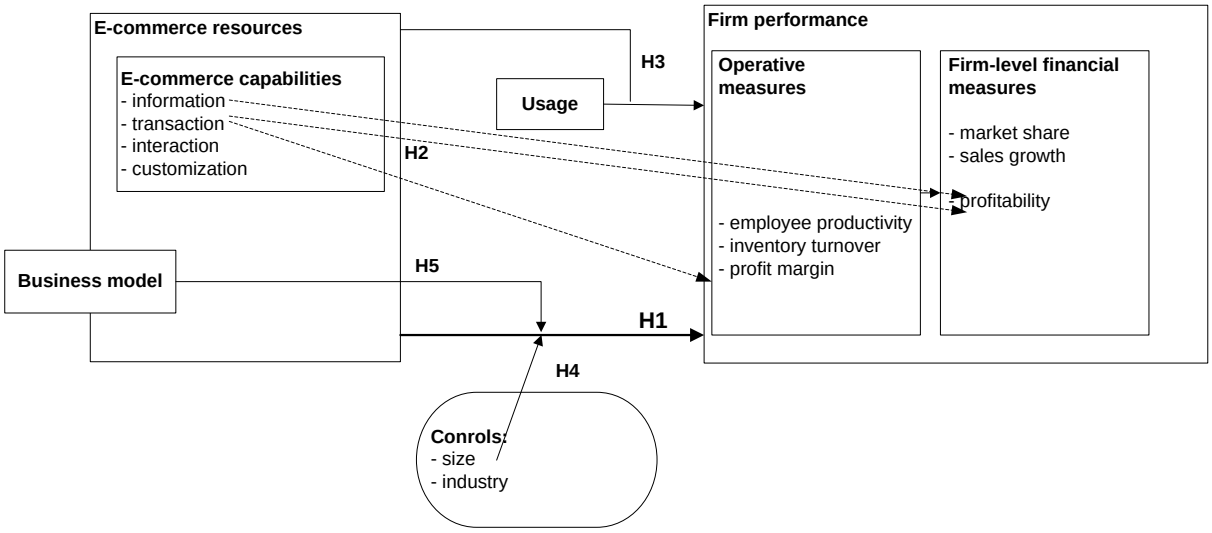
1.3 New approaches and research questions

The research model I use (Figure 2) basically corresponds to both the general and resource-based literature on business value creation by IT. I examine e-commerce resources using the method widespread in specialized literature, i.e. by information/transaction/interaction/customization capabilities and the form of infrastructural equipment [e.g. Zhu, 2004]. In respect of financial information, I have chosen to use accounting data based on the sample size and available data (even though I know that DCF-based measurement would be even better from a shareholder value perspective – see also Section 2.4).

Overall, my model is based on earlier foundations laid by studies on American samples [primarily Zhu, 2004], but a novelty element is that I have also included in the study indicators related to usage and to the business model. Davern and Wilkin [2010] suggest improving the demonstrability of value creation by employing perceived output variables (such as usage) in studies in order to show direct effects together with separately observable output variables (such as financial performance) to measure indirect subsequent effects. DeLone and McLean's [1992] famous model dealing with the success of IT projects already apply usage as an intermediate variable between IT capabilities and technology and their individual and corporate effects. When the authors revised their model [DeLone – McLean, 2003] ten years later, they dedicated a separate chapter to e-commerce still assigning a main role to usage. Koufaris [2002] integrated usage into the research model of e-commerce value creation as part of the technology acceptance theory, while Zhu and Kraemer [2005] did so within a technology-

organization-environment framework. Based on all of this it can be said that including usage as an intermediate variable in the models of related research studies is not a unique practice, but is certainly innovative in the resource-based literature on business creation by e-commerce.

Figure 2. Research Model and Hypothesis



The inclusion of information related to the business model or the sales channel in the analysis of e-commerce value creation is not completely unique either. Strategic choice in respect of the sales model has been taken into account by literature on value creation by e-commerce before; e.g. in this regard, a central question is whether shop trade or online trade is more competitive, or perhaps a combination of the two [e.g. Subramani – Walden, 2001; Dehning et al., 2004]. I personally believe that a study on value creation by IT should seek to take into consideration as many contextual factors and strategic decisions in the analysis as possible; in this current case, the selected business/sales model was possible to include in the study.

Furthermore, one of the innovations of the research methodology is the use of automated crawler-based data collection. Web crawlers – or spider-based search engines – are computer programs that crawl on the worldwide web automatically and systematically collect data (see also Subsection 7.3). Crawlers are useful tools to build large databases in e-business context, where the availability of public databases is limited. Automatic data gathering using crawlers can be more effective than qualitative questionnaire-based surveys and is faster than manual data collection. Thus, I tried to make use of the possibilities offered by Internet technologies, which not only enabled me to conduct an efficient and objective survey but also to enrich the crawler-based methodological approach initiated by the Budapest Corvinus University's E-Business

Research Centre by adding yet another area of application [Nemeslaki – Pocsarovszky, 2011 and 2012].

Naturally, in the central part of the dissertation I will present in detail the theoretical roots of my research model and the research plan built on it. Before that, however, let me introduce my main research questions:

1. Can a positive relationship be demonstrated between the commercial capabilities and business performance of companies in Hungarian ICT retail trade?
2. Can the inclusion of visits (i.e. usage) of websites in the study as an intermediate or complementary variable contribute to exploring and understanding that relationship?
3. Do the impacts of information, transaction, interaction and customization capabilities on company performance differ?
4. Do the impacts of e-commerce capabilities differ by the business size or sales model of ICT retail traders?

Based on the above, it can be seen that in its questions and focus my proposed research follows the traditions of studies on the IT paradox as it attempts to demonstrate or disprove the relationship between certain IT resources and corporate financial and competitive performance within the framework of a quantitative study on a large sample and on the basis of accounting data. Furthermore, my model reflects the resource-based view of IT value creation and is more like earlier studies by Zhu and Kraemer [2002], Zhu [2004], or Merono-Cerdan and Soto-Acosta [2007].

1.4 The structure of the paper

My dissertation is divided into three parts. The first part (Sections 2-4) gives a broad overview of specialized literature on the core questions of IT business value creation and systemizes the answers based on empirical evidence. After outlining the concepts covered by related literature and the systemization criteria used by other authors, I will give an overview of specialized literature in relation to the following questions:

- *Does IT create business value?* Do IT investments have an effect on productivity? Do IT investments create a (sustainable) competitive advantage?
- *How does IT create business value?* What are the critical sources of value creation? What are the necessary and sufficient conditions of value creation?

- *How to measure business value created by IT?* What effects should be taken into account in valuing it? What value measurement or valuation methodology should be selected?

The second part of the paper (Sections 5-7) lays the foundation and presents the empirical research I have conducted. At first I summarize the immediate research background of the subject and literature on e-commerce value creation, again along the above questions, but now with a focus on e-commerce. That will be followed by building the model, formulating hypotheses and finally presenting the research methodology.

The third part (Section 8-10) discusses research findings in detail. First an exploratory study of domestic ICT retail trade is conducted together with a practical analysis of the results reached. That is followed by the itemized testing of the formulated hypotheses from multiple aspects with the use of a wide range of mathematical statistical tools. Here I present my findings based primarily on factor and cluster analysis techniques as well as regression calculations and attempt to interpret and explain them. Naturally, the dissertation is closed by a summary highlighting and further considering theoretical and practical conclusions.

1.5 Acknowledgements

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I consider myself fortunate enough to be assisted by two advisers during the years of my doctoral studies. Dr Miklós Virág was not only a theme adviser to me but also stood behind me as department chair creating a balanced, free and inspiring work environment and ensuring resources necessary for the research.

Among my colleagues, I am indebted to Károly Pocsarovszky for making crawler-based data collection technologically feasible; to Péter Juhász for his insightful critiques and methodological ideas; and Béla Szörfi and Tamás Nyitrai for expert advice on statistical issues. Besides, my appreciation naturally goes to all my colleagues at the Department of Enterprise Finances of the Corvinus University of Budapest for not sparing time and energy in helping my work during workshop discussions.

I wish to express my thanks to Péter Fehér and Géza Sebestyén for their thorough and insightful critiques; I tried to follow their advice. Similarly, my

appreciation goes to the professors of doctoral consortia of CEMS-NITIM, in particular Ulrike Lechner (University Bw München), Paola Bielli (Bocconi University) and Francesc Miralles (University Ramon Llull Barcelona), who continued to follow and guide my work between 2006 and 2012.

My very special thanks to my husband, Dénes Csiszár, who was the primary shaper of my technological outlook and gave his unwavering support for my idea of pursuing a scientific career. I am grateful to my mother, Olga Horváth, my first indefatigable – and hopefully not last – reader.

Finally I express my gratitude to my father, Géza Aranyossy and my daughter, Zoé Csiszár – for my past and for my future.

2. The business value of information systems – Basic concepts

2.1 Information technology and information systems

Literature on IT business value looks at the effects of information technology on organizational performance [Melville et al., 2004, p. 284], i.e. its research focus also depends on how information technology (IT) as such is defined. Orlikowski and Iacano [2001] distinguish five conceptual approaches to information technology: (1) the tool view, (2) the proxy view, (3) the ensemble view, (4) the computational view, and (5) the nominal view. In the first case, IT is considered a performance improvement or information processing tool. The second view tries to capture (replace) information technology through one if its critical characteristics, such replacement being for instance the individual judgment on the usefulness of the system; the proliferation of the technology; or its investment value expressed in pecuniary terms. The third approach views technology as the totality of its components. The computational view interprets IT as an algorithm, while the fifth (nominal) approach summarizes those studies in which the presence of information technology is only nominal, e.g. in the literature on IT outsourcing.

Furthermore, literature on IT business value draws on several of these views [Mellwille et al., 2004]. Some schools look upon IT as a tool to maximize productivity (1. the tool view) while in empirical research they often seek to capture, measure and replace it with the amount of money (the proxy view, see e.g. Subsection 4.1). Also belonging to the proxy view is literature on the diffusion and acceptance of technology, which in my view is closely related to the question of value creation (see Subsection 4.3.2). Finally, some studies go beyond the "black box" view and scrutinize technology in a multi-factor environment with its attendant human and organizational factors (3.ensemble view; see e.g. Subsection 4.3.1 on the resource-based view).

In addition to this, it is to be noted that many studies fall under the above-mentioned "nominal" category in that they treat IT without any particular definition and specification. (Even literature overviews written by seminal and renowned authors lacks the definition of information technology or information systems, e.g. Kauffman and Weill, 1989; Brynjolfsson, 1993; or Chan, 2000). In many cases they define and use IT investment rather than IT. For example, Dedrick, Gurbaxani and Kraemer's [2003, p. 4] study *"IT investment, broadly defined, includes investments in both computers and*

telecommunications, and in related hardware, software, and services." (3. the ensemble view).

On my part, I am inclined to have a simple functional view, similarly to Carr [2003, p. 49], whereby IT denotes *"the technologies used for processing, storing, and transporting information in digital form".* However, it does not necessarily help delineate the area of complex corporate investments; in addition, it is also inconsistent with the broader perspective of the resource-based view applied below. On the other hand, early literature on IT business value approaches the concept of IT from a functional and technological aspect; e.g. Brynjolfsson and Yang [1996] *add software and potential IT personnel to the category of information-processing equipment* and refer to IT in that sense.

The strategic view corresponds to the concept synthesized by Piccoli and Ives [2005, p. 748.], defining the IT-dependent (or IT-based) strategic initiative – rather than information technology itself –, which *"consists of identifiable competitive moves that depend on the use of IT to be enacted, and are designed to lead to sustained improvements in a firm's competitive position".* Among their examples, the authors include business integration created by ERP systems, e-business, electronic Supply Chain Management (SCM) or e-commerce. This definition emphasizes not only the strategic context but also the role of technological resources (albeit inversely formulated) complementing technology.

The concept of *information system* (IS) is even more connected to the idea of complementary resources; it is defined as *"any combination of information technology and people's activities using that technology to support operations, management, and decision-making"*[2] [Ellison – Moore, 2003, p. 67.]. Similarly to the ensemble view, its somewhat more detailed and general definition [Gábor et al., 2007] is this: *"The information system is that part of the organization which provides, produces, sorts, uses and distributes information. It consists of human, technological and financial/economic resources."* Or, put differently, "*it is the totality of persons, activities and technical equipment performing the collection, processing, storage and provision of information related to the environment and internal functioning of the company and to transactions between the company and its environment"* [Chikán, 1997, p. 293].

[2] For an understanding of the concept of IS it may be worth mentioning the definition of *system* in the field of IT, whereby it is "a set of mutually cooperating components serving a shared purpose" or it is, as defined a bit more specifically in data processing, "a set of people, machines and methods organised to perform particular activities" [Molnár, 2002]

According to others, however, the conceptual distinction between IS and IT is heavy-handed; the frequency of their respective use is determined by the mainstream of research [Hirschheim – Klein, 2003]. Generally speaking, the IS literature mostly focuses on applying and placing IT in the corporate context, and therefore so does the current paper.

2.2 The business value of information systems

IT (or IS) business value in different studies can be equivalent to various effects on performance [selected from the compilation of Cronk – Fitzgerald, 1999], in terms of:

- the ability of IS to create a competitive advantage [Hitt – Brynjolfsson, 1994];
- the productivity of IS at the organizational level [Jordan, 1995];
- added value as the difference between revenues and expenses [Strassmann, 1990];
- the economic contribution of IS to management's profit-maximizing efforts [Banker – Kauffman, 1991].

The above approaches therefore assign some kind of financial – revenue or efficiency – indicator to the corporate performance of IT investments. Based on that, Cronk and Fitzgerald [1999, p. 44] define *IT business value* as follows: *"the sustainable value added to the business by IS, either collectively or by individual systems, considered from an organisational perspective, relative to the resource expenditure required".* This definition thus takes over the factor of sustainability from the literature on sustainable competitive advantage.

The notion of competitive advantage is usually also defined from the aspect of business value; i.e. a company has a competitive advantage if its engagement in market exchange has yielded a higher economic value than if the same company had not taken part in it [based on Piccoli and Ives, 2005, and Brandenburger and Stuart, 1996]. Or, put in more concrete terms, *a competitive advantage is what enables a company to realize a ROI higher than the industry average* [Clemons – Row, 1991, based on Porter]. It can also be seen from Porter's definition that the study of competitive advantage is closely related to the issue of return on IT investment; literature frequently handles the two questions together. Therefore, I will hereinafter mainly concentrate on the financial concept of value creation, as the theoretical framework – the resource-based view – selected for the empirical research also uses the concept of competitive advantage but

operationalizes it, as I do myself, mostly by means of financial indicators. (Besides, in Section 4.1.5 I will also briefly summarize the conclusions of research on IT competitive advantage in the field of strategy.)

Table 1. Basic Concepts of IT Business Value Research

Concept	Definition
Information Technology (IT)	*„as denoting the technologies used for processing, storing, and transporting information in digital form."* Carr [2003, p. 49.]
Information System (IR)	*„include any combination of information technology and people's activities using that technology to support operations, management, and decision-making"* [Ellison – Moore, 2003, p. 67.]
IT Business Value	*„the organizational performance impacts of information technology at both the intermediate process level and the organizationwide level, and comprising both efficiency impacts and competitive impacts"* [Melville, 2004, p. 287.]
IT Business Value Research	*„any conceptual, theoretical, analytic, or empirical study that examines the organizational performance impacts of IT*" [Melwille et al., 2004, p. 288.]

In addition to all this, in respect of IT business value in the current study I accept all definitions accepted in this field of science on the basis of detailed literature research as formulated by Melwille et al. [2004]. *Therefore, hereinafter IT business value will be understood as "the organizational performance impacts of information technology at both the intermediate process level and the organizationwide level, and comprising both efficiency impacts and competitive impacts"* [Melville, 2004, p. 287.]. Based on that, IT business value research encompasses *"any conceptual, theoretical, analytic, or empirical study that examines the organizational performance impacts of IT"* [Melwille et al., 2004, p. 288]. I consider these definitions fortunate since they are basically broad and with an inclusive nature and therefore indeed link together the different research orientations of literature on the subject.

Finally, Table 1 summarizes in what sense I will henceforward use the most important basic concepts under discussion. After clarifying the key concepts used in IT literature, I will go on to cover some of the basics of literature on value creation.

2.3 IT Business Value

Although, as is suggested by the points made above, literature on IT business value uses a rather broad concept of corporate value creation, it is worth at least taking a brief look at the concept of value creation as used in the field of finance. In financial literature, corporate value creation is normally and basically understood as maximizing shareholder value, i.e. the increase in business value less obligations falling on shareholders. The corporate goals are adjusted to the shareholders' goals and the shareholders of a business mostly aim to increase their own wealth. Thus, it is the task and responsibility of corporate leaders to "conduct the business in accordance with their (the shareholders) desires, which generally will be to make as much money as possible while conforming to their basic rules of the society, both those embodied in law and those embodied in ethical custom" [Friedman, 1970, p. 1]. Or, as Rappaport [2002, p. 19], one of the most famous representatives of the shareholder value view, formulates Friedman's thoughts, "the business venture has a single social responsibility in market economies recognising private property: it is to create shareholder value by means of lawful and fair methods."

No doubt there are other definitions of business value that take into account a wider range of stakeholders; e.g. Chikán [1994] identifies the making of profits as the basic corporate goal in addition to satisfying consumer needs.[3] In addition to consumers we could also include the interests of employees, business partners or even society and the environment; however, financial literature primarily considers personal redistribution by shareholders against profits generated to be the most effective for all stakeholders (while it mostly agrees with the idea and goals of wider social responsibility) [Tirole, 2005, p. 56-62]. And if we consider the fact that shareholders usually assign the management to run the undertaking then we cannot overlook the reasoning of the proxy view which contrasts shareholders' and management's interests. In this paper however, we confine ourselves to the same theory's proposed solutions, without delving into them, which are aimed to harmonize the interests of the two groups [see e.g. Ross – Westerfield, 1988 p. 13-16, or Tirole, 2005].

Shareholders' value is the present value of future cash flows derived from their business shares, which they can pocket basically in two ways: in the form of dividends

[3] Corporate finance literature related to value creation processes also broadens the concept of corporate value creation from the aspect of consumers taking into account the value produced for consumers, which comprises utility, time and place values [Wimmer, 2000, p. 2].

and by way of changes in the market value of business shares [Palepu – Healey – Peek, 2010, p. 316]. If, therefore, we accept maximizing shareholder value as the goal of businesses then corporate value creation is bound to be manifested in the growth of these factors. "Thus value maximization also necessarily means long-term wealth maximization for shareholders" [Copeland – Koller – Murrin, 1999, p. 18]. In turn, if "the objective of corporate finances is to maximize corporate value then the relationship between financial decisions, the corporate strategy and corporate value must be explored" for success [Damodaran, 2002, p. 9].

At this point it should be noted that literature distinguishes several different value concepts in respect of corporate value (and hence shareholder value). These include asset or book value, internal or yield value, real or fair market value, liquidation value, [Pratt, 1992, p. 12-17; Ulbert, 1994, p. 1-2], or, beyond all these, subjective value as defined from the assessor's point of view [Copeland et al., 1999 or Juhász, 2004[4]]. Besides the assumption of an effective capital market, the real market value at the meeting point of supply and demand[5] can be considered the best option. Since it is not always known, it can usually be estimated via the internal value approach based on future yields [Kazainé Ónodi, 2008]. Valuation techniques on the basis of discounted future cash flows can also be derived from basic calculations based on dividend yields [Palepu et al., 2010]. All in all, the corporate value is all those earnings which "the company realizes by way of its business activity throughout its entire lifetime and which is available to those supplying the undertaking with resources" [Copeland et al., 1999, p. 18].

Valuation methodologies can be categorized in several ways. For example, Martin-Hajdu [in: Fazekas, 2004, p. 95] distinguishes four sets of methods related to the above-mentioned value-categories, including the accounting value, replacement value, comparative market-price-based value and present value approaches. At the same time, Juhász [2004] only divides valuation methods into two large groups: static and market-based estimation procedures. Damodaran [2002, p. 11] basically distinguishes techniques based on discounted cash flows, multipliers and conditional demands. Palepu et al. [2010, p. 315] focuses on techniques of discounted dividends, discounted

[4] "Fair price can therefore be linked to a given situation, conditions, time and external circumstances and so the value of the same company is not identical for management, a trade investor or a layperson small shareholder"[Juhász, 2004, p. 9].

[5] Not only the lack of market value but also the distortion of market value can be a problem. Behavioural finance e.g. names three main effects that can divert market value from economic value, including investors' irrational behaviour, systematic behavioural patterns and limited arbitrage in financial markets [Goedhart M.- Koller T-Wessels D., 2002, p. 8, quoted by Kazainé, 2008, p. 10]

cash flow, discounted abnormal yields and multiplier-based valuation in a narrow sense. I would sum all these up in general terms along four large families of company valuation methodologies, as normally distinguished, as follows:

- Asset-based valuation – including accounting value and also liquidation, replacement or reproduction value.
- Valuation based on discounted future cash flows – i.e. the traditional net present value calculation, also including discounted EVA or APV (adjusted present value), but based on its logic this family includes the technique of discounted dividends or, on that basis, the models of discounted abnormal yields and discounted abnormal yield growth.
- Models also incorporating future decision flexibility – be it a decision tree or a real option valuation technique. Similarly to the first category, these techniques also rely on future cash flows and discounting, but because of the way they handle decision flexibility and uncertainty, literature often treats them as a separate category [Copeland et al., 1999; Damodaran, 2002 and 2006a].
- Market multiplier valuation – in this case the value of an asset is determined on the market value of a similar asset while the comparative market indicators used for the valuation can be based on the book value, revenues, profitability or special industry metrics [Damodaran, 2006a].

In this paper I will cover most of the above-described families of valuation methods in respect of IT investments: In Section 4.1 there will be a separate chapter on judging value creation from a capital market aspect, while Section 4.2 will focus on valuation challenges related to IT valuation with special regard to DCF and real option models. On the other hand, the empirical research designed by me primarily uses accounting data to quantify a company's competitive performance even though I am of course aware of the biased nature of such data from the aspect of value creation [see Rappaport, 2002, Section 2]. Adjusting a thorough DCF-based valuation or even accounting data on a company sample with several hundred of items would be such an information- and resource-intensive exercise that it certainly points beyond the scope of my dissertation. In addition, it often occurs that IT business value researchers or even company leaders [see Fiáth, 2002, p. 4] finally draw on accounting information within the framework of value orientation (for more details see Section 7.3.1).

3. The basic questions of IS business value

3.1 Five basic questions of IS business value research

Based on Melville et al. [2004, p. 298], the five basic questions of research on IT business value are as follows:

1. Is the IT resource associated with improved operational efficiencies or competitive advantage?
2. How does the IT resource generate operational efficiencies and competitive advantage?
3. What is the role of industry characteristics in shaping IT business value?
4. What is the role of the resources and business processes of electronically linked trading partners in impacting the value generated and captured by the focal firm?
5. What is the role of country characteristics in shaping IT business value?

Similarly to the first two questions, Barua and Mukhopadhyay [2000] also identified – although from a methodological aspect – the two most important research approaches related to IT business value, namely: (1) production-theory/economics approach (Does it have a value?) and (2) process-oriented approach (How is value created?). In my current work, in Section 4 I will, as I give an overview of literature, summarize knowledge amassed primarily along these first two questions, focusing on each question separately and their related scientific approaches. In my research I will also touch upon questions 3 and 5, albeit not in the form of comparative analysis but highlighting specific industries; I will examine retail branches operating specifically in the Hungarian environment. Their special features will be covered in Section 5.

3.2 An overview of earlier literature and setting up my own systemization model

Systemizing accumulated empirical and theoretical studies is not an easy task even if focus is only placed on two of the above-listed basic questions of IT business value. Since the 1980s, when looking at the most prominent English-language periodicals alone, one can find several hundred of studies on the subject. Mellville et al. [2004] for example have mapped 202 articles based on 11 of the most renowned American periodicals and on publications of 4 related international conferences and

references listed therein. Literature overviews compiled in the previous decade basically attempted to capture three main characteristics of studies for purposes of systemization, including the historical development of the field, the underlying theories and the characteristics of applied methodologies.

György Bőgel [2009a] – or also Murphy [2002] quoted by him – for instance has selected the historical viewpoint for an overview of the theme, for which he uses the Gartner Group's four-stage model as a framework. He distinguishes four historical phases as shown in Table 2, based on connections between business and IT [Bőgel, 2009a, p. 196-198, similarly to the systemization of Applegate et al [1996, in: Drótos, 2001].

Table 2. Historical Perspective of IT and Business Objectives

Era	**Gartner Group**	**Applegate et al. [1996, id.: Drótos, 2001]**	
	[Bőgel, 2009a]	Objective	Technology
1	Era of automatization, cost control, effectiveness	Productivity and effectiveness improvement	Data processing systems
2	Era of productivity and personal effectiveness	Enhancing individual and group efficiency	PCs and end-user systems
3	Era of new internal business models	Strategic effects and competitive advantage	Inter-organizational systems
4	Era of new external business models	Enhancing firm-level efficiency	Shared systems, telecommunication, multimedia, internet

Perhaps the most thorough classification related to theoretical underpinnings can be found in Melville, Kraemer and Gurbaxani's [2004] overview; they trace back IT business value research to four theoretical roots:

- Microeconomics: Researchers attempted to demonstrate the effects of IT investments by means of production functions, growth theories, Tobin's q, or option-pricing methods.
- Theory of industrial organization: Applications of game theory, agency theory and transaction cost theory in our field.
- Sociological and social policy view: Use of social networks and embeddedness theory in the field of IT business value.

- IT business value research on the basis of resource-based theory.

  András Nemeslaki and I [Nemeslaki – Aranyossy, 2005] have systemized theoretical approaches (and their most typical empirical methods) to be found in specialized literature as follows:

Figure 3. Theoretic and Methodological Perspectives of IT Business Value Research

[Nemeslaki – Aranyossy, 2005, p. 28. – with some modifications]

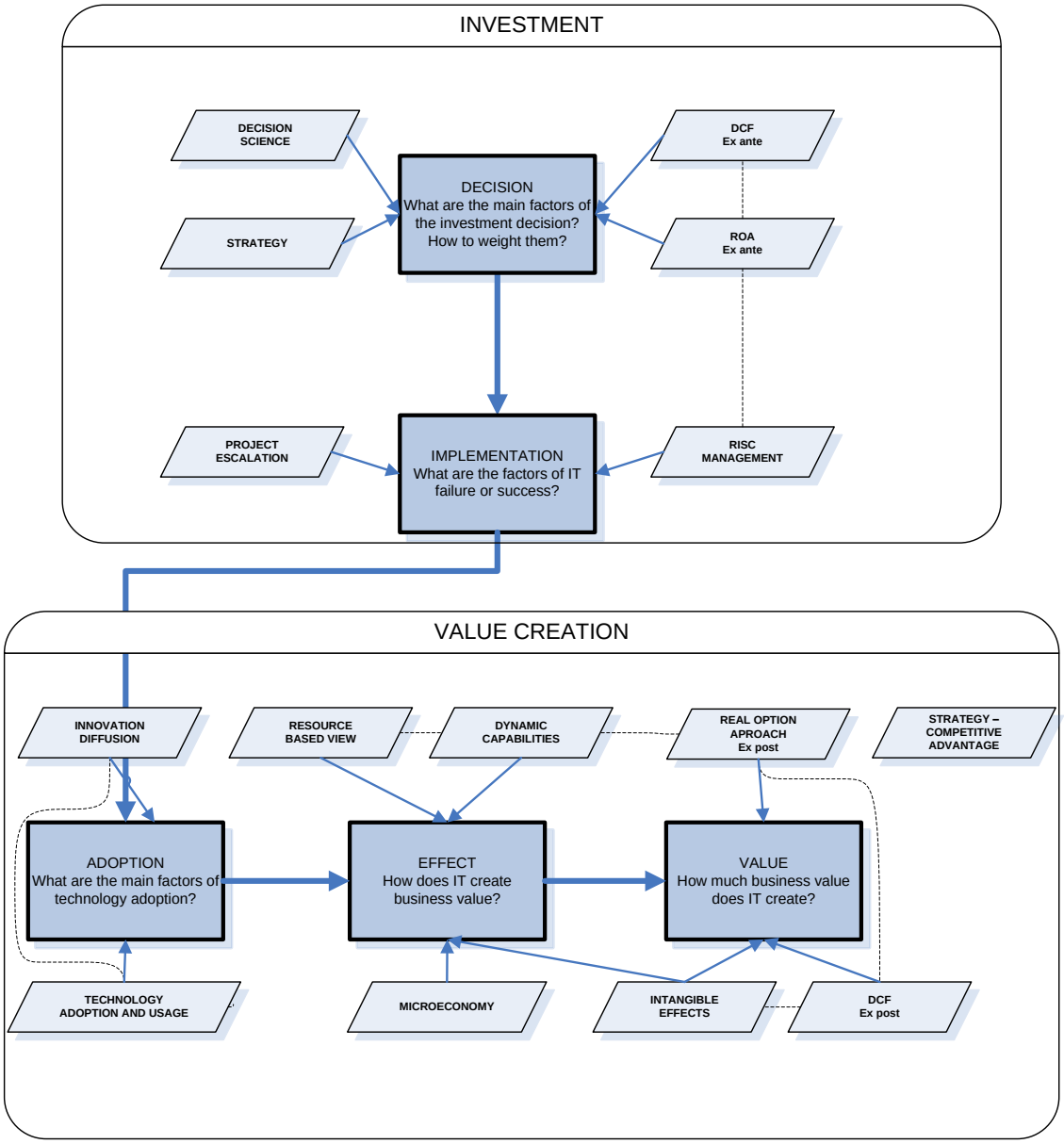
<table>
<tr><td>THEORIES</td><td colspan="2">Microeconomics</td><td>Competitive Strategy</td><td colspan="3">Agency Theory
Transaction Cost Theory</td></tr>
<tr><td>APPROACHES</td><td colspan="3">Recource Based Theory</td><td>Total Cost of Ownership</td><td colspan="2">Shareholder Value Perspective</td></tr>
<tr><td>METHODOLOGIES</td><td colspan="3">Rate of Return Regression</td><td colspan="2">Net Present Value</td><td>Event Study</td><td>Real Option Theory</td></tr>
</table>

Naturally, there are multiple options of systemization but Figure 3 basically encompasses the main finance-oriented approaches that have so far been decisive in the theoretical and empirical scrutiny of IT business value. In a broader sense, however, there are many more disciplines that related literature draws on, including the literature on accounting, strategy or project management in the field of business administration, or psychology and sociology among social sciences. While accounting and strategy primarily help capture the existence of value created by IT (in the form of accounting tools or sustainable competitive advantage), project management or social psychology are instrumental in exploring the process of value creation in the field of user acceptance or successful IT management (see Figure 4).

Melville, Kraemer and Gurbaxani [2004] distinguished between studies based on whether research was built on production functions, process-based models or characteristics of resources. Soh and Markus [1995] further broke down the process-based approach into three sub-processes – conversion process, usage process and competitive process – pointing out that literature on IT valuation can be mapped with a focus on them separately or collectively. The process-based systemization that I apply and is shown in Figure 4 is also similar to that: The related descriptive and normative theoretical approaches can be placed on the research map presenting the main steps/issues of the IT investment and value creation process alike. Research avenues can be distinguished linked to two important stages of the IT investment process centering on the problems of the investment decision and the completion of the implementation project. In addition, the value creation process taking place during operation has caused

three marked research areas to emerge with a focus on user acceptance of information technology, the logic of the value creation process, and the measurement of value and outcome.

Figure 4. Process Centric Research Map of IT Business Value Research



However, in this paper I have chosen another, more crystallized approach to the theoretical systemization of research. Taking as a basis the first two of Melville et al's [2004, p. 298] five basic questions quoted above, I have broken them each down into two sub-questions in accordance with the exploratory-descriptive or normative nature of the study (see Table 3).

Table 3. The Structure of the Literature Review

Question Nr.	Explorative-descriptive	Normative
1	**1./a question:** Does IT create business value? **Sub-questions**: - Does IT affect productivity? - Does IT create sustainable competitive advantage? **Related theories:** Economics - production functions - stock market event study methodology Strategy	**1./b question:** How can we measure the value created by IT investments? **Sub-questions:** - What effects have to be considered in the valuation? - Which valuation methodology should we use? **Related theories:** Economics - agency and transaction costs Finance - discounted cash-flow - real options Accounting
2	**2./a question:** How does IT create business value? **Sub-questions:** - What are the key sources of value creation? - What are the necessary and criteria of value creation? **Related theories:** Resource-based view Technology acceptance	**2./b question**: What can we to support IT value creation? *(This question is far beyond the focus of this paper, so I am not going to discuss it in the literature review.)* **Related theories**: Management / Project management Risk management IT project escalation and de-escalation

4. Literature review

4.1 Do information systems create business value?

4.1.1 The productivity paradox in large-sample studies

Drastic increase in IT investments and no growth in productivity and profitability – this was the famous *"IT productivity paradox"* of the 1980s and 1990s. One of the mottos of my thesis is Robert Solow's [1987] famous statement that "you can see the computer age everywhere but in the productivity statistics". This became the slogan setting a challenge for IT business value researchers for the 1990s. Meanwhile, application software sales in the United States tripled between 1987 and 1993, from USD 2.313 billion in 1987 to USD 6.809 billion in 1993 [Oliner – Sichel, 1994, p. 298]. Naturally enough, the question of IT efficiency came to the forefront of interest. As there are a rather large number of studies and also literature overviews [e.g. Kauffman – Weill, 1989; Brynjolfsson – Yang, 1996; Triplett, 1999; Dedrick et al., 2003, Lee – Kim, 2006] related to the subject, at this point I will only cover the most important – and most frequently quoted – ones.

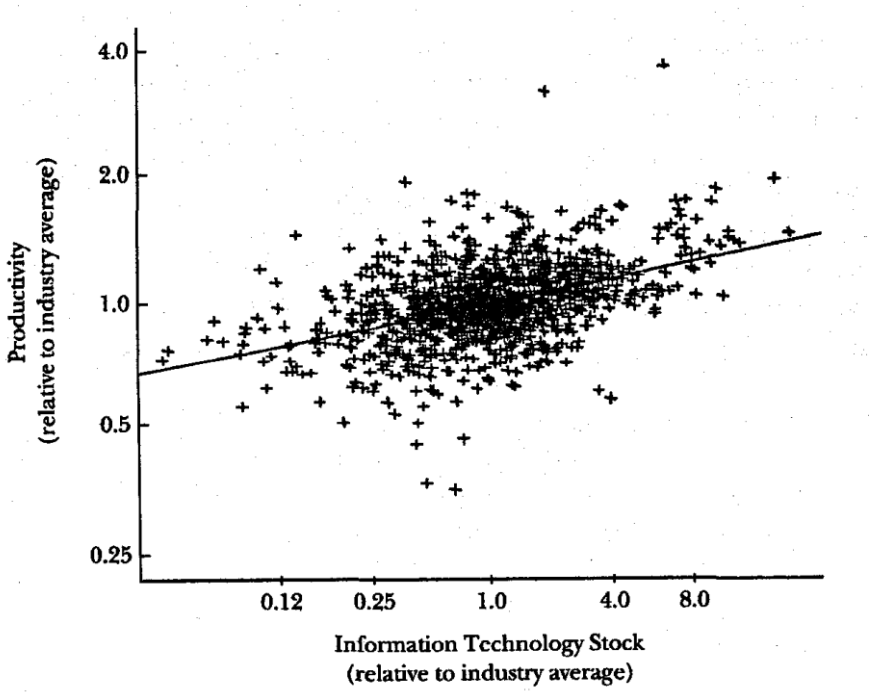
Perhaps the first piece of research on the subject was conducted by Lucas [1975], who – as opposed to subsequent researchers – considered IT usage rather than the size of the investment as a significant input factor in studying the banking sector and the use of accounting systems. In the 1980s, efforts to demonstrate the effect of IT investments on corporate performance did not really succeed; mostly no statistical correlation was found between the two factors [e.g. Turner, 1985; Loveman, 1988]. Although in his book published in 1985, Strassman made clearly positive statements about computers' potential to create business value, he nonetheless admitted that it was not possible to prove for the time being. What is more, he found in his research that the ROA of highly computer-intensive companies was 2.5% lower compared to those not using computers at all. [Strassman, 1985, p. 156]. Besides, in his similarly positively toned article, Jonscher [1983] for example argued that IT-generated increase in efficiency had managed to reverse the otherwise slowing trend of economic growth among white collar employees.

The 1990s already saw the emergence of more subtle and overall more positive results (see e.g. Figure 5). For instance, using the example of a productive company, Weill [1992] concluded that successful IT adoptions occured primarily in the case of technological pioneers, or early adopters, but the advantage was lost with the spread of

the given technology; this argument was by the way consistent with Carr's [2003] subsequent opinion. In addition, Weill also revealed another much examined effect, whereby corporate management and commitment significantly influenced the effect of IT on business [e.g. also Brynjolfsson – Hitt – Yang, 1998]. Others reported cases of more general success such as when IT resources (both in the form of investment in assets and human resources) generated extra yields compared to labor [Lichtenberg, 1995; Dewan – Min, 1997], or the gross marginal product per computer exceeds 50% annually [Brynjolfsson – Hitt, 1996, p. 542]. Even in the case of negative results, where no relationship whatsoever was shown between IT and corporate output [Loveman, 1994], some positive link was found between IT and the output of the work process immediately following it [Barua – Kriebel – Mukhopadhyay, 1995]. Furthermore, although research identified few differences between the USA and Europe, there was a significant difference between the productive and services sectors. While in the former IT investments showed a correlation with quality, productivity and profitability, the same could not be observed in the services sector [Bartelsman – Hinloopen, 2002].

Figure 5. IT Capital and Productivity – Large American Corporations, 1988-1992

[Brynjolfsson – Hitt, 2000, p. 32.]

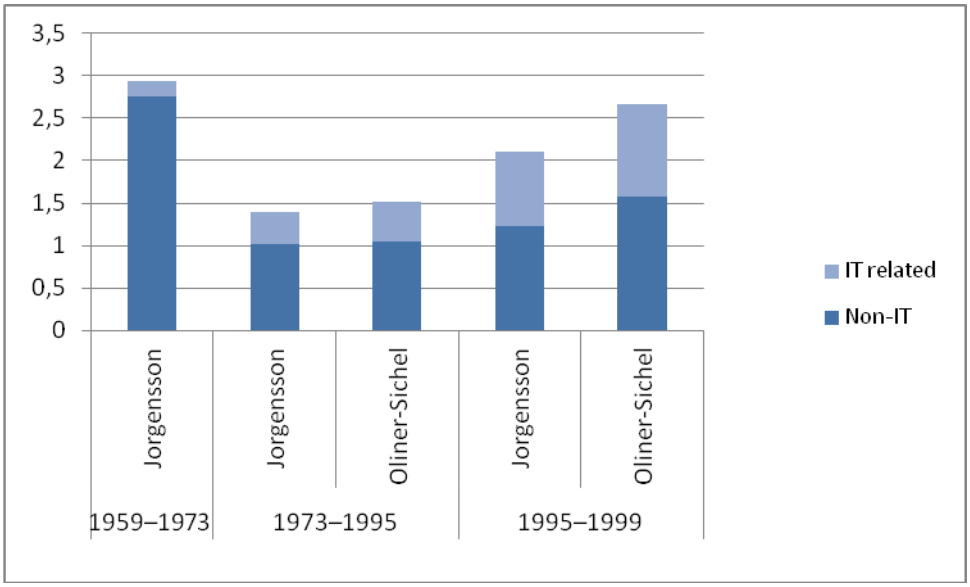


The IT paradox clearly seemed to disappear by the turn of the millennium. Both Jorgenson [2001] and Oliner and Sichel [2000] demonstrated that in the United States IT investments played a major role in increasing labor productivity: Between 1973 and 1999, they contributed to it up to 30-40% (see Figure 6). In studying 18 OECD countries and the European Union, [2000] Daveri observed that the contribution of IT

investments to GDP growth was significant in the 1990s, although in the case of the EU this effect was somewhat weaker. According to Bartelsman and his co-authors [2002, p. 20], in the United States and West Germany the ICT sector had a share of nearly 19% in GDP growth between 1995 and 2000, while the same figure was 13.5% and 11% in Great Britain and Finland, respectively. In Hungary, the growth of ICT's share in increased value added rose from 6.7% to 9.9% between 1995 and 2003 [Pintér et al., 2007, p. 21]. Studies at the company level have confirmed the conviction that IT value creation is particularly strong if the technological investment is in line with the business strategy [Tallon – Kraemer – Gurbaxani, 2000], or is accompanied by some organizational change [Devaraj – Kohli, 2002; Dehning et al., 2003].

Figure 6. Contribution of Information Technology to Labor Productivity Growth

[Based on: Jorgenson, 2001; Oliner – Sichel, 2000 and Dedrick et al., 2003]



4.1.2 Explanations of the productivity paradox

As we have seen, we can find a great many pieces of research proving and also disproving the productivity paradox, but following the turn of the millennium the proponents of IT's positive effect on productivity have been confirmed. In their study Wan, Fang and Wade [2007] reviewed all empirical studies on the IT productivity paradox conducted in the decade between 1996 and 2006. They concluded that by using more reliable data sources, selecting the appropriate level of analysis and involving complementary management skills the paradox seemed to be dissolved. 64% of studies focusing on the company level and 75% of studies analyzing data revealed a clearly positive relationship between information technology and corporate performance [Wan – Fang – Wade, 2007, p. 6-7].

In their detailed literature overview, Draca – Sadun – Van Reenen[6] [2006, p. 28-29] summarize developments around the IT productivity paradox as follows:

1. The reason for Solow's IT productivity paradox was IT's too small share in corporate assets.
2. Productivity growth has accelerated in the United States since 1995.
3. This acceleration seems to be connected to information technology.
4. During the same period, productivity growth did not speed up in Europe especially because of the performance of large ICT-using industries.

Does then the IT productivity paradox exist? If so, in which period? If not, why was it so difficult to find evidence of productivity improvement as an effect of information technology? Explanations confirming and disconfirming the IT productivity paradox rely on one or more of the arguments listed below [based partly on Triplett, 1999, p. 309; Brynjolfsson – Yang, 1996 and Kauffman – Weill, 1989, p. 4]:

- We do not live in the age of computers in *every respect*. The computer age has not in fact exerted significant influence to the same extent on each area of the economy; it has appeared with varying intensity in different industries. In the United States, 70% of private sector IT investments were concentrated on the commercial and financial services sector in the early 1990s [Grilishes, 1994]. Similarly, even today in Hungary we can observe differences in the intensity of the use by different national economy sectors of various information technologies (see Table 4). While the spread of personal computers is nearly complete in all branches, in the case of more specific technologies their even distribution is far from typical. For example, in the area of LAN and the intranet the dominance of the electricity, gas, steam and water supply sector is conspicuous, while financial intermediaries and caterers (hotels and restaurants) respectively use almost all technologies much more frequently and rarely than the average [Central Statistical Office (KSH), 2008, p. 29].

[6] Draca et al's [2006] thorough literature overview also extending to Europe can be a good point of departure for reviewing the IT productivity paradox on a broader basis than covered here.

Table 4. ICT Usage in Different Sectors, 2007

[Based on: KSH, 2008, p. 29.]

Economic Sections	Personal Computer	Wired network (LAN)	Intranet	Extranet	Electronic Data exchange (EDI)
Agriculture, forestry	93,3	40,7	10,2	3,1	26,9
Fishing	89,1	28,2	9,1	0,0	19,1
Mining and quarrying	97,6	31,9	25,6	6,2	15,7
Manufacturing	91,7	52,7	19,4	4,1	21,7
Electricity, gas, steam ,air-conditioning and water supply	99,6	85,0	49,3	19,5	38,3
Construction	92,1	43,7	15,6	1,1	16,8
Wholesale and retail trade, repair	91,3	59,6	24,2	7,3	28,0
Accommodation and Food service activities	73,5	26,5	8,7	2,7	10,4
Transportation and storage	92,2	58,1	26,3	7,2	29,9
Financial and insurance activities	100	82,5	71,9	17,9	52,0
Real estate activities, professional, scientific and technical activities	90,1	61,9	28,4	8,4	21,9
From this: information technology	97,1	87,6	62,1	27,2	31,0
Education	95,7	56,0	32,0	5,1	28,2
Human health and social work activities	88,8	50,1	19,9	1,1	1,4
Other services	85,8	51,6	15,9	6,8	25,6
Average	***90,5***	***53,2***	***21,5***	***5,5***	***23,1***

- Some of the value created by computer technology is *not measured by economic statistics*. Such intangible factors at the company level may include improved decision-making skills, market forecasting skills or higher employee satisfaction [e.g. Anandarajan – Wen, 1999]. No doubt, however, that a company's valuable intangible assets also have an impact on financial performance but the main problem of measuring intangible effects is the issue of capturing and measuring the overly long logical sequence of steps between inputs and outputs [e.g. Chen

– Zhu, 2004]. That is where Davern and Wilkin [2010] also see one of the causes underlying the paradox and suggest multidimensional measurement by the concurrent use of perceived and objective metrics.

- *No such paradox exists, only statistical methodologies applied in the field are inadequate.* For instance, a logarithmic scale should be used to demonstrate a relationship. It is on this and the previous argument that efforts to work out valuation methodologies capturing the uncertainty and intangible nature of IT value creation rest [e.g. Kumar, 1997]. Thus, literature on the subject has always been interlaced with the issue of selecting the methodology and the dilemma of input and output metrics.
- *We cannot yet see* the effects of computer technology but we will in the near future; the impact of the new technology appears in macro-level statistics with a delay, i.e. there is a kind of delaying effect [see Lee – Kim, 2006]. The reason should be sought in the long implementation phase of information technology and the protracted nature of corporate learning, which can mean a delay by as long as 2 to 4 years [Brynjolfsson – Hitt – Yang, 1991].
- It is possible that while focusing on IT investments we lose sight of the big picture, i.e. we should also pay attention to *complementary resources* [Zhu, 2004] and *other contextual factors*, such as related changes in management and organization [pl. Brynjolfsson – Hitt – Yang, 2002].
- The productivity paradox does exist; the reason for it lies in *inadequate IT management*, i.e. not in technology itself but in the specific characteristics of implementation. It is therefore possible that the effectiveness of IT investments is of a rather diverse nature [Brynjolfsson – Hitt, 1995], as are the findings of empirical studies. In the latter, just as on large samples, the effects of different company implementations cancel out, which makes it impossible to draw unambiguous conclusions.
- The paradox exists if we only focus on the company in realizing benefits. As long as *examination extends to customers and final consumers* we can see that the company passes on the positive effects of IT investments in part or in full to the consumer [e.g. Hitt – Brynjolfsson, 1996].
- *There is no such paradox; on the contrary, the opposite is true*; i.e. by the 2000s a *"new productivity paradox"* superseded the old one [Anderson et. al., 2003]. The problem was no longer the lack of evidence of IT profitability but the

existence of demonstrated and unexplainably high returns. Alternative explanations were given in an effort to resolve the new paradox: According to some, the reason for unusually high returns lied in overlooking hidden and organizational costs of information technology investments, while others believed high returns were understandable in the light of the high risk involved in IT investments [e.g. Dewan – Shi – Gurbaxani, 2003].

- *Even though there may be such a paradox, corporate top executives should focus on profitability and competitiveness instead.* The importance of IT-generated productivity growth, or the lack of it, may be far outweighed by its functions supporting fast innovation-adaptation [Woods, 2010, interview with Andrew McAfee]

Based on these arguments, it can be said in general terms that it is worth focusing investigation on information technology-intensive industries; adjusting measurement techniques to the given industry and the specificities of IT investments; and taking into account the widest possible spectrum of environmental and corporate contextual factors and delayed effects; that is what maximizes our chances of bypassing the problem of the productivity paradox and demonstrating real effects. These are important lessons for the current research as well, which in a way also deals with the extended theme of the IT productivity paradox; from a technology aspect, I focus on e-commerce while measuring corporate effects in terms of financial indicators in addition to productivity.

In the next two sub-sections I will seek to systemize literature on the IT productivity paradox from a methodological perspective as well, including empirical studies that were built on more robust theoretical underpinnings than the correlation or regression analysis of a few input and output variables.

4.1.3 From production functions to value chains

Initially, the effects of IT on productivity, profitability and added value creation were scrutinized by using the classical tools of microeconomics; e.g. Alpar and Kim [1990] selected production functions as a tool of analysis. This approach considers information technology as a resource, similarly to labor or capital. If we find a functional relationship between information technology input and the company's output, it will be easy to quantify the profitability of IT. In other words, the effect of additional inputs – in this case IT equipment – on productivity can be measured by the marginal product of inputs. However, determining the specific parameters of the

production function is a difficult exercise, so this theory has remained a theory. The same holds true for Thatcher and Pingry's [2004] work, where they tried to explain the relationship between IT investments and business value creation with the help of the industry structure and microeconomic models built on marginal costs. However, Kudyba and Diwan [2002] – based on some of their predecessors – attempted to determine the coefficients of the IT resource in production functions for the period 1995-1997, whereby they arrived at positive results also indicating improvement in productivity. In addition, Gurbaxani – Melville – Kraemer [2000] have concluded that the IT production function shows a Cobb–Douglas shape at the level of both the company and the economy and that the ratio of hardware and other personnel resources is permanent in size and time. This is confirmed by the empirical observation made by Gurbaxani – Kraemer – Vitalari [1997] that economies of scale are not typical of producing IT services. In recent years, some research also relied on production functions; e.g. examining the effect of e-business on corporate performance, Loukis, Soto-Acosta and Pazalos [2011] also based their analysis on the Cobb–Douglas function.

The concept of value chain worked out by Porter [1985] can provide a framework similar to the production function for tracking connections. For the value chain can be an effective tool for observing how IT affects individual activities and how these pieces of research are built on each other. In his article released in 2001, Porter himself also demonstrated the impact of the Internet on the company by means of the value chain model [p. 75]. However, the value chain only helps in localizing changes; in order for effects to be quantified, function-like relationships had to be explored in this case as well. Finally, researchers using the value chain model as a point of departure also deepened their models to the point of describing production functions [Barua et. al., 1995], and on that basis the effects of IT proved to be significantly positive.

4.1.4 Capital market reactions

Ex post value creation studies provide an opportunity to use large-sample investigations more intensively and take into account the collective judgment of markets. Such research opportunities are offered by large-sample regression analyzes based on capital market reactions. As researchers also increasingly recognized the complexity of IT projects so emerged to the forefront the old economic principle that everything is worth as much as the market pays for it. This also cut the Gordian knot related to understanding and quantifying the effects of IT investments, since now the

basis of valuation could be the extra price stock exchange investors were willing to pay for a company's shares following a major IT investment – on the assumption of an effective capital market.

However, there can be difficulties even with such a seemingly simple methodology. First, such a study can, naturally enough, be conducted in the case of companies listed on the stock exchange in countries with advanced capital markets. This is the lesser problem as large-scale IT investments are characteristic of large – mostly shareholding – companies of developed countries. The bigger problem lies in the time of observation: Should the price change occurring upon announcing the investment be examined? Or is it the time of installing the investment that is relevant? Or perhaps the time interval between the two? Finally, how do we know that the price change has resulted from the IT investment? How can it be made independent of other factors?

Dehning – Dow – Stratopoulos [2003] give an excellent summary of empirical pieces of research based on capital market reactions; I will only mention a few important findings here. In one of the studies of this type, Dos Santos – Peffers – Mauer [1993] were not yet able to demonstrate extra yields with this method, except in the case of companies implementing innovative IT investments. Bharadvaj – Bharadwaj – Konsynski [1999] already observed a positive relationship between IT expenditures and the – also market-value-based – corporate Tobin q indicator. However, empirical studies conducted after the turn of the millennium all revealed positive capital market reactions; e.g. Chatterjee – Pacini – Sambamurthy [2001] observed yields of around 0.4-1% based on announced IT applications and infrastructural investments; interestingly enough, the latter showed greater fluctuations. Im – Dow – Grover [2001] found that while the capital market positively responded to the announcement IT investments, this effect was strongly influenced (in the negative direction) by the size of the business and delayed effects could be linked to the indirect impacts of intangible benefits. Brynjolfsson et al [2002] concluded that IT investments by themselves – and much more along with organizational changes – were highly positively reacted to by the capital market expressed in terms of the difference between the book value and market value.

Hayes, Hunton and Reck [2001] looked at the effects of the introduction of ERP (Enterprise Resource Planning) systems in the light of capital market reactions. The authors considered the time, or more precisely the date of announcing the introduction and the next day to be appropriate for measuring the value of the investment. They found that the market responded positively to the announcements, i.e. regarded the investment to be value-creating. Further analyzes also revealed an interesting fact,

namely that with big-name ERP systems (e.g. SAP, PeopleSoft) the positive market reaction was stronger than in the case of smaller vendors. Hitt – Wu – Zhou [2002] observed similarly positive capital market reactions to the announcement of ERP investments even if corporate productivity and profitability showed a minor fall shortly after the introduction.

In their study, Kim and Mithas [2011] chose an interesting new perspective: They examined the effects of IT investments not from the aspect of the capital market but the bond market. Using an American database for the period 1995-2002, the authors managed to show a positive relationship between companies' IT-intensity and bond market rating and hence the cost of fundraising. However, by distinguishing companies by the nature of industry they made an interesting discovery: A positive relationship was typical in cases where IT was used to replace labor or as an information/decision-support tool. Surprisingly, however, in those industries where information technology brought about fundamental change in the business model and the market structure, major IT investments were negatively evaluated by bond market actors. This latter area therefore still holds surprises and open questions for researchers.

4.1.5 IT-based competitive advantage

While by the turn of the millennium information system researchers became increasingly convinced of the exploitability of IT's potential to maximize productivity, strategic management researchers had the growing belief that most of the time improved efficiency by means of IT did not lead to a sustainable competitive advantage. The reason lied not so much in the technology's lack of strategic potential as in the unsustainability of strategic advantages built on it. Certain authors already talked about "erodible competitive advantage" in the 1990s, whereby although competitive advantage was not possible to sustain, companies did not relinquish short-time advantages in the competition [see Drótos, 2001, p. 96]. Furthermore, a given technology can become a strategic necessity without creating an erodible competitive advantage, i.e. it can become a precondition of staying in competition. A case in point is most bank technologies including ATM systems or online banking [Móricz, 2009]. Nicholas Carr [2003], who triggered the "IT competitive advantage debate" in the Harvard Business Review, goes as far as to say that as a consequence of the standardization and commoditization of information technology it is no longer possible to create a sustainable competitive advantage; information technology slowly begins to be an infrastructural factor similar to the railway or electricity and so he suggests that

companies should reduce IT expenditures and pursue a defensive IT strategy. Naturally, many responded to Carr's provocative article including great names in the IT research community. Responses were centered around the following issues [HBR Letters to the Editor, 2003]:

- Carr's article expresses a disillusioned public mood and is primarily a warning that after the millennium IT has to play according to the usual corporate rules including the achievement of required financial and business goals. The sense of disillusionment is partly the fault of IT vendors who offered their products as a "panacea for all ills" [Brown – Hagel, 2003].
- Carr's statements are extreme, lopsided and can be questioned one by one. The analogy of the railway, electricity and information technology is overly simplified and incorrect in many respects; in addition, it cannot be proven that the development of information technology has reached a plateau [Strassmann, 2003; McFarlan – Nolan, 2003].
- Technology (hardware and software) as a physical resource is indeed a mass product but its efficient usage (human resources) is far from it [Varian, 2003]. Similar arguments based on the intangible part of the technology include the following: The profitable usage of IT requires innovations in corporate processes [Brown – Hagel, 2003], and it is not the system that matters but the use of information and what is in the system [Broadbent – McDonald – Hunter, 2003].
- Complex internal systems continue to have many unique features and their operation remains a strategic factor in many places [Strassmann, 2003]. These can include group work applications supporting internal operations, which, according to a British study, can make a significant addition to a company's ROI [Martinez-Caro – Cegarra-Navarro, 2010].
- The age of IT-based innovations has not ended yet; a range of novel electronically supported processes, products and services keep appearing on the market [Broadbent – McDonald – Hunter; Langdon]

McAfee and Brynjolfsson's study of 2008 responds to Carr's article in an indirect manner. It starts from similar premises but arrives at a radically different conclusion: Since the mid-1990s (in the United States) the turbulence and concentration of competition and the profitability gap between market leaders and followers increased to a great extent. Concurrently, the Internet, corporate IT and network technologies became widespread and general. Of course, there is not necessarily a direct relationship

between the two, since globalization, M&A tendencies and the intensity of R&D activities could also contribute to increased competition but market tendencies also show a correlation with IT investments even when these factors are controlled for. Initially, IT meant a competitive advantage to early adopters but it was also relatively easy to imitate. Once it became widespread and dropped in price, competitors also caught up. Thus, technology leaders took turns in the lead, while the more undecided ones lagged behind both in market share and profitability.

In respect of the intensity of competition we should not forget about barriers of entry either: IT can further strengthen or also destroy them. For example, in an industry characterized by economies of scale, a company management system enabling more efficient production is only worth installing above a particular size. Or, we can mention one of Clemons's [1986] classical studies presenting the competitive advantage-building effect of IT-based increased customer switching costs. Also, the appearance of e-businesses has contributed to a decrease in entry costs in some industries. Often, greatly improved production efficiency increases the attractiveness of the market as well as contributing to dismantling entry barriers. This in turn pulls new entrants into the industry and intensifies competition, an effect of which can be falling output prices. However, the negative effect of decreasing output prices may not be offset by improved efficiency – the circle has been closed. In competitive industries companies relinquish a large part of the wealth produced to consumers and thus it can happen that profits from IT investments will be realized by consumers [Hitt – Brynjolfsson, 1996]. Porter's competition strategy considerations do not therefore lead to an unambiguous result and generating extra profits is doubtful.

Porter [2001] also holds a similar view specifically with regard to Internet technologies: Internet-based competitive advantage is not sustainable since technological development has mitigated both switching costs and network effects, and thus an IT-innovator company will not have too many tools left to keep consumers vis a vis imitator competitors. With technological development therefore it seems that IT becomes increasingly easy to copy, while barriers protecting innovators' competitive advantage are increasingly lower. An effective innovation spreads quickly and often the entire industry switches to low-cost and low-price production (see e.g. the electronic sale of flight tickets).

Table 5. Factors Affecting Firm Performance: Three Logics of Strategy

[Sambamurthy – Bharadwaj – Groer, 2003, p. 240.]

Logic of Strategy	Factors Affecting Firm Performance	Limitations
Positioning see Porter, 1985	- Nature of the industry's competitive forces - Profitability of the firms' strategic position - Extent of integration among the activity systems	- Predominant focus on external industry forces - Inadequate attention to how firms construct inimitable activity systems - Weaker ability to explain strategic conduct in dynamic, disequilibrating, or discontinuous business environments
Leverage see Eisenhardt – Martin, 2000	- Procurement and possession of rare. valuable, and inimitable resources - Ability to create capabilities through integration and reconfiguration of internal and external resources and embedding in firms' social, structural, and cultural contexts	- Weaker ability to explain competitive strategic conduct in fast-paced business environments
Opportunity see D'Aveni, 1994	- Ability to continuously innovate - Ability to develop superior market intelligence - Ability to coevolve assets, capabilities, and knowledge	- Underemphasizes the significance of strategic positions

If, however, we look beyond Porter's analysis of competitive advantage [see also Mészáros, 2002, from p. 242], in addition to the positioning approach we can also see the two main current strategic perspectives increasingly dominating IT literature [Sambamurthy – Bharadwaj – Grover, 2003, see Table 5]: The resource-based view (referred to as "Accumulation" in the table) is what currently features the mainstream, while the real-option view (referred to as "Opportunity" in the table) will predictably dominate the future. At this juncture, therefore, the strategic view converges to the mainstream of IT business value research again, since both the resource-based view and the real-option view are proliferating in IT business value literature. I will cover these latter two approaches in detail in the following sub-sections.

4.2 How to measure business value created by IS?

In the foregoing paragraphs I examined the number one core question of literature on IT business value creation: Does information technology create value for

businesses? However, in respect of this question researchers have several times been confronted with the question of how value creation could/should be measured and demonstrated. With regard to this issue a normative and practical research perspective has been developed with a focus on the methods of financial valuation of IT investments.

Normative literature offers several methodologies for selecting IT investments (projects) for implementation, like [Bőgel, 2003, p. 4]:

- selection on the basis of the general needs of the organization
- selection by way of categorizing projects
- selection based on net present value calculation or other financial analysis
- selection against a set of weighted criteria.

Because this dissertation focuses on value creation, I will only present financial approaches in details. Besides, there is no denying that in corporate practice placing the primary emphasis on value creation criteria is not necessarily a dominant approach, partly because of the principal-agent problem and partly the power/political considerations.

4.2.1 From transaction costs to total cost of ownership

The transaction cost theory and the principal-agent theory are often referred in relation to IT investments and IT operation. The former is primarily connected to "make or buy" decisions [e.g. Watjatrakul, 2005], the latter to information systems between organizations [Clemons – Kleindorfer 1992]. Here I will place the emphasis on the value creation capacity of IT while making use of the key conclusions of these theories.

The agency theory, in contrast to classical microeconomics, does not treat companies as a homogenous market factor seeking to maximize profits but as a diverse system of contractual relationships of "agents" driven by their own self-interests [Alchian – Demsetz, 1972]. Besides, the information asymmetry also makes it difficult for principals to control their agents. Information needed for decisions are usually possessed by the agents and, if necessary, can be manipulated by them. According to the theory, the solution to the principal-agent problem is shareholder control, which can be embodied in different contracts and monitoring systems. The main linkage between the agency theory and IT valuation is that some of the agent costs can be effectively reduced by the use of appropriate information systems. An agency cots advantage – which is not considered by the conventional microeconomic view – can be "cheaper"

monitoring or a more time-saving documentation system. Moreover, IT can also be a useful tool to reduce the information asymmetry and allow shareholders insight into corporate processes thereby supplying them with up-to-date and real information aggregated at the appropriate level. IT, therefore, can reduce so-called "decision-informing costs" in addition to agency costs [Gurbaxani – Whang, 1991] is.

The transaction cost theory starts not from internal corporate processes but from market relationships. Here the company means an alternative or solution to market problems. After all, the functioning of the market is not cost-free either. Interactions between market players also have so-called transaction costs by which the parties fend off each other's possible opportunistic behavior [see Williamson, 1979]. The parties also seek to minimize the risk of market transactions signing proper contracts with control measures. Since, therefore, market transaction costs are of a similar nature to agency costs within the company, it comes as no surprise that the impact of IT on them is also similar. The usage of IT can mitigate information asymmetry; enable closer, more flexible, better monitorable and verifiable – and so less risky – cooperation between vendors and buyers; thus reducing transaction costs arising from search and coordination [Hitt, 1999; Kumar – Van Dissel – Bielli, 2002].

The two theories presented here shed light on those implicit benefits of IT investments which would have been overlooked by an evaluator perhaps thinking in terms of traditional cost-benefit categories. IT can help reducing the costs of both internal (agency costs) and external coordination (transaction costs). Continuing this line of thought it is worth exploring the ever wider spectrum of IT investment costs and benefits. In fact the same purpose is served by – at least on the cost side – the TCO (Total Cost of Ownership) methodology, a technique widely used in the field of IT valuation. The TCO method seeks to map and quantify the whole spectrum of costs throughout the entire life of a product or service and thus ensures a better comparability of procurement options [see Ellram, 1993 and 1994]. This method has really been made known and widespread in the field of IT investments by the Gartner Group [Cappucio – Keyworth – Kirwin, 1996]. Smith – Schuff – St. Louis [2002, p. 103] categorize the full range of costs related to IT procurement and investments as follows:

- Procurement costs (hardware, software)
- Operating costs (support, upgrades, performance evaluation, auditing, training, downtimes, virus damage, power consumption, work time loss due to private use)

- Control costs (centralization and standardization in the field of implementation and maintenance)

There is a wide variety of practical methodologies designed for corporate use, similarly to the TCO methodology, of which a detailed picture is provided by Szatmári's [2011, p. 25] listing. The author presents the following of the more complex IT measurement methodologies:

- TCO – the Gartner Group's methodology
- TEI (Total Economic Impact) – the methodology used by a subsidiary of Forrester Research
- REJ (Rapid Economic Justification) – Microsoft's methodology
- TVO (Total Value of Opportunity) – the Gartner Group's methodology
- Real option approach (see Section 4.2.4 below)

These techniques and the transaction/agency or TCO logic presented in this chapter all serve as tools for decision-makers to count all expenditures and revenues linked to IT investments. They can even based on indirect causes or they can have uncertain outcomes [see e.g. Bőgel, 2003].

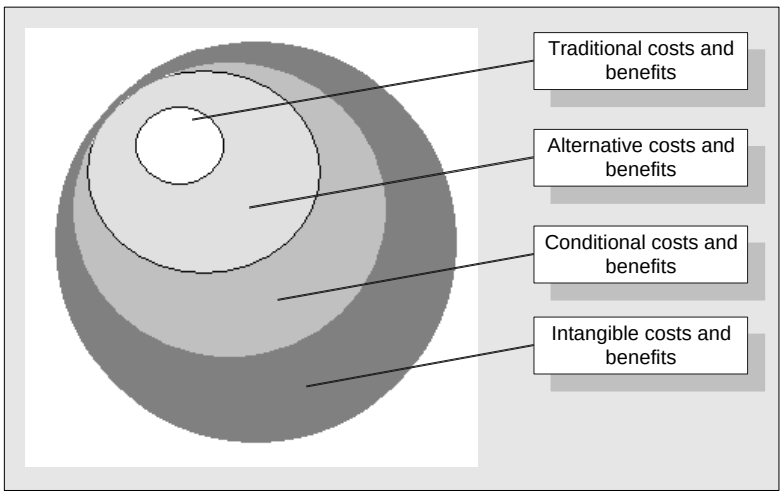
4.2.2 The valuation of intangible effects

The full consideration and forecasting of information technology effects and cash flows are made difficult by two basic problems: a temporal gap and a logical gap between IT investments and corporate profitability. The delayed effect is caused by the complexity and complicated dynamics of the impacts of technology and the inherently protracted nature of its introduction. The problem of cause and effect means that only a part of the effects of IT investments belongs to categories traditionally handled by financial accounting systems (e.g. sales revenue growth, labor saving etc.), while its other effects are more like alternative costs (e.g. the cost of time out of work during training linked to the system) or are contingent (e.g. consequences of system downtime – see Figure 7). Moreover, the complete financial valuation of IT investments would require the quantification of effects like improved product quality or service standards, increased production flexibility, or perhaps strategic considerations such as retaining or improving the competitive position or laying the foundations for further innovations.

These already belong to the range of so-called intangible benefits. “A tangible benefit is one which directly affects the firm’s profitability” [Remenyi et. al., 1993 in: Murphy – Simon, 2002, p. 303], while “the difference between a tangible and an intangible lies in the difficulty of estimating monetary value” [Emery, 1971 in: Clemons – Weber, 1990, p. 11]. In other words, intangible benefits do have financial value but their estimation is difficult. It is only possible by exploring a long chain of causes and effects. In respect of the potential benefits of information systems, Hares and Royle [1994] distinguish four major intangible categories. These are: intangible effects linked to internal development, customer service, forecasting and adaptation. As we progress along the categories, measuring the impacts becomes more and more difficult. The strategy applied in practice is to value these hard-to-quantify factors as zero, even though it can distort valuation [Hitt – Frei – Harker, 1999].

Figure 7. Cash Flow Types of IT Investments

[Nemeslaki – Aranyossy, 2005, p.31.]



Therefore, the greatest challenge in valuing information technology investments lies in finding some way to determine the value of intangible benefits in pecuniary terms. Murphy and Simon [2002, p. 313-314] suggests the following approach to exploring the effects of IT investments:

1. Recognizing the existence of intangible benefits;
2. Making intangible benefits measurable and determining the measurement method, which can be done by rephrasing the phenomenon and assessing possible consequences;
3. “Physically” forecasting benefits; the authors present three different approaches to its implementation, respectively based on market transactions, alternative costs and direct revenues.

The second step – making intangible effects measurable – often makes life difficult for the assessor while literature also offers little in the way of practical guidance. As an example, a methodology described by Anandarajan and Wen [1999] can be mentioned since their goal was to ensure simple applicability in practice. The method applied by them bases the measurement of intangible benefits on expert evaluation and probability theory. They asked corporate managers to rank different intangible benefits on a Likert-scale[7] and used the frequency of responses as a probability estimate. Based on the judgment of managers they determined the probability of each scenario and the extent of extra benefit for each scenario and then calculated the expected value of the benefit as a product of the two. Naturally enough, a great disadvantage of this method is excessive subjectivity, as it only uses managers' judgment as a basis. Even if the respondents are experts of the subject, their opinions may be influenced by different psychological effects (e.g. individual interests or goals) at the time of valuing the project. In addition, preparing the valuation becomes a highly resource-intensive exercise and companies rarely undertake this extra investment. Experience has shown that in reality valuation mostly takes place along the following corporate process [Changchit – Joshi – Lederer, 1998, p. 152]:

1. Identifying the problem;
2. "Mini-valuation" of current business processes;
3. "Mini-valuation" of proposed business processes (enabled by the new IT investment);
4. Valuation of benefits based on the comparison of current and proposed processes.

In relation to the third step, there are a number of approaches and methods available to estimate and forecast the financial value of intangible benefits; for comparison, these can be systemized as follows [based on Damodaran, 2006b; Deloitte, 2006; Reilly, 1998; and Upton, 2001:

- Market-value-based approach: determination of the actual market value or estimation of the fair market value based on market transactions related to similar goods. A typical case is:

[7] The Likert-scale is a multi-grade numerical scale that does not have descriptive elements, except linked to its two extremes [Svensson, 2003].

- multiplier valuation (i.e. the use of relative indicators of other companies, the given company being the baseline)

- Revenue-based approach: the value of future revenues to be generated from the given asset mostly determined with discounted cash flow (DCF) valuation methods.
- Cost-based approach: the cost of developing or acquiring the given asset or good. A special case is:
  - determination of alternative costs (i.e. the cost of achieving the same goal if the company selected another method).

The methodological issues of quantifying intangible factors are important not only in supporting decisions but also subsequently, in determining the accounting asset value of systems. The first time the problem became the centre of accounting experts' and researchers' attention may have been around the turn of the millennium when the market value of companies listed on the stock exchange increased to many times their book value as a result of their use of innovative technologies and ideas. According to an American study, by 2006 the IT-based intangible asset value of an average company would reach one third of total tangible assets and depreciate at no more than 6.5 to 8% per annum [Tambe – Hitt – Brynjolfsson, 2011, p. 12]. This difference could be attributed exclusively to "intangible", non-physical, hidden corporate assets but due to their scale the mapping of these hidden assets had to be started [see e.g. Juhász, 2004; Juhász, 2011].

According to the Intangible Research Centre of the New York University, there can be a narrow and a broad accounting interpretation in respect of intangible assets [in: Upton, 2001, p. 68]: In a broad sense, intangible assets are a non-physical source of the company's future revenues that co-exists with tangible and financial assets. In a narrow sense, they are also characterized by their having been acquired by way of market exchange or internal development; having a finite life; having a market value independent of the company; and being owned or controlled by the company. From an accounting perspective not only the definition of the concept but also the method of valuation is stricter and more conservative, and the historical cost as opposed to the market value is regarded as the basis. However, this is mostly not only the most reliably demonstrable and best supported value but also, in the case of intangible assets, the lowest that we can get among the methods described above. That said, accounting research teams can extensively draw on business valuation approaches and a kind of

convergence can be observed between the two perspectives. In their study on the new economy, the FASB (Financial Accounting Standards Board) research team drew the following and still relevant conclusions [based on Upton, 2001, p. X-XI]:

- There is no exact conceptual basis for making a distinction between purchased and internally generated intangible assets, and nor is such distinction in regulation justified.
- The fact of control is an important criterion of assets. This can be strongly questionable in the case of some intangible goods (e.g. customer satisfaction), therefore they cannot be treated as assets in accounting terms.
- Valuation is hindered by two major obstacles: the "time gap" and the "correlation gap". The former means that the investment often long precedes the point in time when the end product generating value in the future is manufactured (e.g. drug research). The "correlation gap" expresses the fact that correlation between the historical cost of intangible assets and their revenue-generating capacity is weak. In other words, while on the one hand we can say that valuation based on value-generating capacity often lacks any real foundations and market reference points, cost-based valuation at the same time does not provide a realistic picture about the actual value of the asset.
- The most important obstacle to handling intangible assets in accounting terms lies in the fact that companies do not for the time being treat intangibles as assets; how could they then value something correctly if it falls out of their range of vision?

Having a closer look at the arguments above we can see that these factors are obstacles not only to valuation in accounting terms but also to business/financial valuation, not to mention IT management. E.g. according to György Bőgel [2009] problems related to IT valuation can basically be traced to three sources: (1) the innovativeness of and continuous changes in IT; (2) interactions between projects; and (3) the time gap between investments and their effects. One of the research directions of the IT paradox was partly related to uncovering the time and correlation gaps, while the recognition and control of (intangible) IT assets is also an issue explored by the resource-based view to be presented later.

4.2.3 Discounted cash flows in IT valuation

Once we have identified and quantified an ever increasing range of related cash flows (expenditures and revenues), then all we have left to do is find a valuation

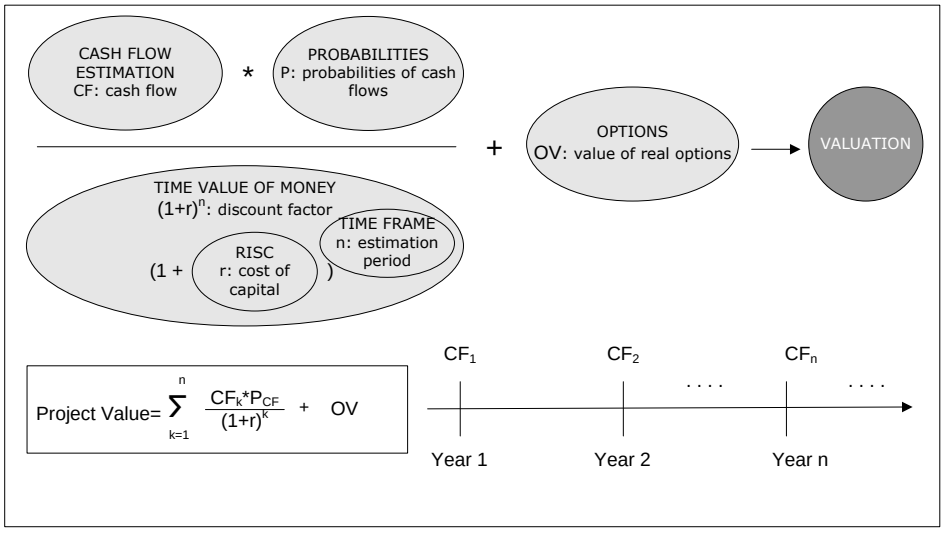
framework that incorporates some key principles of finance: the time value of money and the alternative cost proportionate to risk.

First, it is worth summarizing some of the cornerstones of IT valuation based on DCF (discounted cash flows) [Aranyossy – Nemeslaki, 2005, p. 24; see Figure 8]:

1. Estimation of cash flows: The methodological and reliability problems of exploring and estimating future cash flows are connected to this, with special regard to the issue of quantifying intangible effects.
2. Uncertainty and risk[8]: possible alternatives of a decision made in an uncertain environment and consideration of the probability of alternatives and the alternative cost of capital (changing over time) in the model.
3. The time value of money: comparability of cash flows appearing at different points in time and the application of the method of present value calculation.
4. Option view: integration into the model of the valuation of future decision options offered by the investment[9], either quantified separately or incorporated in cash flow scenarios.
5. Evaluation: Is it practical to have a single figure as the basis of the decision, or should we use more refined ex post analysis techniques to evaluate the results?

Figure 8. IT Valuation – General Model

[Aranyossy – Nemeslaki, 2005, p.24.]



[8] On the fundamental questions of risk, uncertainty and probabilities also see: Bélyácz, 2011 and Száz, 2011.

[9] This model already projects the integration of the option view into DCF-based thinking, which I will cover in more detail in the following section.

In respect of each cornerstone, literature highlights the following critical remarks with regard to the use of the DCF method in IT valuation [based on Clemons – Weber, 1990; Anandarajan – Wen, 1999; de Jong – Ribbers–van der Zee, 1999; Fehér, 2006]:

- With an IT investment, even the definition and forecasting of its expected lifetime is difficult due for example to the unpredictable process of continuous upgrade services offsetting rapid technological development. However, the uncertain timeframe also makes the estimation of cash flows uncertain.
- Analyzes often overlook hard-to-measure and hard-to-quantify yields and expenses, whereas their value is not necessarily zero. Here we talk about hard-to-capture effects (intangible factors), such as improving performance or competitive advantage and new business opportunities, that may make up not an insignificant proportion of the value of IT projects. However, other than this superficiality stemming from practical use, the traditional DCF theoretically does not even take into account management's future decision-making flexibility or the impact of future investment opportunities and decisions.
- In practice, the basis of comparison is usually the maintenance of the status quo, which disregards the cost of, and the effect of market threats arising from, unrealized investments.
- As a way to compensate for high risk, analysts often set the cost of capital too high – higher than it would actually be necessary – and also ignore different risks in the various project phases. But the problem can also be approached from the aspect of the inherent difficulty of determining an IT project's capital costs due to different kinds of risks and high uncertainty.

From the above problems we can conclude that in practice traditional DCF-based techniques, such as NPV calculation, often underestimate the value of complex information technology investments. The underestimation of cash flows and the overvaluation of capital costs both cause a bias in the negative direction and thus the above errors may lead to the rejection of even profitable investments. Although some of the problems listed above stem from the superficiality of the practical application of DCF and the imperfections of parameter estimation, the oversight of decision flexibility and the overrating of risks point to a conceptual issue. This phenomenon has redirected researchers' attention to other valuation methods.

4.2.4 Real options hidden in IT investments

Since the 1990s, besides discounted cash flow-based (DCF) techniques and – as their enhanced versions[10] – real-option methods have increasingly gained ground in the international research arena. Following early IT-option studies [e.g. Dos Santos, 1991; Grenadier – Weiss, 1997] conducted two decades ago this originally financial theory can now be regarded as part of mainstream IT research. The criticisms and practical challenges listed above in relation to the DCF method can actually be traced to two factors: high uncertainty linked to IT projects and the oversight of management's future decision -making flexibility. The first problem is of a practical nature, whereby in the ex ante evaluation of IT projects it is relatively difficult to forecast risks and cash flows. As we will see, real-option methods do not make a difference in terms of handling this problem either. On the other hand, disregard for future flexibility is a conceptual issue in the case of the DCF method, and thus a new valuation approach could be appropriate here. Moreover, the two problems are partially inter-related: The greater the uncertainty, the less it is possible to forecast future cash flows and the more valuable future decision options and flexibility can be.[11]

"An option provides its owner the right (but not the obligation) to sell or buy an underlying asset (at or before the expiration date), at a fixed price (called a strike price)." [Copeland et al., 1999, p. 467]. As opposed to the option theory originated from the stock exchange, the subject of real options is some kind of tangible asset.; The options themselves are not traded but often emerge as exploitable potentials in the company's operation. In the case of IT projects, some authors even consider the real option itself as an investment opportunity whereby the company can "draw down" a given asset at a set price within a determined time interval [see Abel – Dixit – Eberly, 1996; Dewan – Shi – Gurbaxani, 2003]. Others make less general statements about the essence and types of IT real options. The following listing presents the most frequently mentioned option types related to IT investments [Kumar, 2002; Benaroch – Lichtenstein – Robinson, 2006; Aranyossy, 2007a]:

- There is in general a waiting option, i.e. the project launch can be deferred to a later time when we have more information about the given technology *(learning*

[10] Naturally, a number of option valuation methods also factor in discounted cashflows, but since they treat future uncertainty and decision flexibility clearly differently from the DCF approach presented in the preceding section, here I treat it (similarly to the bulk of specialised literature) as a standalone field of valuation.

[11] It is to be noted here that in option-pricing models any increase in risk causes the option value to rise – contrary to classical DCF valuations. This treatment of risk can be both a strength and also a threat of this method.

option) or when the necessary equipment is available at a more favorable price *(timing option).*

- In case of an unfavorable turn of events the project can be abandoned in order to avoid further losses *(quitting option).* Quitting can be facilitated if it is possible to lease the investment or outsource development or the given function.
- The scope/scale of the project can be narrowed or broadened any time later whenever it seems favorable *(scale option).* A special case of this is the possibility of staggered investment, or project implementation/prototype development.
- By way of the given investment we can create an opportunity for further value-creating investments on its basis *(interproject or growth option).*

The above-listed IT options are similar to stock exchange options in three characteristics: they are mostly irreversible; they can be flexibly timed; and the value of the asset subject to the option is surrounded by great uncertainty [Dewan et al., 2003]. Based on these, many have undertaken to use valuation methods worked out for capital market options in the case of real options applied with information technology. For example, Benaroch and Kauffman [1999, 2000] used a modified version of the Black-Scholes [1973] formula in the case of an electronic banking investment, while Taudes, Feurstein and Mild [2000] relied on the same to deal with the valuation problem of a SAP R/2 to R/3 switch option. The general binomial model of Cox–Ross–Rubenstein [1979], which is also regarded as a classical method, has also been used in the field of IT valuation [e.g. by Ekström – Björnsson, 2003], while Benaroch and Kauffman [1999] experimented with the concurrent use of the two models. However, even if the real-option model may seem a straightforward response to valuation challenges arising from the deficiencies of DCF-based techniques – such as the treatment of uncertainty and decision flexibility –, formulas worked out for the capital market cannot be applied without the fulfillment of certain basic assumptions [Hull, 2003; Tallon et al. 2002]. Naturally enough, many different kinds of mathematical solutions have by now been worked out to value options and real options but for the time being IT literature (probably thanks to its simplicity) still gives preference to the Black Scholes formula [see e.g. Tallon et al., 2002 and Aranyossy, 2007a]. That way, however, valuing IT options using classical option valuation formulas is only conceivable in special cases, given the absence of the fulfillment of underlying assumptions.

Nowadays we can also find examples of the integration of the option view into practical decision-making on IT in the corporate sector. According to an American study covering 119 IT managers, 6% of companies use real-option techniques to analyze IT investment opportunities, and this rate reaches 10% with those companies where there is satisfaction with the methods used [Alter, 2006]. For example, besides using the DCF technique to quantify the potential value of their investments, HP now also uses real-option valuation (namely the Black–Scholes formula), especially in valuing initial project steps [Green – Maranhao, 2006, p. 58]. It seems therefore that the concurrent use of the DCF and ROA methodologies can effectively support decisions if geared to the specificities of IT projects as they can mutually offset each other's weaknesses, i.e. DCF's inflexibility and lack of strategic focus and ROA's complexity and heavy-handed communicability [van Putten – MacMillan, 2004; Ekström – Björnsson, 2003].

Generally speaking, however, the corporate practice is not prepared yet for using quantitative option valuation methods in valuing IT; managers often complain about the mathematical complexity or unrealistic assumptions of formulas [e.g. Arnold–Crack, 2004] or the weaknesses of the method's communicability. That said, the real-option approach to IT investments may not be "doomed to death" after all, as de Jong, Ribbers and van der Zee [1999] write in their article entitled "Option pricing for IT valuation: a dead end". All it takes is to shift the emphasis from the precision of calculations to the management approach [Zhu in Tallon et al., 2002]. On the one hand, while experts prepare the option valuation of an investment opportunity, they assess in detail the sources of project risks and potential future decision points, which in itself is indispensable for effective project management. In other words, according to this standpoint, emphasis should be placed on the ranking of different alternatives rather than on exact numerical results [van Putten – McMillan, 2004, p. 139].

On the other hand, the management's targeted search for and raising awareness of investment options is the first step towards capitalizing on these opportunities. If, according to the above points, the real-option method is used as a management approach it will be a good fit for the option-based approach to strategic investments [e.g. Smit–Trigeorgis, 2004 or Majlender, 2003]. The use of the real-option approach is part of the mainstream of research in the field of IT risk management [see e.g. Benaroch – Lichtenstein – Robinson, 2006]. Furthermore, the option view is close to the well-known competency-based organizational theory, and basic skills can be viewed as strategic opportunities for future value creation [Kogut – Kulatilaka, 2001; Clemons –

Gu, 2003]. This thought brings us to the second core question of IT value creation research, namely studies on the "how" of IT value creation.

4.3 How do information systems create business value?

I have given an overview of the literature on the basic question of IT business value creation: Does information technology create any business value for companies? In contrast with literature traditions, I have presented not only exploratory pieces of research based on empirical data but have also devoted a chapter to literature on normative valuation, a subject falling in my area of professional interest. However, the company cannot be treated as a black box if we are to gain an understanding of the value-generating capacity of IT; it is worth exploring in detail the method and process of value creation as well. Large-sample statistical surveys can lead to findings that can be interpreted even without such an analysis but the valuation of individual in-company projects is inconceivable in its absence. As I pointed out in the preceding chapter, any valuation should start as a first step with the mapping of value-creating factors. In this regard, I will present two important research perspectives: the resource-based view and the view based on the acceptance and usage of technology. Both play a key role also in my empirical research to be introduced later.

4.3.1 The resource-based view

In the past decade, applications of the resource-based view (RBV) and the theory of dynamic capabilities have gained ground in IS literature [e.g. Barua et.al, 2004; Wade – Hulland, 2004]. The RBV[12] seeks to uncover the logic of the cause-and-effect chain and of the combination of strategic resources and capabilities which lead from IT investments to a sustainable competitive advantage and financial return. The lead role in the chain of causes and effects is played by intermediary resources and their interlinkages; the research focuses on identifying such resources. Naturally enough, the problem is of a complex nature in many ways. Researchers try to identify key resources at many different levels of abstraction, and thus – due in part to the vicarious nature and complexity of effects – a wide range of resources can be found in specialized literature [Bharadwaj, 2000]. In addition to identifying resources and capabilities, there is also a need to work out a multi-dimensional measurement model [Santhanam, 2003]. Although, similarly to research on the problem of acceptance, there have been attempts

[12] Since this research plan is primarily based on the RBV also referred to here, its theoretical underpinnings will covered in more detail in a subsequent chapter covering the foundations of the research model.

at creating a synthesis [Wade – Hulland, 2004], a unifying theory of the field remains wanting.

Clemons [1986] was one of the first authors to apply the RBV in the context of IT value creation. Some of the initial studies set as an objective to identify the types and categories of IT resources suitable for analysis. Among the first researchers e.g. Mata – Fuerst – Barney [1995] distinguished protected technologies and technological and management IT capabilities. An even clearer and more crystallized grouping was offered by Ross et al. [1996] by distinguishing technological, human and relational IT resources. In the next ten years, researchers mostly followed this logic and added other dimensions; e.g. Wade and Hulland [2004] made a distinction between in-company interdepartmental IT resources originated from the IT area and IT resources impacting external market relationships. In the recent past, an important ambition of resource-based research has been to point beyond the boundaries of the individual company and to examine value creation in the context of inter-company cooperation [Grover – Kohli, 2012] or networks [Barua – Konana – Whinston, 2004, also see Aranyossy, 2006].

Table 6. Different Classifications of IT Resources

<table>
<tr><th>Mata et al., 1995</th><th colspan="2">Ross et al., 1996</th><th>Lopes - Galletta, 1997</th><th>Powell - Dent-Micallef, 1997</th><th>Bharadwaj, 2000</th><th colspan="2">Wade - Hulland, 2004</th></tr>
<tr><td rowspan="3"></td><td rowspan="6">IT processes</td><td></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="8">Outside-In resources</td><td rowspan="2"></td></tr>
<tr><td>Strategically aligned planning</td></tr>
<tr><td>Cost-effective operations and support</td><td>Cost effective IS operations</td></tr>
<tr><td>Proprietary technology</td><td rowspan="8">IT assets</td><td>Fast delivery</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Technology</td><td>Property-based resources</td><td>Technology resources</td><td>IT Infrastructure Resources</td><td>IS infrastructure</td></tr>
<tr><td>Technical IT skills</td><td rowspan="3">Human IT resources</td><td rowspan="5">Knowledge-based resources</td><td rowspan="3">Human IT resources</td><td rowspan="3">Human IT Resources</td><td>IS technical skills</td></tr>
<tr><td></td><td>IS development</td></tr>
<tr><td>Managerial IT skills</td><td rowspan="3">Spanning Resources</td><td>IS planning and change management</td></tr>
<tr><td></td><td rowspan="3">Relationship resources</td><td rowspan="3">Business resources</td><td></td><td>IS-business partnerships</td></tr>
<tr><td></td><td></td><td rowspan="2">Inside-Out Resources</td><td>External relationship management</td></tr>
<tr><td></td><td>IT-enabled Intangibles</td><td>Market responsiveness</td></tr>
</table>

A comparative systemization of what I consider to be the most important (and most diverse) classifications of IT resources can be seen in Table 6. On my part, I hold

Ross – Beath – Goodhue's [1995] crystallized categories the most useful, supplemented perhaps with Wade – Hulland's [2004] detailed sub-categories.

After identifying IT resources the next logical step is to prove empirically the creation of sustainable competitive advantage and uncover the distinguishing characteristics of IT resources ensuring that advantage. Since Bharadwaj [2000] and Santanam – Hartono [2003] there has been empirical evidence that higher-level IT resources go with higher-level financial performance – although their studies did not operationalize the IT capabilities in question. Based on RBV core literature, Mata et al. [1995, p. 494.] primarily offered a simple analytical framework and a multi-step theoretical proof for what characteristics should be studied from the aspect of IT resources' capacity to generate sustainable competitive advantage:

- Is the resource valuable? (If not, then it is a competitive disadvantage.)
- Is the resource heterogeneously distributed among the competing companies? (If not, then everybody has a level playing field in the competition in this area.)
- Is the resource imperfectly mobile? (If not, then the competitive advantage cannot be sustained.)

Table 7. Barriers to Erosion of IT-based Competitive Advantage
[Piccoli – Ives, 2005, p. 753.]

Barriers to Erosion	Response Lag Drivers
Response Lag Drivers	IT Assets - IT infrastructure - Information repositories IT Capabilities - Technical skills - IT management skills - Relationship asset
Complementary Resources Barrier	Complementary Resources
IT project barrier	Technology Characteristics - Visibility - Uniqueness - Complexity Implementation Process - Complexity - Process change
Preemption Barrier	Switching Costs - Tangible co-specialized investments - Intangible co-specialized investments - Collective switching costs Value System Structural Characteristics - Relationship exclusivity - Concentrated links

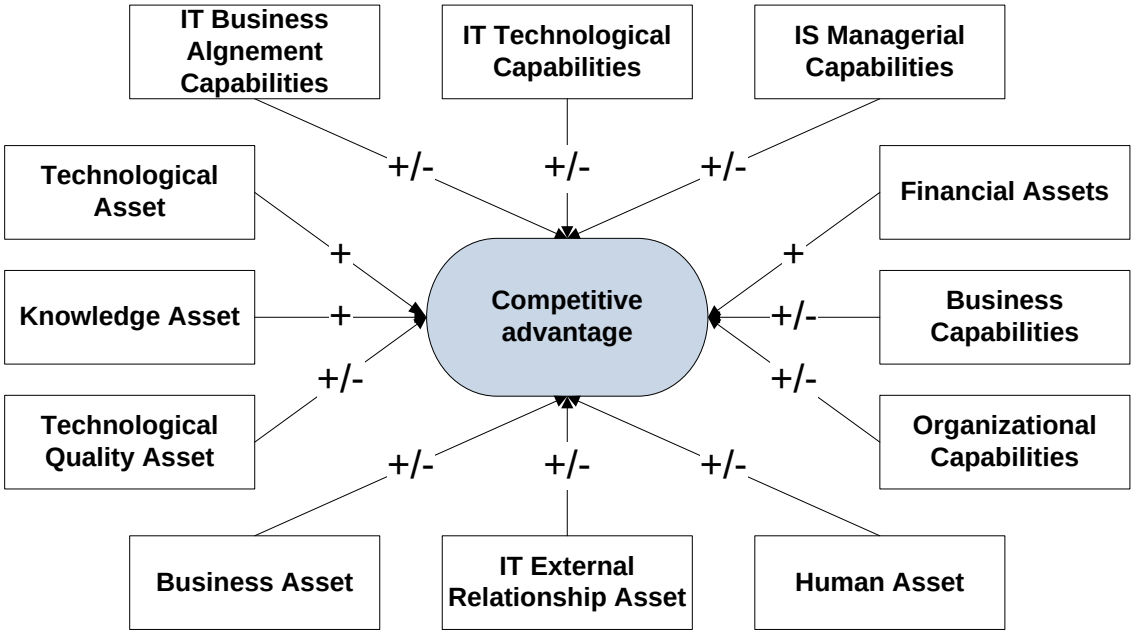
Table 7 systemizes limits contributing to the sustainment of competitive advantage based on the logic of the RBV. Piccoli and Ives's [2005] attempt at a synthesizing theory highlights that it is not only IT equipment that plays an important role in sustaining competitive advantage but also related human capabilities, knowledge and management factors (see "IR resource barriers" and "IT project barriers" in Table 7). Generally speaking it can be concluded that the ex post conditions of the sustainability of competitive advantage (low substitutability and imitability) help sustain the ex ante conditions of competitive advantage (value and rarity) [Wade – Piccoli – Ives, 2011, p. 375].

Since IT resources in a narrow sense (hardware and software) are available in the market in a standardised form, they – while being valuable – tend to be increasingly less rare and inimitable resources. Therefore, a true protective barrier can be found much more in organizational and human capabilities. Brown and Hagel use the same argument in a debate in the Harvard Business Review (also see Section 2.3) in defence of IT investments saying that "the underlying technology components may be widely and cheaply available, but the skills required to organize them into high-value architectures are still in very short supply". [Brown – Hagel, 2003, p. 111]. Similarly, complementary IT capabilities can merely be barriers to imitation also according to Varian [2003], whereby using technology in a value-creative manner remains a relatively rare capability. In Powell – Dent-Micallef's [1997] sample, only human IT resources had a positive correlation with corporate performance (see Table 6). In their theoretical proof, Mata et al's [1995] arrive at the conclusion that of IT resources it is only management capabilities that can mean competitive advantage, while Mithas, Ramasubbu and Sambamurthy [2011] demonstrated empirically the positive effect of management capabilities on performance. On the basis of its effect on an intermediate operative variable (customer service performance) alone, Ray – Muhanna – Barney [2001] only found the effect of IT management's technological knowledge to be significantly positive while observing no such effect with IT infrastructure, applications or technical capabilities. In the same way, Bhatt and Gorver [2005] did not find any relationship between IT infrastructure and competitive advantage either, but did demonstrate the positive effect of IT business expertise and relationship infrastructure.

Complementarity has taken centre stage [Wade–Hulland, 2004, Zhu, 2004], with a focus on the complementary role of different types of IT and non-IT resources in value creation [Ravichandran – Lertwongsatien, 2002]. Aral and Weill [2007] has also

come to the conclusion that organizational IT capabilities enhance the positive effect of IT investments on performance. In their meta-analysis, Liang, You and Liu [2010] reviewed 42 resource-based studies and found that corporate capabilities are important intermediaries between technological capabilities and corporate performance. Figure 9 summarizes the findings of yet another recent meta-analysis and literature overview [Patas – Bartenschlager – Goeken, 2012] in respect of IT resources' effects on corporate competitive advantage. The figure shows well that empirical studies have remained contradictory to date with regard to the impact of IT resources and, in my view, the categorization of resources are not sufficiently crystallized either.

Figure 9: Research Map Presenting the Effects of IT Resources on the Competitive Advantage
(the signs on the arrows indicate the direction of the relationship empirically justified by different studies)
[Patas – Bartenschlager – Goeken, 2012, p. 5068.]



In any case, specialized literature seems to be coming to a consensus on the fact that the appropriate use of information technology complemented by the proper adjustment of business processes and the existence/development of complementary corporate capabilities can in combination provide real competitive advantage and thus create value.

4.3.2 Technology acceptance and use

Although it was not until recently that the subject of user acceptance of technology had emerged in literature, its relevance is nevertheless beyond doubt. In order for information technology investments to create real value for the company it is of primary importance that it is used, and is used efficiently, by employees. Financial evaluations consistently demonstrate that it is this single factor that return is the most

sensitive to [e.g. Aranyossy – Nemeslaki, 2005]. Studies on risks also point out that in a great percentage of cases the cause of project failure lies in "non-usage" [e.g. Aral – Brynjolfsson – Wu, 2006]. Here I would like to briefly mention the basics and most important results of this discipline, even though this branch of science currently seems to be very vaguely linked – by international standards – to research on IT value creation.

A number of models exist to explore the factors of technology acceptance by users. Of them, e.g. the technology acceptance model [TAM, TAM2; see Davis, 1989; Venkatesh – Davis, 2000] or the innovation diffusion theory [Moore – Benbasat, 1991] explicitly focus on IT. The UTAUT (United Theory of Acceptance and Use of Technology) model [Venkatesh – Morris – Davis, 2003; see Figure 10] has been created out of an attempted synthesis of existing theories. Mention can also be made of some more general and basically social psychology models such as the theory of justification; motivation model,; social cognitive theory; or the theory of planned behavior. Overall, however, research studies have identified similar individual, social and institutional factors.

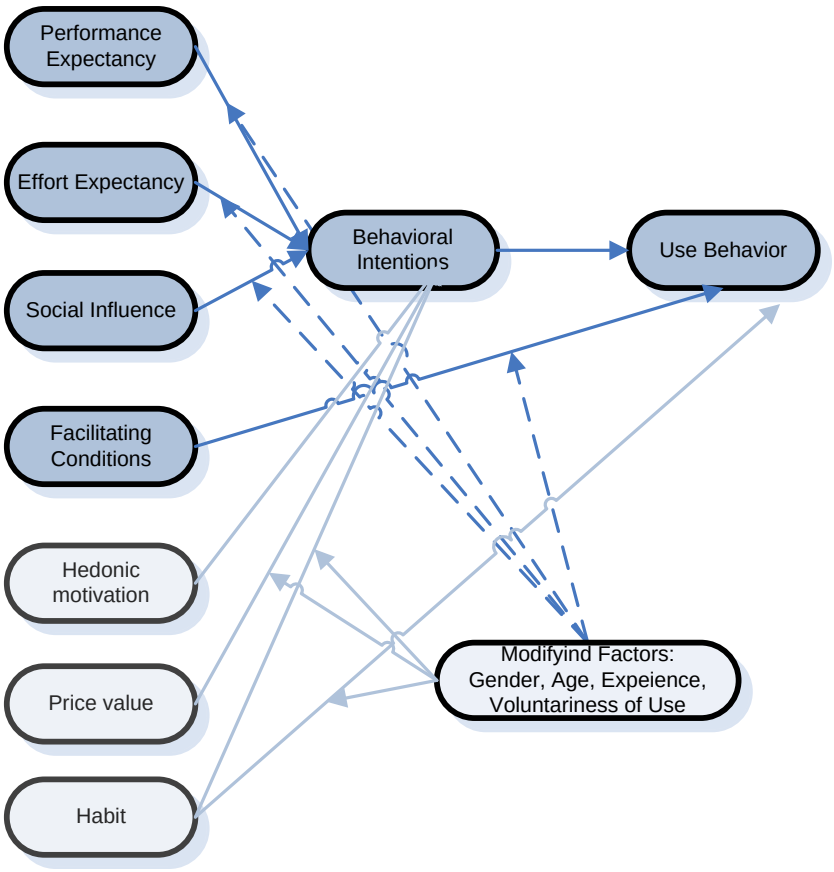
Of 101 empirical studies based on the TAM model, 74 demonstrated the system's perceived positive effect on propensity to use [Lee – Kozar – Larsen, 2003]. Meanwhile, the other explanatory variable of the model – ease of use – is a necessary rather than sufficient criterion of usage, except, interestingly, in the case of Internet-based applications [King – He, 2006]. Complementary explanatory variables used in studies included relevance to the job and pre-existing experience [Thompson – Higgins – Howell, 1991], or voluntariness [Moore – Benbasat, 1991][13].

The common points of findings drawn so far and the most recent experiments suggest that the most important factors of acceptance include expected performance improvement; expectations about the difficulty of using the system; community influence; and incentive corporate factors; with regard to factors influencing the effects, the age, gender and experience of the individual and voluntary usage are of relevance [Venkatesh et. al, 2003]. Over time, even the proponents of TAM could not ignore the proliferation of Internet-based applications and mobile devices, and thus the model has by now been expanded by the addition of new relevant factors (see Figure 10, light-shaded boxes).

[13] For a systemised set of complementary explanatory variables see Lee et al [2003].

Figure 10. IT Adoption and Usage – UTAUT and UTAUT2

[Venkatesh et al., 2003, p. 447. (dark background) with the added factors of Venkatesh et al., 2012, p.11. (white background)]



This latter extension, however, cannot nearly be considered to be generally accepted. I am convinced that technological advancement and changes in user habits will offer many more open questions to experts of the field. Future research will be driven by ambitions to create a synthesis and move towards generalization [Benbasat – Barki, 2007], which, naturally, may rest on yet further empirical studies [Venkatesh et al., 2003]. It may also prove useful to place acceptance theories in a broader perspective and integrate the group/corporate-level view in addition to individual studies along with linking findings up perhaps with project management and value chain research in an effort to establish a comprehensive theoretical framework. As studies currently focus on technology acceptance and implicitly assume that acceptance will at the same time lead to usage, it would also be important to take a direct a look at factors determining actual usage of the 101 TAM studies processed by Lee et al. [2003] only 15 dealt with the connection between intention to use and actual usage. Whereas from a practical aspect it can be critical to see what management has done to stimulate acceptance and usage, such as e.g. emphasizing the commitment of top management [Lewis, – Agarwal –

Sambamurthy, 2003]; the effect of training; or setting up an appropriate performance management system. The research model presented in the current paper examines system usage as an intermediary variable of IT value creation (see Section 7.3.3).

4.4 The current state of research: Lessons drawn from the literature review

A few years ago Kohli and Grover [2008, p. 26-27] made the following simple statements about the standing of IT value creation research:

- IT does create value
- IT creates value under certain conditions
- IT-based value manifests itself in many ways
- IT-based value is not the same as it-based competitive advantage
- IT-based value could be latent
- There are numerous factors mediating IT and value
- Causality for IT value is elusive

To make sense of the above statements let us take one by one the questions posed at the beginning of the theory overview and the answers that can be given to them on the basis of specialized literature (see Table 8). Question 1/a: Does IT create business value? Of metrics related to the question the most frequent ones include corporate-level profitability indicators; mostly, these are the ones that empirical studies also use to measure competitive advantage. Concerning value creation, a positive confirmatory position had been formulated by the turn of the millennium since most studies had by then succeeded in demonstrating a positive relationship between corporate performance and the volume of IT investments. Although a positive relationship at the national economy level is evident, at industry and company level the key to success should be sought in factors connected to individual organizational or business models. In corporate practice, neither complete IT failures nor three-digit returns are rare occurrences; therefore, even if the productivity debate appears to be subsiding, it is possible that the debate on IT competitiveness shifting to a level higher has not been settled yet.

When approaching the issues of corporate IT value creation from a more practical standpoint, Question 1/b related to the methodologies of the financial valuation of IT value creation naturally emerges to the fore. The related theory is more of a

normative nature and supported by few empirical findings, which are mostly based on case studies. The real-option view, which is currently considered to be the mainstream, only dominates theory and perhaps IT management perspectives and remains unmanageable for company valuation practice for the time being. The latter is left to rely on the traditional DCF-based model, which places emphasis on uncovering and estimating all related cash flows due to challenges stemming from uncertainty and intangibility. In my opinion, it is exactly because of forecasting uncertainty and vicarious effects that the principal function of pre-investment ex ante IT valuations lies not so much in determining an exact value as in identifying the key factors of value creation. After all, even though the final result of DCF valuations may not be accurate, the comparison of cash flow sources by scale enables identifying the most important value-creating factors and thus the management of the implementation project and risk management can focus on these factors.

Apart from all this, the RBV adopted from literature has also worked its way up to become one of the mainstream theories of the field in the past decade. Its inward-looking analytical approach allows demonstrating not only the existence of value creation but also corporate resources – assets and capabilities – facilitating it. Question 2/a: How does therefore IT create business value? Empirical findings have by now shown evidence that hardware and off-the-shelf software makes very little difference (or none at all); rather, it is human resources complementary to IT resources; management capabilities; and processes ensuring business linkages that matter. For those constitute corporate resources that are not available from commercial outlets, are rare, and are harder to substitute or imitate, which can make them a source of sustainable value creation by IT. I would, on my part, add to it that research aimed at exploring the process of value creation should devote more attention to the question of usage and integrate separate but related research findings [see Aranyossy, 2010a]. After all, no matter how good technological or organizational capabilities are, failure to use the system, or to use it appropriately, will make value creation impossible.

Overall, it can be concluded that the RBV framework allows scrutinising the existence, ways and sources of value creation alike. That is why, among other things, I have selected it as the basis of my empirical research (see also Section 6.1). In raising its basic question, my study follows the traditions of research on the IT productivity paradox: It seeks to demonstrate or disprove the relationship between certain IT resources and corporate financial and competitive performance. Moreover, my model looks at IT value creation in the specific area of e-commerce and is therefore akin to

earlier pieces of research like the works of Zhu – Kraemer [2002], Zhu [2004], or Merono-Cerdan – Soto-Acosta [2004]. In what follows, I will present theoretical and empirical studies forming the immediate underpinnings of the specific research plan.

Table 8. Summary of the Literature Review

Question	Explorative-descriptive	Normative
1	**1./a question:** Does IT create business value? *Chapter 4.1.* - Does IT affect productivity? Yes, IT industry certainly has an effect as a factor of macro level productivity and growth. IT-based effects and opportunities might differ by industry , and on firm-level IT performance depends on a lot of unique factors and circumstances. - Does IT create sustainable competitive advantage? The dispute is not closed, there are extremely different views from "IT as a utility service" till IT-based competitive advantage created by complementary resources.	**1./b question:** How can we measure the value created by IT investments? *Chapter 4.2* - What effects have to be considered in the valuation? Every additional effect has to be considered: from traditional cost savings till intangible effects and future options. - Which valuation methodology should we use? From a practical perspective DCF is the mainstream, in theoretic literature the real option approach is also popular. In both methods mapping the value drivers could be more useful than the actual numbers.
2	**2./a question:** How does IT create business value? *Chapter 4.3* - What are the key sources of value creation? Hardware and software are often commodities, so the focus should be on complementary human, managerial or business resources. - What are the necessary and criteria of value creation? There is still an ongoing debate in the resource-based literature, but we could learn a lot from the research focusing on actual usage, as they are concentrating on more direct effects.	**2./b question**: What can we to support IT value creation? *This question is far beyond the focus of this paper, so I am not going to discuss in the literature review. But I consider the research on IT project escalation and de-escalation very interesting and useful.*

5. E-commerce value creation in the literature

In the foregoing section I reviewed the most important perspectives and results of IT business value literature. However, at this juncture it is worth devoting attention to technology, i.e. e-commerce, the central theme of empirical research. In what follows, I will summarize the core concepts of e-commerce value creation and related theoretical and empirical conclusions grouped around the basic issues presented in the preceding section. I will also briefly cover the domestic trends of e-commerce. However, let me first discuss the fundamental question of my selected theme: Why e-commerce?

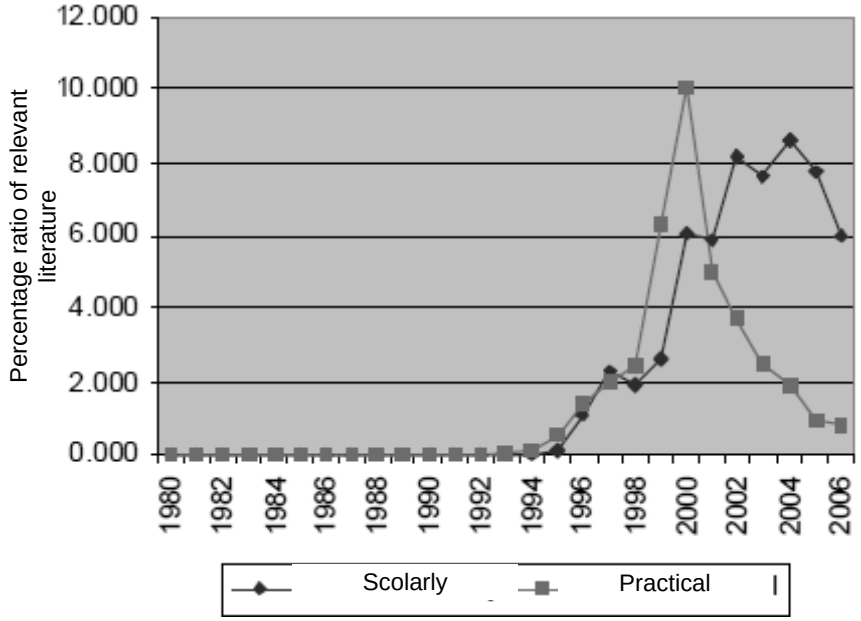
5.1 Why e-commerce?

For the empirical study of the question of IT value creation, this time I have chosen e-commerce from the spectrum of corporate IT investments. This choice has been made for the following reasons:

- On the basis of a historical approach to IT business value creation (see Section 3.2 and Table 2), the present is the "age of new external business models" as the Gartner Group sees it, or the "age of the Internet" in Applegate et al's [1996] systemization . In other words, literature on IT value creation should also turn towards value creation via external electronic links. It comes as no surprise therefore that e.g. in their meta-analysis reviewing 42 empirical IT business value studies Liang, You and Liu [2010] have concluded that it is primarily outward-looking technological resources that have an effect on financial performance.
- Indeed, in the international arena a kind of shift towards e-commerce is discernible in researchers' attention. In their study on IT research trends, Baskerville and Myers [2009] observed that while it had been office automation systems in the 1980s or IT-backed reorganization in the 1990s that took centre stage, the latest fad placed the focus on e-commerce. Interest in this field no doubt peaked at the turn of the millennium, but this peak was of an unusual prolonged nature by scientific standards and a significant portion of research remained targeted at e-commerce even between 2002 and 2006 (see Figure 11). In addition, the market proliferation and maturity of e-commerce have by now also reached a level in Hungary where it is worth examining using large-sample quantitative statistical methods.

Figure 11. Scholarly and Practical Interest in Electronic Commerce Articles

[Baskerville – Myers, 2009, p. 657.]



- Even though we accept Porter's [2001] view that the Internet will not change the ground rules of competition, it must certainly be an important part of corporate strategy against the background of an ever expanding industry. Internet-based corporate technologies have by now become widespread in Hungary, our closer neighborhood and Europe alike. On our continent, 38% of retail trading companies offer some kind of online order opportunity [e-Business Watch, 2008], while in Hungary the same holds true of 34.5% of trading firms [KSH, 2008].[14] In respect of the investment volume, the amount of e-commerce investments ranges from a few hundred thousand forints to HUF 6 to 7 million [Kis, 2009], while with large multinationals it can exceed HUF 1 million as early as in the first half-year [Kauffman – Walden, 2001]. Therefore, it is absolutely necessary to ask the question of whether this penetration and the amount spent is explained by something on the side of efficiency or competitive advantage. Or, coming back to Porter's [2001] analysis: Is it positive or negative industrial competitive factors that have a stronger impact on the business success of domestic e-commerce applications?

[14] Of course, the inverse of this argument is also true: E-commerce applications are now beginning to become mass products both across Europe and in Hungary and therefore we must identify those few rare cases and their typical characteristics (e.g. community functions or search optimisation) where e-commerce capabilities have still become sources of competitive advantage. Or, conversely, based on Carr [2003] we can also say as a hypothesis that e-commerce can no longer be a source of competitive advantage.

- Early studies mostly predicted that small and medium-sized enterprises (SMEs) could profit from e-commerce applications the most as they can make their market entry easier and cheaper, especially in the case of niche segments with few and scattered consumers. This phenomenon is known as "long tail", whereby with the help of IT, highly multi-faceted small target audiences with very special preferences can be attacked in an economical manner [first: Anderson, 2004]. However, recent studies suggest that the tangible and quantifiable benefits of e-commerce, such as direct cost cutting or sales revenues, can be negligible compared to qualitative intangible benefits like changes in the quality of partner relationships or information. This is an exploitable investment opportunity basically for larger companies [Corbitt – Al-Quirim, 2004, p. 159]. It can be interesting to examine on a domestic sample consisting mainly of SMEs which theory holds true and whether some of the benefits of e-commerce can be quantified after all.
- Last but not least, a focus on e-commerce is also fortunate from the aspect of empirical observation as it is an outward-looking and mostly publicly visible system of companies. There is no need to obtain insider information, conduct in-depth interviews with top executives, or even wait for answers to questionnaires for data gathering. Hence, as opposed to internal corporate systems, with e-commerce applications a sample containing a few hundred or thousand items can be compiled even without gaining stakeholders' confidence and support [see Bőgel, 2011]. The generalizationability of such large-sample studies is significantly better that of than of case study-based research often applied with complex internal information systems.

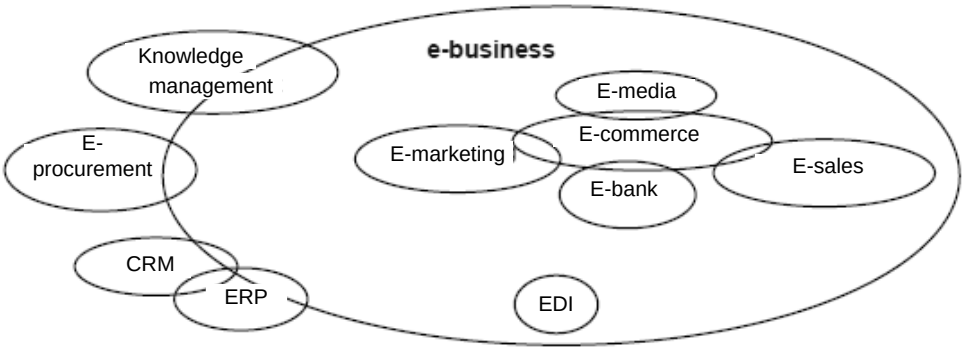
5.2 Basic concepts in e-commerce

Of the related concepts, perhaps the definition of e-business should be dealt with first, since it is used by many (in my view erroneously) as a synonym of e-commerce. "The e-business concept includes the competitive environment; innovation challenges; management and organizational implications; and strategy-making and project management tasks of e-commerce models" [Nemeslaki – Duma – Szántai, 2004, p. 44]. From a technological point of view, e-business is the transposition of Internet technologies into the corporate environment along the corporate value chain linking up stakeholders [see Kalakota – Robinson's 2002, e-business ABC]. That is to say, it incorporates corporate technologies ranging from supplier systems to customer

relationships systems and from company portals though ERP to knowledge management applications, i.e. all business processes implemented via computer networks. Thus e-commerce is actually one of e-business applications (see Figure 12) that is focused on customer relationships and functions as a sales channel.

Figure 12. Different Areas of E-business

[Badinszky, 2009, p. 62.]



The concept of e-commerce can also be approached from different aspects [Nemeslaki et al, 2004, p. 40 based on Turban – King – Lee, 2004], for example:

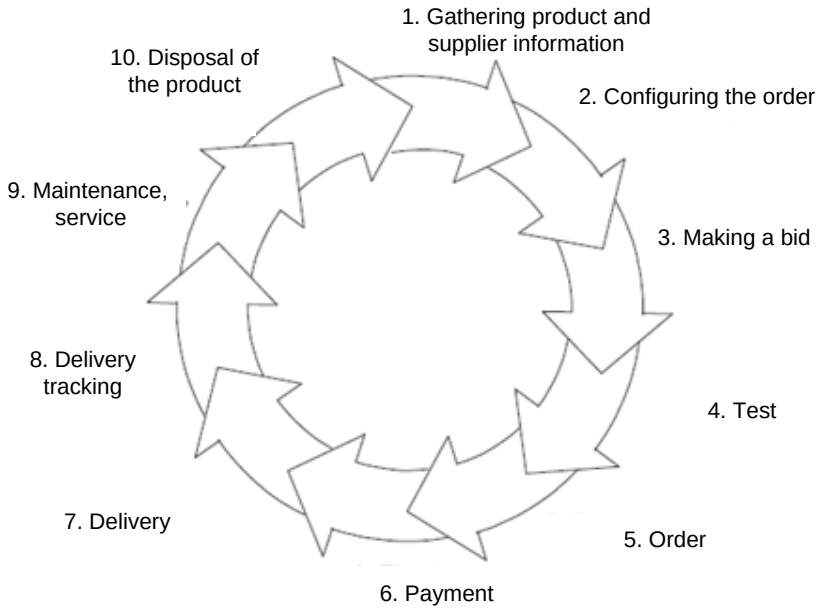
- From a trade aspect, purchase or sale of products and services via the Internet or other electronic channels;
- From a communication aspect, transmitting products, services and payment means via a computer network;
- From a business process aspect, a kind of electronic (not physical) sales channel.

From a functional aspect, one of the most accurate definitions can be found in the discussion paper on a domestic uniform Communications Act [quoted by Mojzes – Talyigás, 2000, p. 22]: "E-commerce: It means the conduct of business activities by electronic means based on processing and transmitting data (text, voice, images). Electronic commerce encompasses a number of different activities such as distributing goods and services; transferring money; trading securities; issuing waybills; conducting commercial auctions; public procurement; direct marketing; and customer service activities etc. by electronic means." In many places, the concept of e-commerce is used in an even broader sense; e.g. Zhuang – Lederer [2006, p. 252] define it as follows: "any form of economic activity conducted via electronic connections". E-commerce can be defined more precisely as the use of the Internet as a sales channel in respect of both information and business transactions [Mallick – Sharma – Kumar – Subrahmanya, 2005].

The different manifestations of e-commerce can be systemized along three dimensions: based on the degree of digitalization of (1) the product, (2) the intermediary, and (3) the process [Gábor et al., 2007]. Depending on the degree of digitalization of the product or the sales process, a wide spectrum of e-commerce activities can be observed. Total e-commerce is when the product itself (e.g. a piece of music or a film) and the entire exchange process (from obtainment of information to payment) are digitalized [Nemeslaki et al., 2004, p. 41]. The digitalization of the process between the buyer and seller can cover many sub-processes, which is illustrated in the flow model of Drótos – Móricz (see Figure 13).

Figure 13. E-commerce Lifecycle Model

[Móricz, 2009, p. 165.]



According to authors Mojzes and Talyigás [2000], locations of sale can normally be broken down into three units:

- Marketing and value-added information: Its purpose is to attract customers and gain their confidence.
- Catalogue: It includes detailed product information, conditions of sale (guarantee, replacement etc.), and prices.
- Order processing: In this unit the buyer can place orders, make payments and (in the case of more advanced systems) track their orders.

In addition, within the framework of e-commerce in a narrow sense (i.e. commercial purchase and sale of products or services via an online channel) we distinguish B2B (business-to-business), i.e. e-commerce between economic entities, and

B2C (business-to-customers), i.e. e-commerce directed at end-users[15] [Mojzes – Talyigás, 2000]. Within e-commerce, therefore, e-retailing or e-tailing is a narrower concept, which explicitly refers to the conduct of electronic retail trade transactions. Among B2C electronic business models taken in a broader sense we can distinguish several directions [Krishnamurthy, 2007]: (1) direct selling model; (2) intermediary model; (3) advertisement-based model; (4) community-based model; and (5) fee-based model. In a narrower sense, however, the concept of e-retailing usually means the first one of these.

On my part, I use the following e-commerce concepts in the empirical research:

- I interpret *e-commerce as commercial activities conducted via the Internet* including, however, each related process (see Figure 13) and not only a specific transaction. That is to say, my study extends to information and transaction (marketing and commercial) functions alike but I ignore other electronic channels outside the Internet (e.g. EDI use).
- My research focuses on *electronic retail trade*, i.e. *B2C e-commerce explicitly taking place in the retail sector*. By retail trade I mean direct selling to the end-user.
- By e-tailers I mean *retail traders whose exclusive sales channel is the Internet*.

There is significant literature on electronic retail trade alone. According to Doherty and Ellis-Chadwick [2006, p. 6.], the question can be approached from the aspect of (1) the retailer, or (2) the customer, or (3) technology. From the perspective of my theme, studies from the aspect of the retailer are relevant. Within them, the two authors have identified three focal areas of research to explore: (a) Internet as a potential market channel; (b) factors influencing the acceptance of the Internet; and (c) related management challenges. Accordingly, my research can be categorised into Group (a), within which the following main avenues of research can identified in literature:

- What are the distinctive features of the Internet as a new distribution channel?
- What are the main economic benefits of the electronic sales channel?
- How does it change the industry competition?
- How does it change the supply chain?
- How does it effect the traditional retail activity?

[15] This is complemented by C2C (customer-to-customer) purchase and sale, although it is basically separate from the sphere of interest of the business sector, similarly to transactions related e-public administration.

In my paper, I will primarily deal with the second question of the ones listed above: What economic benefits do electronic channels have? In relation to that, in the forthcoming chapter I will take a detailed look at international literature on value creation by e-commerce.

5.3 Theoretical overview of research on value creation by e-commerce

In their comprehensive overview of specialized literature, Kauffman and Walden [2001] distinguish five different dimensions of literature on e-commerce. Accordingly, research can be directed at the level of (1) technology; (2) the product; (3) the business process; (4) the market; and (5) the national economy. In what follows, I will not cover in detail most of the technologies or management issues, as in the current research e-commerce applications are merely illustrations of value creation by IT. Therefore, in this section I will attempt to introduce international literature on value creation by e-commerce, and present the domestic e-commerce market as the immediate theoretical basis of the current paper and its business environment.

The method of overview and systemization of value creation by e-commerce agrees with that introduced in Section 4: I will examine the two basic questions of IT value creation from an exploratory and normative aspect.

5.3.1 Does e-commerce create any value?

Value created by e-commerce has been studied with the classical tools of economics from different perspectives. The frequently mentioned benefits of e-commerce include for example access to distant geographical markets or the automated observability of buyer habits [see Merono-Cerdan – Soto-Acosta, 2007]. Thus, for example, in his market-level analysis Bakos [1998] concluded that companies find opportunities to create business value in e-commerce by (1) increased product customization; (2) the aggregation and disaggregation of information-based products; and (3) reducing search costs. Also studying – this time the e-commerce – market, Bernstein et al [2006] looked for a state of equilibrium in the competition of traditional ("brick-and-mortar") and e-commerce-based ("click-and-mortar") business models. According to the study using game theory tools, an oligopolic market can be dominated by the e-commerce-based business model, although from companies' aspect it seems to be a strategic necessity rather than a move generating extra profits; however, it benefits consumers more. By contrast, a study by McKinsey [quoted by Krishnamurthy, 2007]

found that companies complementing the traditional sales channel with the Internet ("bricks-and-clicks") were a cut above virtual-only retailers since their costs of acquiring and retaining buyers were lower and the visitor-to-buyer conversion rate was higher.

In studying the direct financial impacts of e-commerce, researchers often use some kind of a market value-based indicator. Subramani and Walden [2001] attempted to demonstrate e-commerce-related above-average price increases by using the method of event analysis. Interestingly enough, the effect of B2C initiatives proved to be larger than that of B2B announcements; similarly, the market valued e-commerce investments related to tangible products higher than in the case of digital products. With e-commerce (B2C) initiatives, an abnormal yield of 9.3% was measured in the ten days around the announcement. Dehning et al [2004] repeated Subramani's study for the original period and for the year 2000 alike and arrived at results reflecting the burst of the dot-com bubble, i.e. the positive impact of e-commerce announcements had ceased or became negative by the turn of the millennium. (Table 9 shows a comparison of the two studies.) However, the impact of B2C announcements remained the same even in 2000, similarly to the dominance of conventional businesses over e-tailers.

Table 9. Effect of E-Commerce Announcements on Share Prices

cumulative abnormal returns during the next 3 day after the e-commerce announcement	**Subramani - Walden (2001)**	**Dehning et al. (2004)**	
	1998	1998	2000
B2B initiatives	3,10%	1,74%	-4,3%
B2C initiatives	5,30%	9,02%	3,4%
E-tailers	4,40%	4,46%	-1,0%
Conventional firms	3,90%	10,32%	7,4%

5.3.2 How to measure business value created by e-commerce?

In reviewing literature on measuring e-commerce, this time I will not restrict myself to financial literature, and will thus first present the results of experiments linked to operations. Of the studies presented in the 2002 special issue on e-commerce of Information System Research [Vol. 13. No. 2.], several made an attempt to work out a methodology of measuring e-commerce capabilities:

- Palmer's [2002] article takes a practical direct approach, based on sound theoretical underpinnings, though, to the question of e-commerce: It seeks to put together the indicators of the usability, structure and performance of websites.

Indicators include the website's technological performance; download speed; navigation; information content; and interactivity.

- Similarly, Agarwal and Venkatesh's [2002] study also focuses on website usability but the research model and study criteria have been taken from the corporate sector (Microsoft). These criteria based on practical experience are: content; ease of use; made-for-the-medium; and affective responses.
- Torkzadeh and Dhillon [2002] analyze the success factors of B2C e-commerce from a transactional perspective focusing on what buyers perceive to be important when shopping on the Internet. Such success factors include e.g. ease of delivery and payment; quality of customer relations; and online product choice and shopping security.

Later, again on the basis of the functional valuation of websites, Kotha et al [2004] looked at the effect of e-commerce websites using Tobin's q indicator as a value metric. He found that while the positive impact of website usability can be eroded in competition, buyers' trust and customer relationship services can be a source of sustainable competitive advantage.

When examining the effect of e-commerce on companies strictly through the eyes of financial analysts, the transaction cost theory can have great explanatory power. After all, one of the biggest financial benefits of e-commerce can lie in the reduced transaction costs of sales on the side of both the buyer and the vendor [Malone – Laubacher, 1998]. From the company's point of view, it enables bridging great geographical distances and meeting needs more accurately (e.g. by way of simpler customization), and reducing the costs of concluding contracts. From the buyer's perspective, it minimizes the cost of search and comparing prices; reduces information asymmetry; saves time; and facilitates the bridging of geographical distances, too [Lee – Clark, 1996].

As to the applicability of specific financial valuation methods is concerned, most e-commerce researchers remain skeptical for the time being [Kauffman – Walden, 2001]: Conventional valuation techniques can be applied with difficulty due to technological and market uncertainties surrounding e-commerce. That is why Kauffman and Walden [2001] urge the enhancement of alternative techniques, primarily real-option tools, also e.g. in the case of e-commerce. For example, Dai – Kauffman – March [2000] place the focus of real-option analysis on the uncertainty of the proliferation of XML standards in the case of B2B e-commerce and point out the potential in the

waiting option. Besides, many infrastructural projects (e.g. middleware) in a company's life can be construed as an interproject option that can open up opportunities for introducing, among other things, B2B and B2C e-commerce applications [Dai et al., 2000]. In general terms, however, it can be concluded that – in terms of both its practicability and empirical underpinnings – literature on IT investment valuation is replete with shortcomings and does not contain special elements compared to general literature on value creation by IT (see Section 4.2).

5.3.3 How does e-commerce create business value?

Naturally enough, the prevailing resource-based view has also found its way into research on the mechanism of value creation by e-commerce as a special IT application. For instance Amit [2000], based on this and other financial and strategic theories, attributed the success of e-commerce dot-com firms to four factors. These are: efficiency; complementary; innovation; and a kind of lock-in effect. Using the RBV, Craighead and Shaw [2003] examined the supply chain to identify benefits to the final consumer.

Since the turn of the millennium, co-authors Zhu and Kraemer have explored the question of value creation by e-commerce in several studies. They were among the first authors to build their research model purely on the RB-based theory; they scrutinized the effect of four e-commerce capabilities (information-transaction-interaction-integration) on corporate performance in the productive sector [Zhu – Kraemer, 2002, see Table 10]. After industry and volume adjustments significant performance improvements were demonstrated thanks to e-commerce, especially in operative indicators such as inventory turnover. While with technological companies the cost of goods sold also decreased as a result of e-commerce applications, quite the opposite happened in the case of conventional productive companies. Later, Zhu [2004] used the same model in the retail sector. He showed the complementary nature of e-commerce capabilities and basic IT infrastructure and their joint contribution to cost-cutting and more efficient management of human resources and inventories. Findings suggesting the complementary nature of IT resources can at least partly serve to explain the "productivity paradox" with companies that only have, or invest in, one part of complementary resources.

Table 10. E-commerce Business Value – Results of the Studies Similar to Mine

(*0,05 < p < 0,1; **0,01< p <0,05; *** p<0,01)

Authors	Profitability (ROA or gross margin or value added)	Inventory turnover	Sales revenue per employee
Zhu [2002]	model R^2: 0,361*** e-com. R^2: 0,104		model R^2: 0,379*** e-com. R^2: 0,251**
Zhu – Kraemer [2004]	model R^2: 0,140 e-com. R^2: -	model R^2: 0,412** e-com. R^2: 0,458*	
Merono-Cerdan – Soto-Acosta [2007]	model R^2: 0,891*** e-com. R^2: 0,252***		

In Europe, Merono-Cerdan and Soto-Acosta [2007] wanted to show evidence for the effect of corporate website content on organizational performance and also conducted their study along the dimensions of information-interaction-transaction. They found that the information and interaction functions greatly contributed to the positive effect of transaction capability on performance, i.e. a kind of complementarity occurred also among e-commerce capabilities. Moreover, recent European studies have also revealed that it is web-based innovations complementary to Internet infrastructure that make a real addition to corporate value creation [Soto-Acosta – Loukis – Colomo-Palacios – Lytras, 2010].

Merono-Cerdan and Soto-Acosta [2007] summarize the contribution of information-interaction-transaction capabilities to value creation as follows:

- Information: Access to geographically distant and earlier unreachable consumers;
- Interaction: Management of long-term customer relations; handling loyalty programs; and building virtual communities;
- Transaction: Reducing the costs of coordinating and conducting transactions; tracking buyer habits; and data mining for marketing purposes.

Lederer – Mirchandani – Sims [2001] studied the effect of Internet-based information and transaction benefits on corporate competitiveness, which companies seek to achieve through improved customer relations. E-commerce capabilities featuring Zhuang and Lederer's [2006] study can also be systemized along the dimensions of information-transaction-interaction complemented by usability and human and business resources. Results suggested that the effect of human resources on e-commerce

performance was negligible, while the impact of other resources proved to be significantly positive. Also based on the RBV but using quite different concepts, Hulland – Wade – Kersi [2007] investigated the same question in the retail trade sector looking at the effect of technological and marketing-like business resources on corporate performance through the intermediary effect of online commitment. Interestingly enough, while the direct impact of IT resources proved to be negative, it was found positive through online commitment. Furthermore, the effect of established conventional sales channels also negatively affected online commitment and the process of value creation by e-commerce, i.e. e-tailers' position in this respect can be more favorable.

Similarly to the resource-based view, the effect of technology diffusion and acceptance theories (see Section 4.3.2) can also be felt in e-commerce literature. Thus, for example, Gefen and Straub [2000] used TAM[16] to examine consumer-side acceptance of e-commerce. While the perceived ease of use was an important factor in exploiting the information function of websites, the same did not influence the use of transaction functions. Gefen – Karahann – Straub [2003] added consumer trust to TAM's perspective and held each factor important from the aspect of online shopping. Koufaris [2002] has complemented TAM with consumer behavior theories and concluded that factors identified by both approaches influence the level of e-commerce acceptance and usage. Relevance; web skills; challenges; and the use of good search mechanisms equally influence online shoppers' behavior, while perceived website usefulness determines revisit likelihood. In my opinion, some of the factors determining this acceptance can also be incorporated in the study of value creation through the information-transaction-interaction functions.

5.4 E-commerce in Hungary

I have already introduced the relevant Hungarian research literature in the last chapters – now I intend to summarize some statistical surveys on the Hungarian e-commerce market. The overview's main dimensions include a short introduction of the regulatory environment and the technological background followed by e-commerce attitudes and activities of businesses and consumers, and finally by some characteristic features of the domestic market. According to the research time span, the review

[16] TAM – Technology Acceptance Model; its two independent variables are perceived usefulness and perceived ease of use.

focuses on market conditions in 2009-2010 but, naturally, some recent developments also merit mention.

The functioning of e-commerce in Hungary is fundamentally determined by the relevant regulatory background, specifically Act CVIII of 2001 on Certain Aspects of Electronic Commerce Activities and Information Society Services. The Act defines electronic commerce as "information society services for the purpose of selling, purchasing or exchanging things, including money, securities and natural forces exploitable as things; services; property; proprietary rights (hereinafter collectively referred to as goods) on a commercial basis." Information society related service "means distant services provided by electronic means, generally against payment, and accessed by the recipient of the service individually". The Act includes provisions on e-commerce reporting, data provision, contracting, data protection and consumer protection. The main actors of the institutional system responsible for enforcement of the Act are the Hungarian Authority for Consumer Protection and the National Media and Communications Authority. Act XCVII of 2003 on the amendment of Act CVIII of 2001 on Certain Aspects of Electronic Commerce Activities and Information Society Services was designed to make adjustments to the original act. It supplemented certain provisions of Act CVIII of 2001; clarified issues relating to the responsibility of service providers and intermediary service providers; and supplemented provisions on data protection [Pintér et al, 2007]. Meanwhile, the Act has been amended several times, also in 2007, when the purpose of the amendments was to harmonize it with EU legislation and classified mail order/telephone order (MOTO) activities as commercial activities without physical outlets.

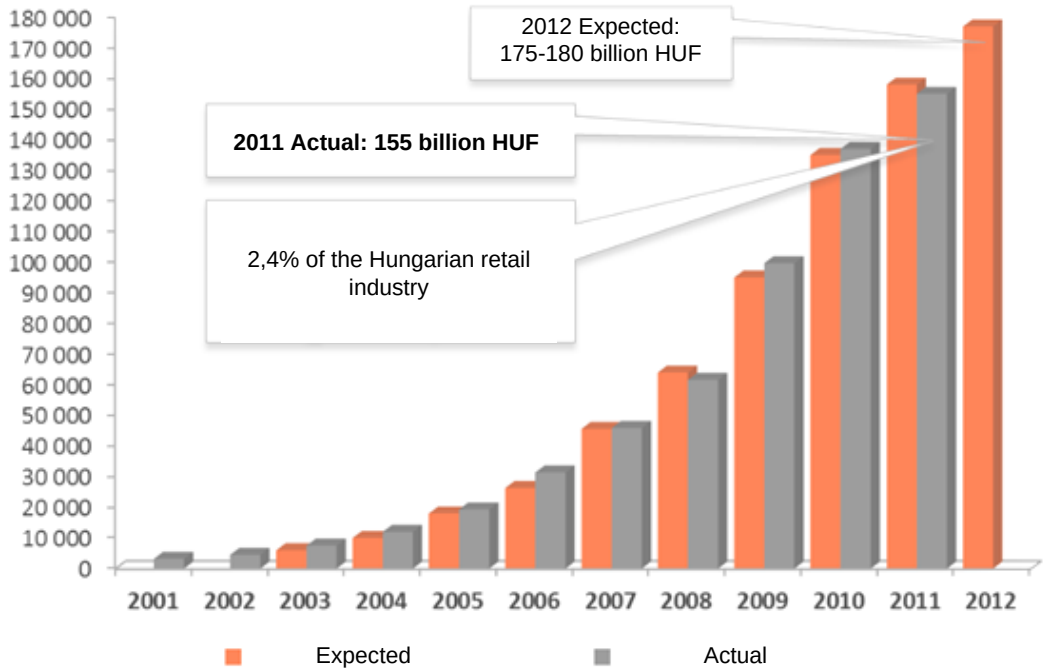
Another important basis for e-commerce is IT infrastructure, i.e. the quantity and quality of corporate information technology. According to an OECD study covering 26 countries, Hungary ranks 25th by ICT investment volume followed only by Slovakia [Information Technology Outlook 2006, quoted by Pintér et al., 2007]. In 2004, the average corporate IT budget in proportion to revenues was 2.2%, reaching 4% only in highly information-intensive industries (energy supply; commerce; telecommunication; IT) [Drótos – Gast – Móricz – Vas, 2006]. In 2007-2008, the average amount spent by online stores on one-time technical development was slightly over HUF 1m; only sites having over 10 000 visitors expended 3 to 4 times that amount [Kis, 2009]. The country report issued in 2007 by BME (Budapest University of Technology and Economics) and GKI (Economic Research Institute) researchers defines the Hungarian website-ecosystem situation as follows [Pintér et al., 2007, p. 19]: "The development of the

Hungarian Web (…) is basically characterized by following, i.e. websites and online models successfully operating in countries at the cutting edge of the e-economy typically appear with a 2 to 3-year delay and in an adapted format. Few websites implementing really innovative ideas can be found while the knowledge of Hungarian web developers, the technological solutions they use, and the high standards applied in design do not lag behind the leading edge of the world in any respect."

In this environment the volume of electronic commerce has shown a dynamic growth over the past decade: B2C turnover was estimated at HUF 440m in 2000 and HUF 2.2 billion in 2002, [Gábor et. al., p. 172.] and in 2011 the market volume was already HUF 155 billion [GKIeNETa, 2012; see also Figure 14]. Moreover, this value did not include the volume of tourism and financial services and the turnover of online auction sites, which are, without exception, among the most popular online transactions in Hungary [Pintér et al., 2007].

Figure 14. Yearly Turnover of Hungarian Webshops, 2001-2012 [GKIeNET, 2012b]

(the statistics do not include e-turism and e-insurance, million HUF)



In 2008-2010, i.e. the research period, the main e-commerce market indicators were as follows [Kis, 2009; GKIeNET, 2009 and 2010]:

- Online retail trade turnover in 2008 amounted to appr. HUF 63 billion, while in 2009 it was up to nearly HUF 199 billion (this amount again is exclusive of tourism, financial and insurance services and the turnover of online auction sites).

- In 2008, the share of online retail trade turnover in total retail trade in Hungary was 1%, representing a growth rate of 0.1% in one year. In 2009, revenues from electronic commerce represented 16.8% of the total turnover in Hungary, exceeding the EU average of 14%, of which, however, only 3.4% was realized through websites [KSH, 2011, p. 21 and p. 50].
- 72% of purchases were made through e-tailer portals, while 28% through those of retail traders also using traditional sales channels.
- There were 1800 and as many as 2700 webstores legally operating in Hungary in 2007 and in 2009, respectively [Pintér et al., 2007]. However, 90% of the turnover was still generated by the largest webshops, i.e. the ones with a turnover of over HUF 100m and over 1000 visitors a day.
- The per-transaction value of purchases as compared to the previous trend reversed in 2008, representing an average HUF 3500 per transaction in the case of solely online webstores and HUF 11660 per transaction with online shops also having the traditional retail trade background. The average of the two types is HUF 5800 per transaction in total. In 2009, however, the average value of Internet purchases was already as high as HUF 11000.

Table 91. Corporate Usage of Internet in Hungary

	Drótos – Szabó, 2001	*KSH, 2008*	*KSH, 2008*	*KSH, 2008*	*KSH, 2008*	*KSH, 2010*	*KSH, 2010*	*KSH, 2011*	*KSH, 2011*
Different levels of internet usage	**2000**	**2005**	**2006**	**2007**	EU average 2007	**2009**	EU average 2009	**2010**	EU average 2010
The firm does not have internet connection	42,3%	23,8%	21,9%	15,0%	7,0%	13,2%	7,0%	10,4%	6%
The firm has internet connection, but no webpage	30,3%	38,1%	38,3%	39,7%	30,0%	35,8%	29,0%	32,8%	27%
The firm has webpage, but only contains information	24,0%	33,6%	29,7%	30,4%		37,7%	51,0%	41,7%	
The webpage is used for business transactions as well (e.g. sales)	3,4%	4,5%	10,1%	14,9%	63,0%	13,3%	13%	15,1%	67%

According to a 2008 questionnaire survey, 62% of Hungarian companies had never realized sales through the Internet. However, 75% of companies using this sales channel did so regularly, although at a rate lower than 25% of the total turnover [Badinszky – Kulcsár, 2008, p. 44.]. KSH [2008] surveys show that in 2007 over half of companies did not have their own homepages but nearly 15% had a webpage also suitable for placing orders (see also Tables 11 and 12). Urbán et al. [2007] analyzed a sample of 125 most frequently visited Hungarian websites, 16.67% of which implemented a basically e-commerce business model. The possibility for online shopping or placing orders was identified in the case of 92.3% of the sites, while a further 7% of retailer sites preferred the placement of orders or making inquiries by e-mail.

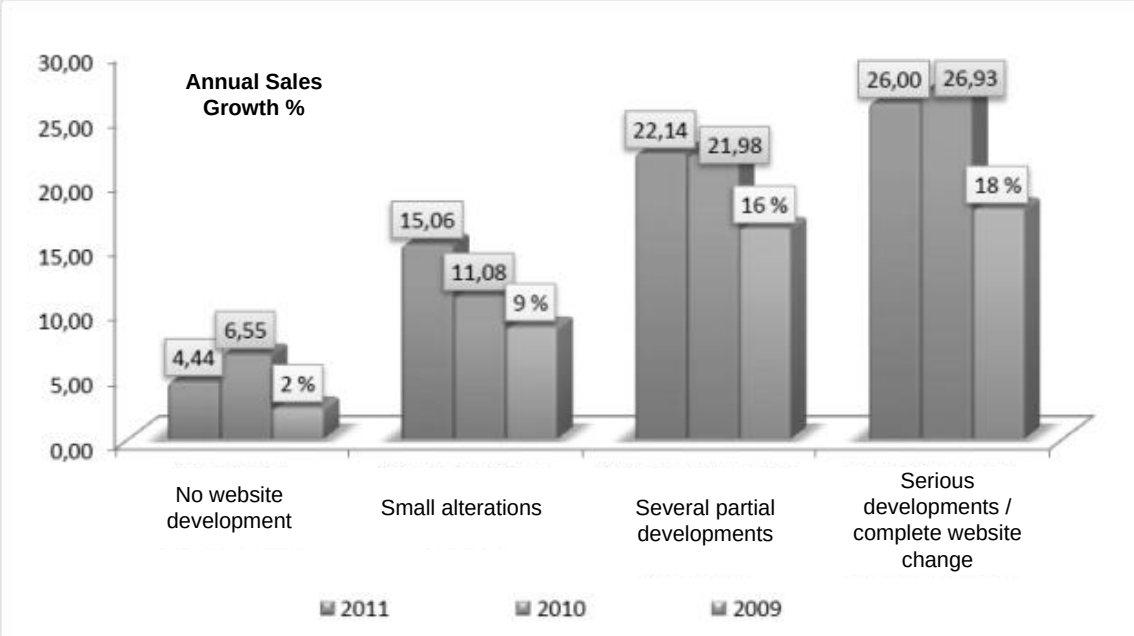
Table 102. E-commerce Functions on Hungarian Commercial Websites – Percentage Share of Total Enterprises [Based on KSH, 2008, 2010 and 2011]

E-commerce functions	2005	2006	2007	2009	2010
Information – corporate and product information on own website	33,5%	37,5%	39,4%	44,4%	49,4%
Transaction – on-line order placement	4,5%	10,1%	14,9%	13,3%	15,1%
Interaction – on-line help	4,3%	2,8%	2,6%	na	na
Customization – website customization options	1,9%	2,7%	2,0%	5,6%	6,8%

Based on a 2009 survey conducted under a research program entitled "Competing with the world", in their study, Mirkó Gáti and Krisztina Kolos [2011] also analyzed what benefits businesses expected from e-commerce applications. Respondents primarily expected that e-commerce programs would enhance the satisfaction of consumer needs and provide an opportunity to target new markets. Agreement on the statement that "the use of e-commerce has reduced the costs of procurement and/or sales" was above average. Interestingly, it was found that looking towards the future it was primarily small enterprises that expected the role of online communication to increase in their operation.

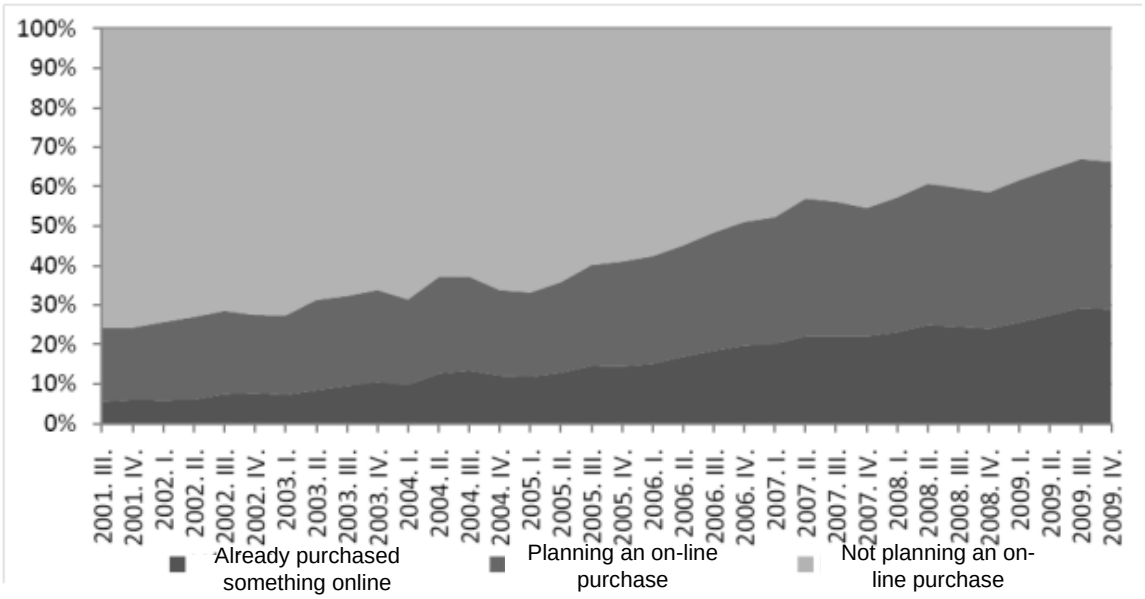
Figure 15. Website Development and Sales Growth

[WebShop-Experts, 2012, p. 5.]



In its survey, WebShopExperts [2012] asked the owners of 305 Hungarian webstores about their commercial activities, and 64 % of them were able to report turnover growth. It was also found that with older and continuously developing webstores higher rates of sales revenue growth were expected in 2009-2011 (see Figure 15).

Figure 16. Internet Users Planning to Purchase on the Internet [GKIeNET, 2010]



Extrapolating the ratios found in surveys to the entire population of Internet users, from their perspective we find that in 2008 as many as 749000 persons, or 20%,

performed some shopping activity via the Internet within one year [Kis, 2009; Figure 16]. By 2011, the number of online shoppers already increased to 1.4m [GKIeNET, 2012a]. In 2007, 27.6% of companies on the corporate buyers market reported that they used the Internet for purchasing (or selling) products and services [KSH, 2008]. If we accept the fact that in general corporate e-sales volumes lag 3-4 years behind e-purchases [Badinszky, 2009, p. 55.], then in a few years' time nearly 25% of companies in Hungary can also be expected to offer the opportunity for electronic purchase on the Internet.

Focusing on small and medium-sized enterprises (SMEs), which is particularly relevant in respect of my sample, the following major empirical results can be highlighted [Nemeslaki, 2007, p. 54]:

- Online procurement is more widespread among SMEs than are online sales, and it is these the two areas where companies learn about e-business opportunities.
- In 2003 (in a sample taken from sectors also included in the e-business w@tch research), 73 % of SMEs had their own websites; 23 % carried out online sales; and 12% enabled online payment [Szirmai et al., 2004, p. 47-48].
- There is a strong correlation between company size and the complexity of the applied e-business solutions.
- Half of SMEs reported increased numbers of customers resulting from online sales, while smaller enterprises had a more positive opinion about the effect of e-business applications.

According to a GKIeNET [2009] survey, one of the major obstacles to the spread of Internet shopping is the lack of consumer confidence.[17] This is also the reason behind a typical feature of the Hungarian market in the field of payment solutions, namely the dominance of collect-on-delivery (47%) and cash-on-delivery (44%) transactions [Kis, 2009] and the fact that electronic payment solutions are comparatively lagging behind within the region. According to Imre [2007], the latter is partly due to the underdeveloped financial services system; uncompetitive services; structural problems; and missing links in the value chain. In Urbán et al's sample [2007, p. 26.], 38.4% of retailer sites offered opportunities for online payment by online bank transfer; regular transfer; or payment via sms or telephone bill.

Overall, it can be concluded that in Hungary the weight of Internet-based e-commerce in the total trading turnover is low even as compared to the EU medium

[17] Internet users were similarly mistrustful, or at least doubtful, in Majó and Veres's [2004] survey, in which only 27% of the respondents were of the opinion that it was safe to deal with official matters on the Internet, and only 37.8% did not have concerns about sharing their personal data electronically.

intensity, while the lion's share of the turnover is concentrated on the largest webstores. Hungarian companies are lagging behind the EU average in respect of both IT spending and active Internet usage. Moreover, buyers' confidence in Internet transactions and primarily electronic payment solutions is, for the time being, difficult to increase [GKIeNET, 2009], and this remains an obstacle to improving sluggish, albeit steady, growth. Based on relevant international research results, these characteristics do not really come as a surprise. In respect of the European market, Zhu – Kraemer – Xu [2003] have come to the conclusion that in countries with low e-business intensity, consumer acceptance and readiness play a bigger role and the market is mainly dominated by larger companies, while with the increase of e-business intensity these effects lose their importance. Molla and Licker [2005] also indicated in their research that although macro-level infrastructural incentives could also promote the spreading of e-commerce to a certain extent, corporate level commitment and management skills were at least as important in the process. In certain industrial sectors, however, purchasing through the Internet e.g. insurance and travel services, books, clothing, IT and telecommunications devices already has an established culture and tradition also in Hungary [Kis, 2009].

In this chapter I mainly focused on introducing 2008-2010 e-commerce trends in Hungary, as this period is the theme of my research, for which I have tried to provide the necessary background. However, for an outlook, it may be worth taking a glance at e-commerce trends in 2011, which in key words were as follows [GKIeNET, 2012a, p. 1]:

- The ratio of women to men among Internet buyers became balanced, and from 2012 female buyers are expected to increase in number.
- Online bonus and coupon sales have made marketable also services that used to be inaccessible through the Internet.
- There was an explosion in the growth buyers' clubs, as in other markets of Europe.
- Auction marketplaces successfully operating in Hungarian e-commerce were challenged by general classified advertisement sites.
- Construction of online hypermarkets: Media and telecommunications companies and the largest Hungarian Internet retailers started building webplazas driven by the "all in one place" principle.

6. Research Model and Hypotheses

Following the introduction of both the broad and narrow theoretical framework and the Hungarian market environment, in this chapter I will present the empirical research model. To build up the model, first I will review the basic premises of the resource-based view and then go on to discuss the IT and e-commerce business value models rooted in these premises. Finally, I will place my formulated hypotheses in the context of developed research model.

6.1 The resource-based view

According to Hámori and Kapás [2002], trends in the theory of the firm can be distinguished according to whether they belong to the range of evolutionary competence-based or contractual theories of the firm emanating from Coase's work. The resource-based view of the firm (RBV) in strategic management literature is closely connected to the first group. Its roots are mostly traced to Penrose [1959], and its foundation is associated with the names of Wernerfelt [1984], Barney [1991], Grant [1991] and Peteraf [1993] [See also Dankó, 2004]. The first two authors held a common view that companies are the totality of their resources, while the growth of the company and the success of its market strategies are influenced by the efficient deployment of those resources. Later, Wernerfelt [1995] argued that the spread of this theory was initiated predominantly by the more practical theory of core competencies developed by Prahalad and Hamel [1990] based on similar concepts. The number of studies using RBV as their conceptual framework has increased exponentially, particularly in the field of management and other indirectly related sciences including IT management [Acedo – Barroso – Galan, 2006]. The real-option theory mentioned earlier within the context of normative valuation and even evolutionary economics [Nelson – Winter, 1982] and the theory of dynamic capabilities [Pelikan, 1989] are also linked to this group of dynamic and internally focused strategy theories.

First of all, the resource-based view succeeded and complemented the product-centered approach in research on competitive advantages and sources of heterogeneity [Wernerfelt, 1994] and shifted the focus of strategic assessment from the external factors of the market (opportunities and threats) to the internal aspects of the firm (strengths and weaknesses) [Barney, 1991]. Accordingly, companies must control resources of different types and characteristics in order to achieve competitive

advantage. The heterogeneity of the company's resources may at the same time provide sufficient explanation to the significant differences in the market performance and profitability of companies having certain market information [Rumelt, 1984]. Some theory-related studies concentrate on the ways to identify and measure corporate resources and on the process of their creation, while others are aimed at identifying the resource characteristics that contribute to the generation and maintenance of competitive advantages.

It is worth beginning with an overview of the basic concepts and terminology of this theory. Barney [1991, p. 101] defines corporate resources as "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by the firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness". Wernerfelt [1984, p. 172] is not much more accurate in stating that resources are "those *(*tangible and intangible) assets which are tied semi-permanently to the firm". Later others [Amit and Schoemaker 1993, p. 35; Makadok, 2001] divided the "resources" construct into assets and capabilities. While the former are mostly tradable, are held by the firm and are not specific to the firm; capabilities are company-specific, intangible, non-marketable and immobile, and facilitate the combination and deployment of corporate resources.

For a resource to have the potential of generating sustainable competitive advantage, it must fulfil the following necessary – but not sufficient – conditions [Barney, 2001]. It should be

- valuable
- rare
- inimitable and without substitutes.

Rarity is only important if the resource is valuable and is possible only if the resource cannot be imitated by competitors. Hence, it is sufficient to focus primarily on the remaining two conditions [Hoopes – Madsen – Walker, 2003]. Being valuable is somewhat tautological and is to be understood by definition, i.e. resources are considered valuable if they support strategies that increase efficiency and effectiveness [Barney, 1991, p. 106]. Being valuable is partly related to the more fundamental criterion of heterogeneity [Peteraf, 1993]. It is among the premises of this theory that companies have different sets of resources, which is one of the reasons for the heterogeneity of their success. As a consequence, certain resources are more valuable

than others. Immobility of resources (i.e. they are not traded) can be used as a first approximation to the issue of substitution and imitation. On the other hand, substitution can be interpreted as a special type of imitation, and studies often end up focusing on the question of imitability [Foos – Knudsen, 2003]. The key barriers to imitation of resources [Barney, 1991; Peteraf, 1993; Hoopes, 2003] are as follows:

- copyrights, patents and proprietary rights;
- the level of learning, development and other transaction costs;
- social complexity and embeddedness;
- company-specific roots;
- hard-to-define causality.

According to a recent meta-analysis of empirical findings [Crook – Ketchen – Combs, 2008], the impact of resources fulfilling the above criteria is significantly higher on corporate performance. The question arises, however, about whether the profits from the resulting competitive advantage are taken by the owners (through achieving extra yield by definition) or whether other relevant groups, including top management, employees and customers/end-users receive some or all the value generated by strategic resources [Amit and Schoemaker, 1993; Peteraf, 1993].

The resource-based view came under much criticism regarding its scientific applicability over the last 20 years. Criticism and counter-arguments can be summarized broadly under the following categories [based on Kraaijenbrink – Spender – Groen, 2010 and the indicated authors]:

Criticism on basic concepts and assumptions:

- Some RBV assumptions are presented in an implicit form only, while other assumptions and terms remain rather vague and uncertain [Foss – Knudsen, 2003].
- The definition of "resource" itself is too wide and general – and consequently useless, as practically anything can constitute a corporate resource by definition (see above) [e.g. Priem – Butler, 2001].
- The criterion of "being valuable" is ambiguous, and its definition leads to tautology [e.g. Priem – Butler, 2001]. If resources are defined as means of value-creation, the concept that certain special resources create value cannot be disproved.

Criticism on theoretical applicability:

- The RBV aspires to be an independent enterprise theory while it is not[18]. As Foss [1996] concludes, the resource-based theory does not give an answer to questions concerning, for example, the existence, limits and organizational structure of companies. Similarly, the RBV has not facilitated the development of alternative explanations of competitive heterogeneity – although it has been one of its declared goals right from the beginning. [Hoopes et al, 2003] However, if we accept the RBV as a branch of strategic theories and a useful approach to studying the sources of sustained competitive advantage, we will certainly not over mystify this trend. [Hoopes et al., 2003]. The RBV is capable of incorporating traditional strategy insights concerning distinctive competencies and heterogeneous capabilities, and also fits well into the paradigm of organizational economics, while complements and enriches them with new proposals [Mahoney – Pandian, 1992]. Peteraf and Barney [2003, p. 310], however, maintain that the fundamental role of the RBV is to provide explanation for performance differences among competing firms, attributable to differences of resources.
- Sustainable competitive advantage, a cornerstone of the RBV, cannot actually be achieved. Firms and markets are in a constant dynamic change [pl. Priem – Butler, 2001]. Barney [2002] explicitly states that the RBV is more suitable to provide explanations in a relatively stable competitive environment. Although its fundamental works lack a dynamic approach, the theory has potential for further development for example in the area of evolutionary economics [Barney, 2001].
- While RBV focuses exclusively on internal factors, the environment and context are also important aspects [e.g. Priem – Butler, 2001]. However, the original objective of the RBV was to build a model for mapping internal strengths and weaknesses in addition to existing models incorporating market factors, and Barney [2001] intended it to be a complementary theory right from the beginning.

Criticism concerning the practical applicability of the RBV:

- The RBV has nothing to say directly for the purposes of practical management. Its premises are operationally invalid, and it gives insufficient answers to

[18] I would like to make a comment here on the terms I use: although I often refer to this scientific approach as a "theory", even the name has not yet been crystallized. Both resource-based view (RBV) and resource-based theory (RBT) are used in strategic and IT literature.

questions concerning the "how". Still, the RBV has a definite impact on management practices due, among other things, to its being a remarkably widespread theory.

- According to the RBV, firms should be involved in constant and incessant search of superior resources. This criticism, however, is less valid if strategic management is not expected to develop deterministic closed-end models – and attention is consequently focused on the relationship between resources and capabilities rather than on an endless quest for the optimum.
- Neither of the above listed resource criteria for achieving a sustained competitive advantage actually constitutes either a necessary or a sufficient condition. According to Foss and Knudsen [2003], there are only two necessary conditions for resources to ensure sustained competitive advantage: uncertainty and immobility. However, Crook et al [2008] and others have found empirical evidence in support of the original criteria.
- The scope of the RBV's applicability is very limited – to large and strong firms, predominantly, and it is difficult to generalize the findings of individual research on resources. The latter is not impossible, though, and the RBV can be adapted to smaller firms as well, provided that their specific objective is to achieve sustained competitive advantage.

So it can be seen that while proponents of the RBV have managed to counter-argue most of the criticisms concerning theoretical and practical applicability, so far there has been no meaningful response given to the criticism of the premises of the RBV. Barney [2001] argues that being tautological does not mean in itself that a theory is not meaningful or has no practical advantages. He acknowledges, though, that more efforts are needed to set the parameters for the criterion "valuable" and to simplify the definition of resources. For example: "resources are the tangible and intangible assets firms use to conceive of and implement their strategies" [Barney, 2001, p. 54] and result in reduced costs or increased revenues for the company. Competitive advantage is, at the same time, a relative term and can be measured in market competition as it means the added value created – i.e. the strictly positive profit differential over alternative costs including the cost of capital [based on Peteraf, 1993 and Foss – Knudsen, 2003]. A possible interpretation of the sustainability is that the forces of market competition can not errode these kind of competitive advantages, which implies that the company has some protective barriers against strategic imitation [Porter, 1985, p. 20].

Although a wide variety of literature and different interpretations of the term "competitiveness" exist in macroeconomics and management science based on Porter [see in detail: Somogyi, 2009], the Competitive Research Centre's approach is also very popular in Hungary. The latter defines corporate-level competitiveness as "the capability of the firm, while observing the norms of social responsibility, to offer on a long-term basis products and services to consumers that they are more willing to purchase than the products (services) of competitors under conditions that ensure profit for the firm. The condition for such competitiveness is the ability of the company to discern, and adapt to, environmental and internal changes by meeting competition criteria in the market on permanently more favorable terms than do competitors" [Chikán – Czakó – Kazainé, 2006, p. 9]. This is basically in line with the resource-based view as well, and the definition of the term itself as relative profitability compared to competitors is similar to those discussed earlier. From now on, I will use these further explored definitions, complementing them with the usual definitions used in IT literature.

Literature on IT business value traditionally defines resources as follows [based on Wade – Hulland, 2004, p. 109 and Sanchez et al, 1996]. *Resources are* "assets and capabilities that are available and useful in detecting and responding to market opportunities or threats". Hence, within the category of resources we can differentiate between tangible or intangible *assets* "the firm can use in its processes for creating, producing, and/or offering its products (goods or services) to a market"; and *capabilities* that "are repeatable patterns of actions in the use of assets to create, produce, and/or offer products to a market".

After reviewing the basic concepts, key research areas and seminal authors and critics of the resource-based view, it is worth examining why the RBV can serve as a useful theoretical point of departure for studying IT business value. According to Wade and Hulland [2004, p. 109-110], the advantages and shortcomings associated with the application of the RBV in this field are the following:

- The strategic resource criteria developed by the theory draw attention to the need for a more accurate definition and systemization of IT resources and …
- … provide a basis for comparison of IT resources and between IT and other organizational resources.

- The RBV can be used to examine the relationship between IT resources and organizational performance and it assigns a well-defined independent variable to the latter.
- It must be acknowledged, though, that the effects that IT resources have on the company's performance are in most cases neither direct nor intrinsic – hence, emphasis should be placed on exploring and understanding complementarities.

Zhu and Kraemer [2002] argue that the RBV is especially useful for exploring IT-based advantages as it accepts the potential mass product nature of technology while allowing company-specific capabilities and resources to result in sustained competitive advantage. In addition, although contingency theory-based studies are more useful for cost-driven IT investments, empirical evidence suggests that the explanatory power of the resource-based view is higher in the case of strategic, revenue- and profit-driven IT investments (while the two approaches, of course, basically complement each other) [Wonseok – Pinsonneault, 2007].

I believe that the main focus of RBV is appropriate for a joint study of the first and second basic questions of IT business value research mentioned earlier. Do IT investments create (sustainable) competitive advantage in the form of extra profit? This theory associates tangible and intangible IT resources with (higher than industry average) financial profitability while, due to its intra-company viewpoint, we can also expect it to help find answers to the questions of "why" and "how". In addition, as the RBV is one of the mainstream theories in current IT business value research, it creates a common language and a basis for comparison for other researchers in the field.

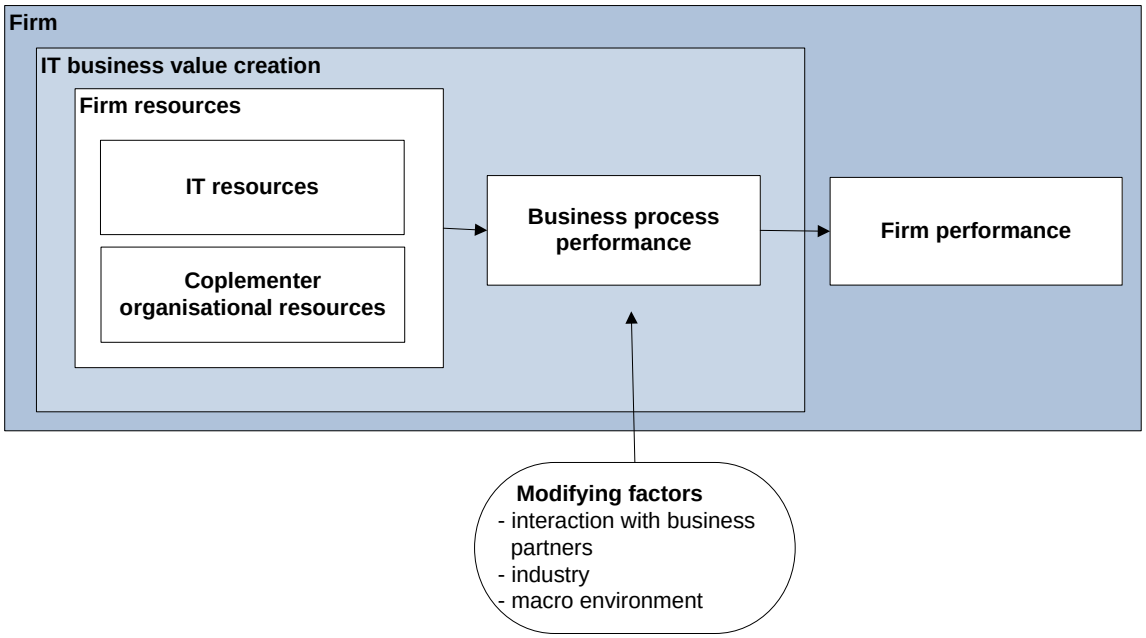
6.2 Model building

6.2.1 E-commerce capabilities in the model

Having laid the theoretical foundations, I'd like to continue with the development of my research model. Figure 17 outlines the general model of IT business value using process and resource based synthesis theory models [Dehning – Richardson, 2002 and Mellville et al., 2004]. IT and complementary resources have a direct influence on the efficiency of a business process and their impact can then be detected in company-level performance. This impact is influenced by different external factors such as business partners (and their IT capabilities), industry-related features (such as IT intensity) and national and international macro-economic factors.

Figure 17. General Resource-based Model of IT Business Value

[Based on Dehning – Richardson, 2002 and Melville et al., 2004]



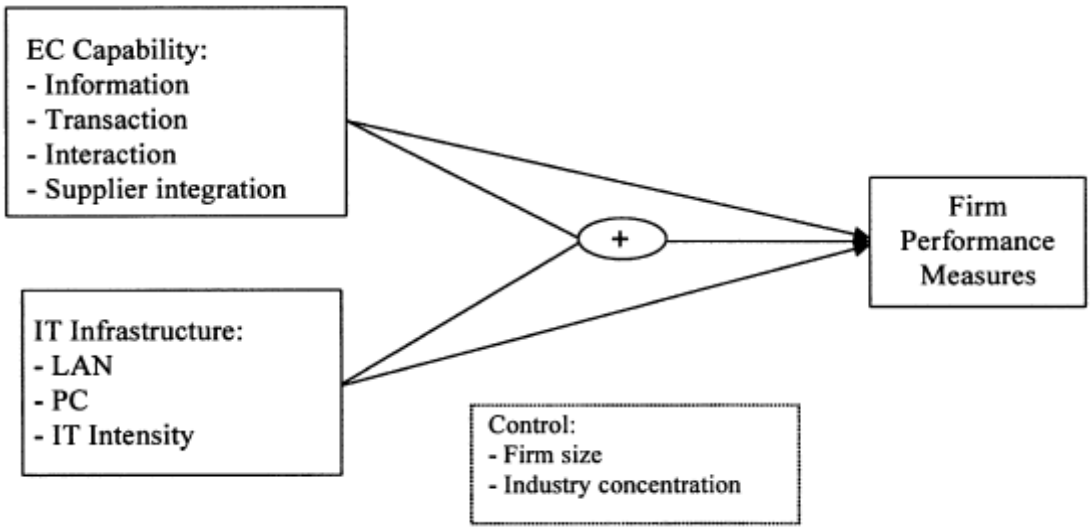
I attempted to fit my own research model focusing on e-commerce applications in the above the framework. Perhaps the simplest projection of the resource-based view onto the e-commerce theme is seen in the model developed by Zhuang and Lederer [2006], where IT-based e-commerce resources are complemented with human and business resources contributing to e-commerce performance, which in turn affect the overall performance of the firm. Although their work already features some information functions such as interaction and transaction capabilities among e-commerce technological resources, my model bears the closest resemblance to the e-commerce model developed by Zhu and Kraemer [2002 and Zhu, 2004] (see Figure 18), which

also takes the resource-based view as its basis. This model captures e-commerce resources along the four core capabilities of information, transaction, interaction and supplier integration complemented with IT infrastructure assets.

While the four e-commerce capabilities of the model mostly describe the functionality of the website as a connection between the firm and the customer, they are also useful and directly observable manifestations of the company's e-commerce capabilities [Zhu, 2004]. While Merono-Cerdan and Soto-Acosta [2007] use the term "external web content" instead of e-commerce for similar reasons, they also study the effect the information-communication-transaction dimensions have on corporate performance. Although Miranda – Bangil [2004] applies a different typology they identify information, transaction and communication functions as the key measures of web site performance as well. And also Hungarian co-authors, Mojzes and Talyigás [based on p. 77, 2000] used a similar system to describe the opportunities offered by e-commerce along the following four dimensions:

1. Publication and appearance: online product information; advertisements, information on product availability
2. Interactions: reception of customer feedback, joint planning, interactive marketing, customer service, product support
3. Transactions: electronic purchasing, auctions, demand-based pricing, loyalty programs
4. Integration: electronically integrated supplier chain, intention-based services, integrated supplier requirements

Figure 18. Research Model of Zhu – Kraemer [2002] and Zhu [2004]



As far as I am concerned, I use ability to customize rather than integration (which does not capture the relationship with the customers) as the fourth capability. Although customization is included in the interaction capabilities of the model of Zhu – Kraemer [2002], I believe that it constitutes a new dimension and a new level of e-commerce capabilities. (See, for example, the business success of Amazon's recommendation engine.) Similar four-dimension e-commerce systemization has been used for international and Hungarian data survey as well. Under the provisions of Regulation (*EC*) No 808/2004, EU member states are required to collect data on the ICT accessibility and ICT use of businesses and households. As part of this data collection, the questions concerning e-commerce asked by the Hungarian Central Statistical Office (KSH) basically relate to these informational/transactional/ interactional/customization functions. (Questionnaire No. 1840 "Qualitative and quantitative data of information and communication technologies" used for KSH data collection includes questions related to the following variables of the ones under review in my study: security, product information, configuration, online shopping, online order tracking, content customization.)

Obviously, there are other alternatives in literature to this e-commerce business value model, as it is best illustrated by the diversity of models presented in the 2002 special e-commerce edition of Information System Research [Vol. 13. No. 2]. Certain parallels can be drawn between some operational indicators used by those models and the four dimensions of my own model:

- Although the method used by Palmer and by Agarwal and Venkatesh to systemize the website features they studied is entirely different, there are some overlaps with the e-commerce capabilities of *information* and *interaction* and the *usage*-related indicators outlined in my own model.
- Some B2C e-commerce success factors identified by Torkzadeh and Dhillon – albeit from a corporate point of view – are incorporated in the *information* and *transaction capabilities* of the model I have chosen.

While the above models obviously apply quite different methods to systemize and examine e-commerce success factors, some of their variables can be integrated into the capability space of information/transaction/interaction/customization. In addition, a part of this four-element model can also be interpreted not only in terms of e-commerce research but in the general resource-based framework of IT value creation as well. Aral and Weill [2007], for instance, grouped corporate IT assets into the following four categories: (1) infrastructural; (2) transactional; (3) informational; and (4) strategic.

Nemeslaki et al. [2004] described the level of integration of e-business models in the company as grades of presence-interaction-transaction-transformation. On the whole, e-commerce resources are represented by the four capability groups of information/transaction/interaction/customization in my model.

6.2.2 Adding usage and the business model to the research model

The model also includes website usage as an intermediate or complementary variable in the scope of explicit examination. As Devaraj and Kohli [2003] phrase it in the title of their article: "Performance Impacts of Information Technology: Is Actual Usage the *Missing* Link?"

The vast body of TAM literature discussed earlier [see Davis, 1989 or Venkatesh et al., 2003 and Chapter 4.3.2] is based on the concept that attitude to use and actual usage are keys to the success of corporate technology adaptation. When Benbasat and Zmud [2003] made attempts to determine the basic concepts of information systems research, usage served as an intermediate variable between the technology and related capabilities and practices and the IT-effect. The inclusion of usage-related indicators is justified by empirical findings such as the outcomes of the research conducted by Aral et al. [2006]. They studied the impact of introducing ERP, SCM and CRM[19] systems on productivity and found that it was not the capital investment itself but going live and using the system that correlated with higher corporate performance ratios.

Literature on the success and failure of IT projects [e.g. Fowler – Horan, 2009] stands on similar theoretical grounds. Usage has already been included in the famous model of IT project success by DeLone and McLean [1992] as an intermediate variable between IT capabilities and technology and its individual and corporate effects. Ten years later, when they reviewed their model [DeLone – McLean 2003], the authors kept usage (and similarly to TAM, intention to use) and satisfaction as important intermediate variables for their model. What is more, the authors devoted an entire chapter to e-commerce, where they consider their model to be especially relevant. Here the usage variable includes all kinds of customer activities from website visits to transaction execution. The original DeLone-McLean model was further developed, for instance, by Gable, Sedera and Chan [2008], who retained the usage variable – as a precedent and also as a consequence of the IT-effect in a circular process. To improve the demonstrability of value creation, Davern and Wilkin [2010] suggest that empirical

[19] ERP – Enterprise Resource Planning; SCM – Supply Chain Management; CRM – Customer Relationship Management

studies should use perceived output variables (such as usage) for detecting direct effects and independently observable output variables (such as financial performance) for measuring indirect and delayed effects.

Early empirical studies used to measure corporate online presence using such operational indicators as: frequency of use and page revisit probability [e.g. Palmer, 2002] – showing that usage is a natural and widely used direct operational output variable of online presence. IT business value literature obviously takes one step further stating that the ultimate aim of the company is not usage but profit-making. In addition, usage as an intermediate variable is also present in the literature on e-commerce value creation although it is embedded in the framework of theories other than RBV. Koufaris [2002] applies the theory of technology acceptance to e-commerce environment linking usage indicators (and its underlying factors) to e-commerce success. The model of Zhu and Kraemer [2005] present the links between corporate e-business initiatives, e-business use, value created by e-business and company performance as a chain. Actually it was their study focusing on the retail industry that demonstrated the existence of a significantly positive relationship between e-business use and created value. Consequently, although the inclusion of usage in the model as an intermediate variable is relatively new in the resource-based literature of e-commerce value creation, it is not unique in related research areas.

Including information on the business model or on the sales channels in the analysis of e-commerce value creation is not entirely unique either. As already discussed, IT business value literature unquestionably demonstrates that complementary corporate capabilities and resources as well as the corporate and even market environment of IT projects have a significant impact on the volume of created value. The resource-based research by Zhu and Kraemer [2004], for example, takes into account the technology-intensiveness of the industry. The strategic choice concerning the selection of a sales model has been taken into account in e-commerce value literature before, and as a result it has become a central issue whether selling exclusively through physical shops or e-trading is more competitive or whether it is the combination of the two [e.g. Subramani – Walden, 2001; Dehning et al., 2004, Brynjolfsson – Hu – Rahman, 2009]. I agree that IT business value analyzes should cover as many contextual factors and strategic decisions as possible in the given research. In my case, the collected data allowed me to draw an accurate picture of the decisions made by Hungarian ICT retailers regarding sales channels, which is obviously an important element of the retail business model. While this variable is naturally

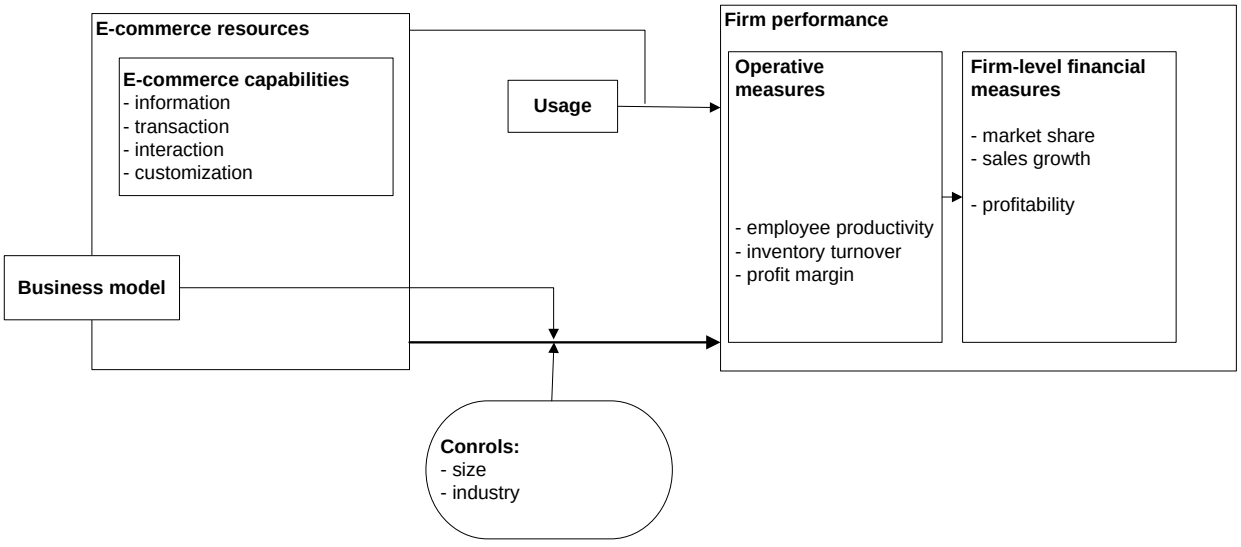
related in part to the e-commerce capability of transaction under study, it is also connected to the overall business strategy of the firm.

6.2.3 Dependent variables

The selection of dependent variables for the model – i.e. corporate performance indicators – was also based on a careful review of the literature. The process resulted in selecting the items listed in Figure 19. Empirical studies apply a wide range of performance measure and this fact has been used in some cases as an explanation of the varied and inconclusive findings by the empirical studies conducted in IT business creation [Dao – Shaft – Zmud, 2007]. In a broad sense, corporate performance indicators can be grouped into the following four categories [Aral and Weill, 2007]: (1) indicators based on market value, (2) profitability ratios (3) cost efficiency ratios, and (4) innovation metrics. As I mostly work with accounting data, the indicators used in the model refer primarily to profitability and cost-efficiency. Wade and Hulland [2004] suggest the following three criteria for the dependent variable of resource-based IT business value research:

- it should provide an assessment of performance,
- it should incorporate a competitive assessment element, and
- it should address the concept of performance over time.

Figure 19. Research Model



In order to take the second and third aspects into account as far as possible, market share and its changes over time should also be included in the study. Crook et al. [2008] argues that it is worth selecting variables (such as market share) that reflect performance before the owners take their income, as these are more closely related to

strategic resources. Based on the above, I developed a model for the present research plan as outlined in Figure 19.

In the following section I present my basic research hypotheses using this model while I discuss the variables of the model in more detail in Section 7.3 on operationalization.

6.3 Research questions and hypotheses

Based on the research focus, the theoretical background and the above outlined research model, I wish to test the following hypotheses:

H1: There is a positive relationship between Hungarian ICT retailers' firm level e-commerce capabilities and the companies' competitiveness.

This first hypothesis is the basic translation of the main research question of the resource-based view into the field of e-commerce value creation. Based on the different operationalization of the concept of competitiveness, we can test the following sub-hypotheses: So this is the fundamental question of an IT business value study within the framework of the resource-based theory provided that it is asked specifically in relation to e-commerce applications. This question, however, can be phrased in several ways in practice according to the usual research approaches in literature:

H1/A: There is a positive relationship between firm level e-commerce capabilities and market performance of Hungarian ICT retailers.

H1/B: There is a positive relationship between firm level e-commerce capabilities and profitability of Hungarian ICT retailers.

H1/C: There is a positive relationship between firm level e-commerce capabilities and operational efficiency of Hungarian ICT retailers.

For this basic hypothesis I consider profitability and market share to be the determining factors from among the variables reflecting competitiveness. Although RBV literature considers making extra profits as the primary expression of competitive advantage, market share (and its trends over time) can serve as direct indicators of the formation of competitive advantage. According to a survey taken in 2002, European SMEs tend to expect increased sales revenues from their e-business applications, particularly from their e-commerce applications [Johnston – Wade – McClean, 2007, p. 357-8]. Consequently I expect to find a positive relationship between e-commerce capabilities and corporate profit ratio and between the market share expressed by sales revenues or sales revenue growth. A somewhat similar but dominantly qualitative study

conducted by Demeter and Matyusz [2006] found that among the successes of different corporate functions, the success of the firm measured by financial ratios show the strongest correlation with the success of the IT area. The lack of such relationship would mean that either there is no value creation taking place or it is rather intangible or unsustainable in market competition.

Although profitability and market performance may seem less affected by direct e-commerce effects, the impact on operational efficiency ratios is worth examining as well. Earlier similar studies [Zhu – Kraemer, 2002 and Zhu, 2004] managed to relate e-commerce capabilities under study primarily to efficiency (per capita sales revenue and inventory turnover) ratios. This is reflected in the third sub-hypothesis formulated in connection with Hypothesis 1.

Although my hypotheses concerning the value creation effects of e-commerce capabilities have been quite general so far, it is worth examining the effects of information, transaction and interaction e-capabilities on a one-by-one basis [see e.g. Zhu – Kraemer, 2002]. I will conduct my examination not only in relation to H1 but also to test a hypothesis formulated from a gradual development aspect:

H2: Different levels of e-commerce development have different performance effect in the Hungarian ICT retail industry.

I believe that the first steps in e-commerce – namely appearance on the Internet or creating a website – affect primarily the income generating capability of the firm by creating an opportunity to reach a wider customer base and a larger market thus serving as marketing tools in this first phase. The activated e-transaction function, however, works as a new online sales channel and as such can have a revenue generating effect due to the resulting direct access to new markets. From certain aspects, on the other hand, this new sales channel is also more efficient than the traditional ones, which should be reflected in direct costs of sale and in inventory efficiency as well. Bases on the above, this hypothesis will be tested by the following two sub-hypotheses:

H2/A: Moving from the state of a total lack of e-commerce capabilities to the online informational level is related to sales growth.

H2/B: Moving from information e-commerce capabilities to an online transaction level is related to both sales growth and retail efficiency.

Similar research [Zhu – Kraemer, 2002; Merono-Cerdan – Soto-Acosta, 2007] found significant positive relationship between transaction e-capabilities and corporate

performance ratios. Obviously, the level of this effect may differ according to whether businesses use their online platform as a complementary or exclusive sales channel.

H3: Greater e-commerce capability in conjunction with higher levels of website usage, is associated with better competitiveness in the Hungarian ICT retail industry.

If outstanding e-commerce capabilities are not coupled with attendance, the website can hardly contribute to firm value creation. Hence website attendance is a key addition to e-commerce capabilities and the inclusion of this variable in the study facilitates the exploration of the logic behind the value creation process. As discussed in detail in the previous section, the inclusion of usage in IT business value research is not a unique phenomenon in literature at all, while it is still a real novelty in resource-based e-commerce research.

In addition to the above, the effects of certain external factors in relation to the first hypothesis are also worth examining, and I intend to include company size and business model in the study[20]. Taking firm size and sales model into account allows creating more homogenous sub-samples, which can be an important aspect regarding the intensity of the e-commerce value creation effect I wish to demonstrate.

H4: Relationship between Hungarian ICT retailers' firm level e-commerce capabilities and company's competitiveness changes with firm size.

Literature has always emphasized the role of company size in IT business value. Size as a modifying factor is part of the general model developed by Dehning and Richardson [2002] as well as the e-commerce-specific model of Zhu and Kraemer [2002]. In a similar research conducted by Merono-Cerdan and Soto-Acosta [2007], company size expressed by the number of employees has a significantly positive effect in the model. Furthermore, the question whether e-commerce offers more advantages for smaller businesses due to the long tail effect or whether larger firms are better positioned to take advantage of its positive effects is still to be answered. [Corbitt – Al-Quirim, 2004]

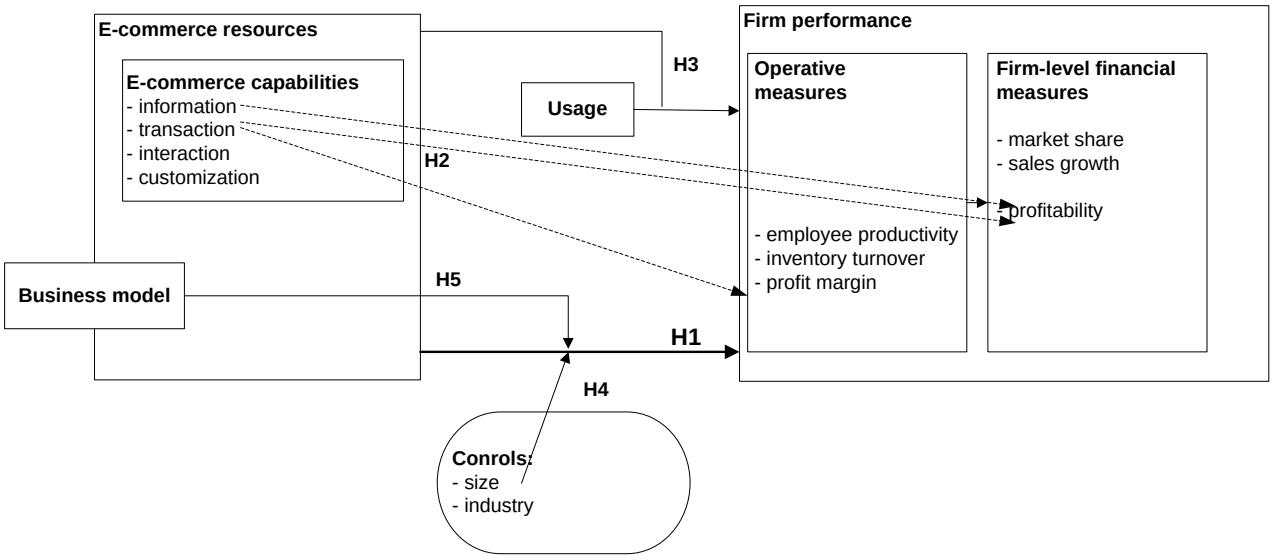
H5: Relationship between Hungarian ICT retailers' firm level e-commerce capabilities and company's competitiveness changes with sales channel choice.

[20] In addition to these two control variables, a more precise industry classification (in our case the 4th digit of the Hungarian Standard *Industrial Classification* of Economic Activities – TEÁOR) and geographical location may also be of interest. As my research is planned to focuses on a relatively narrow scope of economic activities and I consider geographical location less important in an online environment, I will exclude them form the present analyses.

The role of the sales model in e-commerce value creation has also been a major question of the research [e.g. Doherty – Ellis-Chadwick, 2006]. The issue can be studied either by examining the interactions of electronic and traditional sales channels or by exploring the differences in the success of brick-and-mortar, brick-and-click and pure e-tailer sales models. The previously discussed e-commerce impact analyzes (see section Section 5.3.1) used the latter approach alternately demonstrating the advantage of the mixed model [Dehning et al., 2004] and the pure e-tailer model [Suramani – Walden, 2001]. My study aims to determine the impact level of e-commerce capabilities on the performance of retail traders selling through shops only, e-tailers also having physical outlets and pure e-tailers, as well as the dominant e-commerce capabilities in each case.

Overall, my hypotheses are demonstrated in Figure 20 in the framework of the research model presented earlier.

Figure 20. Research Model and Hypotheses



7. Parameters of empirical research

7.1 Empirical research methods in the examination of IT value creation

Before detailing the methodological parameters of the planned study, I would like to describe its background by briefly introducing the empirical methods applied in literature on IT value creation. The most basic related issue here is the level of analysis at which the studies are conducted, thus the framework for classification is defined by the level of the given examination focusing on the national economy, industry, company, team, IT project, or even individual IT value creation [Kauffman – Weill, 1989; Brynjolfsson – Yang, 1996; Chan, 2000]. Whether the study focuses merely on the IT system or it does also include the system's contextual factors can be a differentiator as well [Kauffman – Weill, 1989; Cronk – Fitzgerald, 1999].

According to the applied data collection method, research can typically be divided into two main groups, namely the group based on secondary data processing and the group based on case studies. However, another group of questionnaire surveys can also be added [Chan, 2000]. We can also differentiate between qualitative and quantitative examinations [Cronk – Fitzgerald, 1999; Chan, 2000]. The former category is less frequently used in the field of value creation. Quantitative examinations can further be classified according to the type of output measure (financial or non-financial) [Chan, 2000] applied by researchers. Measures used in the case of a financial approach can be either accounting-based or capital market-based [Dehning – Richardson, 2002].

Considering both the theoretical underpinnings and the applied methods, it is the initial classification by Kauffman and Weill [1989] that offers the most comprehensive approach (see criteria in Table 13). The authors of course do not only examine the issues raised by the theoretical foundations and the level of abstraction but also apply other significant systemization criteria such as methodological approach. By methodological approach the authors mean the focus – i.e. theoretical modeling or exploratory data analysis – of a given study. I would like to complete their system with the distinction of normative studies because the literature on valuation methodology in this field is also notable. Although methodological questions typify and classify each study, I have come to the conclusion that each theoretical school of thought or research sub-question can be easily linked to a characteristic unit of observation, i.e. variable

type, or a combination of data collection or data analysis methods. To give an example: early pieces of research on the IT productivity paradox tended to be quantitative large-sample studies based on the whole national economy, while research examining the drivers of value creation was, as a matter of course, case study-based and of an exploratory nature. Consequently, further classification may not necessarily lead to additional information.

As an introduction to the observations of the following sub-sections, I have placed the current study in relevant literature in Table 13 based on the system introduced by Kauffman and Weill.

Table 13. Main Characteristics of the Research Plan, Using the System of Kauffman - Weill [1989]

Motivation	Focus	Caveats
> Purpose *Are the e-commerce resources associated with improved operational efficiencies or competitive advantage?* > Approach *Justificatory* > Theory base *Resource-based view*	> Unit of analysis *Firm (Hungarian ICT retail industry)* > Locus of value *Firm level financial performance* > Data collection *E-commerce data: web crawlers* *Usage: ranking databases* *Financial data: secondary analysis of national databases*	> Measures *Multiple measures for E-commerce resources, Usage and Financial Performance* > Data analysis *Correlation and regression analysis, paired sample statistical test, cluster analysis* > Organizational context *Firm size, industry and retail model*

7.2 Sampling

The study focuses on the e-commerce capabilities of companies in Hungary as well as their effects on financial performance/return thus the initial universe here meant the entire population of Hungarian businesses. My objective was to concentrate the empirical analysis on just one particular industry which is both IT- and e-commerce-intensive because this way it was possible, inter alia, to exclude the distorting external effects of the industry. Then I narrowed down the focus in the following steps:

- First, I reduced the entire universe to the circle of companies registered in Hungary that are required to submit their annual report to the Ministry of Public Administration and Justice, as in their case financial and accounting information is publicly available and reliable.

Pursuant to Section 154 of Act C of 2000 on Accounting, all companies keeping double-entry books (including the Hungarian branch offices of foreign-registered companies) shall publish their annual report simultaneously upon depositing it with the Court of Registration. (A company meets its obligation of publication by forwarding the report to the Company Information Service of the Ministry of Justice and Law Enforcement simultaneously upon depositing it.)

Table 14. Services Available on Corporate Websites in Different Economic Sectors, 2007

[Calculations based on KSH, 2008]

Economic Sections	**Online product order** (as a percentage of companies with website)	**Online product order** (as a percentage of all the companies)	**Online product order** (number of companies)	**Online product order** (number of companies in the sample)
Agriculture, forestry	42,6	7,6%	136	15
Fishing	15,2	9,1%	2	1
Mining and quarrying	49,4	18,1%	19	9
Manufacturing	30,1	14,9%	1295	283
Electricity, gas, steam ,air-conditioning and water supply	23,4	13,8%	37	15
Construction	24,1	8,6%	336	41
Wholesale and retail trade, repair	***34,6***	***16,4%***	***1298***	***297***
Accommodation and Food service activities	53,9	22,3%	434	49
Transportation and storage	35,7	15,6%	281	53
Financial and insurance activities	35,3	25,1%	106	50
Real estate activities, professional, scientific and technical activities	26,9	13,6%	636	148
From this: information technology	37,6	32,4%	182	0
Education	38,1	29,9%	41	19
Human health and social work activities	12	4,4%	12	2
Other services	34,2	17,6%	126	33
Average	***32,1***		***4940***	***1015***

- As a next step, I selected a sector of the national economy which was sufficiently e-commerce sensitive. E-commerce, of course, does not only occur in case of companies engaging in trade as their principal activity. Ensuring product or service ordering through a website is a business solution applied basically in every sector (see Table 14). According to data provided by KSH (Hungarian Central Statistical Office) [2008], such a solution is most frequently used in different service sectors (IT services, education, financial intermediation, accommodation services or catering) where ordering through a website is available in case of 25-30% of businesses. When examining the e-commerce of

tangible products, the trading sector comes first – naturally enough, one might say – with 16.4% of the businesses using their website as a sales channel. KSH data from 2007 highlight mining and manufacturing as e-commerce-intensive sectors. These sectors are not suitable for the purposes of the current study due to their small sample size and the inaccessibility of B2B (business to business) e-commerce characteristics. Thus, my further examinations were aimed at the field of domestic retail trade [see Hofmeister – Simon – Kozák, 2011].

- The sectoral differences within retail trade are still significant with regard to both financial characteristics and e-intensity, thus the need for further narrowing the research focus was obvious. The most popular product and service categories in Hungarian e-commerce are the following according to Gergely Kis [2009]:
    - Insurance services
    - Food
    - Office and school supplies
    - Books
    - Clothing
    - Computer equipment
    - Telecommunications equipment
    - Travel services

  In 2009 food, computer and telecommunications equipment, consumer electronics, and books were the most popular product categories in e-commerce and their order did not change by 2011 [GKIeNET, 2010 and 2012b]. Ignoring the fields of services and low-value food purchase, it is the retail trade in books, office supplies, and computer and telecommunications equipment that prove to be the most attractive research areas. The e-commerce models of book retailing are in the focus of attention both abroad (see Amazon) and in Hungary (see Bookline). Hence, I decided to turn to the lesser-known area of retailing of computer and telecommunications equipment (hereinafter referred to as ICT retail trade)[21]. The impetus towards research in this direction was further strengthened by my discussions with practical experts of the area as well as by significant international and domestic success stories (e.g. Extreme Digital[22]) in

[21] Of course, ICT retail trade is not an entirely unmapped area in Hungary – see e.g. Simon – Pusztai – Jenes – Neumann-Bódi [2008].

[22] Based on the steps described above Extreme Digital was not eligible for the sample, thus a further study could be aimed at the examination of its case, business model, and e-commerce capabilities and at the comparison of the conclusions with other research results.

this field. Moreover, the products in this market are typically mass products and the sector is primarily characterized by price competition [Bőgel, 2005], and so differentiation strategies have a less distortive effect on the study results.

- I selected the domestic businesses retailing computer and telecommunications equipment based on the TEÁOR (Hungarian Standard Industrial Classification of All Economic Activities) code of their principal activity [KSH, 2007b]. Consequently, the appropriate companies belonged to the well-defined TEÁOR '08 group of "47.4* Information and communication equipment - Retail", in particular under the following activity codes:

  - 4741 Computer, peripheral equipment, and software-Retail
  - 4742 Telecommunications equipment-Retail

  My sample consisted of companies who already engaged in these principal activities in the year 2007, so I also had to identify the relevant activities based on the former, TEÁOR '03 classification. The result is the following [KSH, 2007a]:

  - 5248 Other manufactured goods – Retail

  This way I selected the businesses with the principal activity of 5248 TEÁOR '03 from the sample of 2007, then using the KSH website[23] I identified the TEÁOR '08 code of their principal activity by their VAT number. From the resulting list I was able to filter out those companies which operated in 2007 with a principal activity bearing the code 4741 or 4742 according to the new classification. My sample consisted of 155[24] retailers of computers, peripheral equipment and software and 63 retailers of telecommunications equipment at this phase.

Based on the research sample the following can be said (see Figure 21): I examine ICT retail traders operating in Hungary since at least 2007 whose data are publicly available. I will describe the methods of data collection I applied with regard to these businesses in the next section.

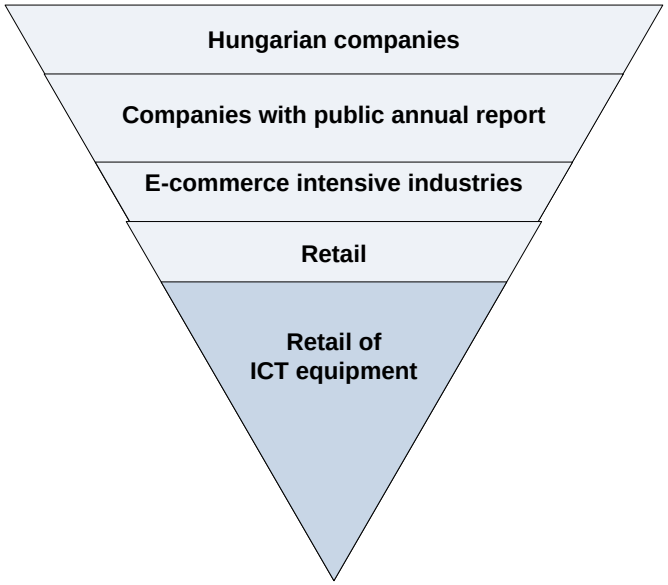
Despite the fact that during my study I focus on a single albeit significantly e-commerce-intensive sector, the businesses in the sample show great heterogeneity from

[23] http://portal.ksh.hu/pls/portal/vb.teaor_main.gszr_main1

[24] This was the number after excluding two businesses – a fishmonger and a furniture manufacturer – which were registered with deceptive principal activities.

the aspect of the chosen e-commerce strategy. The most important decision by businesses here is whether to include Internet as a strategic option in their business model. In the context of the data collection methods described in the following section, it is difficult to perform explicit data collection on such decisions, so I can only rely on implicit conclusions. However, companies' choice of whether or not to be present on the Internet, and if so, to create their own website and make online shopping possible may give us some hint.

Figure 21. The Logic of the Sampling



It is also important to mention that the population defined by the chosen data collection method was not used as a basis for sampling but the data of the entire population were collected. However, it is obvious that the actual number of ICT retail traders in Hungary in 2009 was much higher, including e.g. sole traders and those who registered the activities with the above mentioned TEÁOR codes not as their principal activities or those who started their operation later in 2008 or 2009. Although such businesses were not included in the study, the data collection method itself resulted in a sample from the domestic ICT retail sector. Further on, I will conduct my analysis based on this approach, treating the examined group of companies as a sample.

7.3 Operationalization and data collection

Data collection in the current study meant two parallel processes, namely secondary data collection of financial and website usage data and the automated gathering of data related to e-commerce resources, the latter further supplemented by manual data collection. The data collection method and process were adjusted to a more

precise definition of variables. I will introduce the two processes together, devoting a separate sub-section to each variable group.

7.3.1 Corporate performance

With regard to financial information reflecting corporate performance, a sample containing hundreds of items is primarily suitable for using information deriving from accounting sources. Although in financial terms, I would consider it appropriate to use DCF-based valuation presenting ownership value creation more accurately (see Section 2.4), due to the sample size and the available data I opted for the application of indicators calculated from accounting data. I am mindful of the criticism related to the reliability of accounting data [see e.g. Rappaport, 2002; Becker – Turner – Varsányi – Virág, 2005], so let the arguments below serve as a justification for my decision of using such data:

- Some types of accounting data inaccuracies such as decisions on depreciation and investment capitalization or goodwill issues do not influence my model - or if they do, such influence is quite indirect. Other biases can be corrected on the same database by using the operating income before taxes or well-defined value-based indicators of profitability (see Annex 3). A third type of accounting bias can be evaluated as an industry characteristic, thus its influence is less significant when comparing competitors.
- Although national and international literature on performance measurement/evaluation emphasizes effects distorting accounting data [e.g. Reszegi 2004; Bőgel – Forgács, 2004], it is such data that are mostly applied in empirical studies [e.g. Kazainé Ónodi, 2008]. Most types of company valuation methodology – among other things DCF calculating from indirect cash flows – is based on accounting data [e.g. Palepu et al., 2010], so the question is only the level and way of correction used by the analyst. The majority (93%) of domestic companies analyze their operation based on accounting figures [Wimmer, 2002, p. 27; Dankó, 2006, pp. 30. and 34.].
- Other authors employing either very similar [e.g. Zhu, 2004; Merono-Cerdan and Soto-Acosta, 2007] or rather general [e.g. Bartelsman et al., 2002] models build their IT business value studies on accounting data.

Beyond the general accounting biases, the reliability of reports by domestic SMEs represented in my sample can be further distorted by certain “creative

accounting" practices. Due to the enterprises' need for meeting the requirements of market partners, investors, or tax authorities [Mezei, 2011], the cost management of such businesses can be characterized by their focus on tax optimization [Csányi – Dolgos – Wimmer, 1997] and the manipulation of financial statement data [Fiáth – Virág, 2011]. These effects, however, cannot be filtered out and the confidential nature of such maneuvers practically makes data collection impossible; one can only assume that the presence of this type of behavior is more or less at the same level in the sector's businesses. A questionnaire-based qualitative survey could have also been applied [see e.g. Zhuang – Lederer, 2006] as an alternative way of data collection with regard to financial and competitiveness metrics, providing – from a certain point of view – a more detailed analysis of the mechanisms of action, but this way the majority of the sample along with the objectivity of data would have been lost.

Consequently, in the case of data from annual reports submitted to the Ministry of Public Administration and Justice, I employed the method of secondary data analysis, using the direct sources listed below:

- According to an agreement between the Ministry of Public Administration and Justice and the Department of Enterprise Finances at Corvinus University of Budapest, I had access to the annual reports of 2006 and 2007 in a format identifiable by tax number and company name.
- With the help of the information services provided by *Complex Céginfó* to the Department of Enterprise Finances at Corvinus University of Budapest, I had access to the annual reports from 2009 and 2010 in a format identifiable by tax number and company name.

Databases used for the purposes of the study contain the main lines of the balance sheet and the income statement supplemented by headcount data relevant to assessing efficiency. Combined with industry-specific metrics these figures can be used to derive the profitability, efficiency, liquidity and debt indicators applied by literature on financial analysis [Virág, 1996] to describe a company's financial profile. According to Zhuang – Lederer [2003], the e-commerce performance of the retail sector can be measured with the following five indicator groups: (1) back-end efficiency, (2) market expansion, (3) inventory management, (4) cost reduction, and (5) customer service advantages. With the exception of the last indicator group, my model employs basically similar independent variables. The most important indicator types in my approach of e-commerce are thus the following (as also shown on Figure 19 on the research model):

- Market indicators: change of sales revenue and market share
- Profitability indicators: different income categories relative to revenue or invested capital
- Turnover and efficiency indicators: inventory turnover indicators, metrics of indirect costs and labor-intensiveness of goods sold

Table 15. Indicators of Corporate Performance in Different Related Studies

	Zhu –Kraemer, 2002	Zhu, 2004	Merono-Cerdan – Soto-Acosta, 2007	This model
Market indicators	-	-	-	> Sales growth > Changes in market share
Profitability ratios	-	> ROA	> Value added	> ROIC > CFROI > ROE > ROA
Operative efficiency	> Inventory turnover > Sales per employee > Profit margin > Cost of goods sold	> Inventory turnover > Sales per employee > Cost of goods sold per sales revenue		> Inventory turnover > Sales per employee > Profit margin

Table 15 introduces such a typology of performance indicators applied in the current study as well as in the most similar international studies. These studies were conducted primarily by technology experts who paid less attention to recommendations in relevant literature on company valuation and financial analysis when selecting the indicators. In my current paper, I did not only use the traditional indicators of related research but also applied value-based performance indicators. The examination was further supplemented by a few market indicators, and thus another dimension of competitiveness was included in the study. Annex 3 will give a detailed description of the method of calculation for each selected performance indicator.

7.3.2 E-commerce resources – data collection with web crawlers

It is a constant challenge for IT literature to be able to measure its variables in order to make them adequate for empirical studies, yet there is no general consensus on the question of variable selection [Soto-Acosta – Merono-Cerdan, 2008]. The majority of e-commerce research (both scientific and statistical) uses the four-grade model of information-interaction-transaction-customization to systemize capabilities (see Section 6.2). These four concepts are the most tangible and most functional characteristics of e-commerce, thus the model's advantage is that they can be assessed by examining the functions and contents of websites. These constructs, however, are rather different from the two original concepts of "capability" and "resource", thus the application of such a measurement method should be preceded by the logical connection of a few abstraction levels. Due to the lack of other accepted systematization, I find this model – allowing for the comparison of results as well – the most justified one.

Table 16. E-commerce Metrics

(Abbreviations: Z-K: Zhu – Kraemer, [2002]; MC-SA: Merono-Cerdan – Soto-Acosta [2007])

Studies	Type	Variable Name
Z-K [2002], MC-SA [2007]	Information	Product information
Z-K [2002], MC-SA [2007]	Information	Search
Z-K [2002]	*Information*	*Product update*
Zhu [2004]	Information	Virtual experience with the product
Zhu [2004]	Information	Store locator
	Information	Support
MC-SA [2007]	Information	Company information
	Information	Language
MC-SA [2007]	Information	Return
Z-K [2002]	Interaction	Real-time support
Zhu [2004]	Interaction	After-sale support
Z-K [2002]	Interaction	Product review
Zhu [2004], MC-SA [2007]	Interaction	Virtual community
Z-K [2002], MC-SA [2007]	Transaction	Buy capability
Z-K [2002], MC-SA [2007]	Transaction	Online order tracking
Z-K [2002]	Transaction	Refunds
Z-K [2002]	Transaction	Security
Zhu [2004]	Transaction	In-store pickup
	Transaction	Delivery
MC-SA [2007]	Transaction	Payment
Z-K [2002], MC-SA [2007]	Customization	Registration
Z-K [2002]	Customization	Account management
Z-K [2002]	Customization	Configuration
Z-K [2002]	Customization	Online recommendation
Z-K [2002]	Customization	Content personalization

In Table 16, I summarized the examination variables used in two American studies closest to the current research and superseded the type classification at certain points as well as complementing it with other variables that I found adequate. I used italics to mark variables that cannot be explored by the selected data collection method. I also indicated the variables that also feature in some form a more recent Spanish study [Merono-Cerdan – Soto-Acosta, 2007].

Thus, keeping the typical four-grade scale I supplemented each level of e-commerce with a few important characteristics otherwise often used in practice as well. Just to give a few examples, company information (e.g. official company name and tax number), non-real-time customer support (e.g. FAQS, Frequently Asked Questions), multilingualism (above all, the option of selecting English), or the motivation to visit the site again (e.g. by newsletters or "add to favorites") may belong to the informational function. I also supplemented the measuring of transactional function with a more detailed assessment of shipping and payment options.

If we accept the above framework for e-commerce capabilities, the next step is to collect website keywords connected to each capability. For this purpose, in the current study we apply a partially automated method using web crawlers. Automated web crawler data collection is a novelty both in general and in the relevant literature, so below I will provide a brief introduction to its background.

Web crawlers or web search engine spiders are computer programs exploring the web to perform automated and systematic collection of different data. For users, their best known forms are Internet search engines. One of the first publications in the topic was released by the owners of Google [Brin – Page, 1998]. Crawlers can be used for different purposes such as website indexing, link maintenance, or specific data (e.g. e-mail addresses) collection [Miller – Bharat, 1998]. We can differentiate between general crawlers (such as search engines) and focused web spiders visiting only websites with certain characteristics [Shkapenyuk – Suel, 2002]. The objective of some crawlers is the targeted and automated mapping of the web based on a few initial URLs (Uniform Resource Locator) using their links for moving on. They use automated mechanisms to download websites, gather hyperlinks, and compile URL lists. Automated crawler data collection allows for an extensive survey with a relatively high number of items in respect of e-business phenomena in whose case few public databases are available. Moreover, it is more efficient than qualitative questionnaires and faster than manual data collection. Web crawler data collection can be useful in e-business research

requiring exploratory, systematic or time series data [Nemeslaki – Pocsarovszky, 2012]. For example, crawlers similar to those applied in the current research have been used recently in several studies aimed at exploring the Hungarian web ecosystem [Nemeslaki – Füleki – Theiss –Balázs, 2011].

In my case, a list of websites to be examined was available because I had manually compiled it by googling the companies in the sample. Thus the crawler's task was simply to examine a fixed list of URLs and the main page links to subpages. I used certain specific keywords to make e-commerce capabilities suitable for automated examination. These are the very words that the crawler searches for and counts on the main page of the websites and on their first-level subpages, more specifically crawling the buttons, menus, and links primarily, and the entire content secondly[25]. Some of the companies in my sample do not have a separate website but a part of their company information is accessible on certain information portals. In the current study, only the content crawling of the main page of such portals (without subpages) was justified.

Below I will outline the steps of creating the keyword list belonging to each e-commerce capability:

- I compiled the initial keyword list in a brainstorming session conducted with experts and colleagues.
- I used a random selection of 20 websites from my sample to manually examine them for the validation and supplementation of the keyword list. See Annex 1 for the list of keywords by capability.
- As a next step, I had to decide where to search the certain keywords, namely on the primary constituents (i.e. links, buttons, or menu items) of the website where their occurrence is more significant. (For example, the presence of the Search Button more clearly refers to information capability than when the word "search" appears in a text section of a page.) Other keywords or expressions (e.g. "Terms and Conditions" or "Privacy Policy") are less frequent on such primary pages, yet they are specific enough to serve as a basis for making conclusions even in the case of identical contents. See Annex 2 for the systemization of keywords by location of search.
- As a supplement to the final keyword list, a negative keyword list – comprising of the most common antonymous expressions for the keywords – was built to

[25] Hereby I would like to thank Pocsarovszky Károly, former colleague in GKI Economic Research Co. and BCE E-learning Teaching and Service Center, for building this unique custom crawler.

avoid the inclusion of the occurrence of keywords with negative meanings (e.g. in the case of the keyword “delivery”, expressions like “no delivery”, “delivery denied”, “delivery not possible”, or “delivery not allowed”) in the measurement.

As a result of the crawler research based on the keywords, a database was created which contains the number of keyword occurrences on each website’s main page and on its first level subpages (i.e. one-click subpages).

The business model variable which can be mostly related to e-commerce capability in the study model and is the most relevant to my latest hypothesis is worth mentioning here. The sales channel selection is an important element of the retail business model and in my current study I also try to grasp this strategic decision. In other words, a domestic ICT retailer can choose from the following business models:

- traditional: limited exclusively to in-store retail sales (brick-and-mortar business model)
- mixed: employing both in-store retail sales channel and e-commerce sales channel (brick-and-click model)
- e-tailer: pure e-tailer with no in-store sales

Upon gathering the data previously described, the classification based on the business model took place as follows: I considered it as a characteristic of the use of the traditional business model if the number of physical sites was three or more and the keyword (or keyword group) “Our Stores” occurred on the website. An indication of e-commerce was first of all the presence of keywords related to a webshop function on the website (online shopping, e-shop, cart, shopping cart, webshop), and secondly the availability of order tracking and registration functions. Whenever the features of both business models could be traced, I concluded that the mixed business model was employed. Finally, where I could not find any reference to either of the models on the website, I assumed that the owners in all probability had to use a traditional business approach. Upon primary classification, I reviewed the data of each individual company with either the e-tailer or mixed model and reclassified them if necessary.

As a summary, it can be pointed out that the collection of e-commerce capability data performed here was independent and methodologically innovative. In line with the theme, I tried to exploit the potentials of the Internet as well as publicly available data sources, so I opted for the automated “scanning” of businesses’ websites. In addition, I also made use of the advantages offered by the Internet when I measured the usage variable. Below I will present the relevant data collection methods in more details.

7.3.3 Usage

In addition to the above, I included in my examination the concept of usage as an intermediary or supplementary variable between e-commerce capabilities and corporate performance. Due to the lack of the availability of direct usage data on my sample, I used indirect popularity indicators to measure the dimension of usage during my research. The popularity of websites and their location within the web ecosystem reflect a kind of user valuation, so – based on information content and access opportunities – I found different web indicators of *ranking* type the most useful to measure this popularity. There are several different approaches and methods to rank website popularity in the Internet ecosystem but it all comes down to three groups [Lo – Sedhain, 2006]:

- Method based on activity criteria: The site that attracts the most traffic measured in number of visits, frequency of visits, or length of visits ranks at the top (e.g. Alexa Rank).
- Method based on reference criteria: The ranking is based on the number of citation links which may be classified as self links and foreign links where the reference is actually made by another site, and the latter can be weighted according to the site's popularity (e.g. Google PageRank).
- Method based on opinion criteria: A subjective ranking based on the opinion of certain experts or users (e.g. 100bestwebsites).

The first two approaches of ranking usage quite objective criteria; however, the third one is rather subjective and selective and thus cannot be used with my sample. Thus, I decided to select variables from SeoQuake [2010] and Whois databases, namely the following most common indexes of activity-based and reference-based methods:

- *Google PageRank*: To rank the importance of websites, PageRank uses an equation consisting of more than 500 million variables and 2 billion expressions. Instead of counting direct links, when Site A cites Site B in PageRank's interpretation it means that Site A votes for Site B. PageRank than determines the importance of the site based on the number of votes cast on it at the same time considering the importance of other sites casting votes on the site in question.
- *Google index:* The number of sites indexed to a website by Google search.
- *Yahoo links:* The number of links to a page identified by Yahoo search.

- *Yahoo Linkdomain (LD):* The number of links to a given domain by Yahoo search.
- *Bing index:* The number of links to a page identified by Bing.
- *Alexa Rank*[26]: A ranking calculated on the basis of the number of visitors and page views estimated by Alexa where traffic data are obtained from volunteers downloading Alexa Toolbar. It is a popular metric of traffic at international news agencies and multinational corporations due to its penetration and its cross-national and universal measurement methodology.
- *Rush Rank*: A ranking indicator used for the measurement of the value assigned to a site by search engines and for the comparison of niche pages.
- *SEO Score:* SEO (Search Engine Optimization) efficiency estimated on the basis of the Whois formula, in other words a metric of visibility by search engine crawlers based on website analysis.
- *Webarchive age:* The date when the website first appeared in the database of Archive.org consisting of web-archives.

In my opinion, Alexa Rank is the ranking indicator closest to viewing data, while Google PageRank is the most popular algorithm among those which determine the ranking based on the number of citation links. Thus, these two indicators are worth considering when measuring the usage dimension.

The three sub-sections above gave a detailed description of the methods and sources of the collection of each variable group and the variables I will use in the paper. The next section will look into some methodological questions related to the actual database creation.

7.4 Database assembly

According to the characteristics of data collection, the basic data were obtained from three sources and thus they were presented in three different data tables. For filtering the data relevant to a certain company I used tax numbers as the primary tool and then combined the financial, e-commerce, and usage tables into one table. Due to the large number of keywords in the e-commerce survey and to repeated measurements,

[26] The use of Alexa Rank instead of directly measuring the number of visitors is relatively common both in the news and in the benchmarking practices of international companies (e.g. Microsoft). The major reasons for this are public availability and the possibility of international comparison. Based on the methodology, however, it is likely that the lower ranking a website gets in Alexa Rank, the looser its relationship is with the actual number of visitors.

the data table thus created consists of more than a thousand variables in the context of the 219 companies. The primary data tables were in MS Excel, while the final database was stored in SPSS format. Next, I would like to reveal a few problems related to the process of database cleaning and preparation:

- **Treatment of missing data**: I only encountered a few cases of missing data but when it happened I followed the procedure described below:
  - The primary study period is 2009 (and 2010 is only secondary), so when I had no access to company financial data from this year, I did not try to estimate the missing data but simply excluded the companies concerned from the hypothesis testing. (There were 31 such companies.)
  - If the crawler did not collect data from the main page but found keywords on first-level subpages (there were 3 such companies), I processed those data instead of the missing ones.
  - If the crawler could not gather data from a website during the 2009 survey, I performed manual data collection using the keyword list applied when examining the main pages of the website. If during the manual process the website was not accessible due to some technical error, I added zero value to all the e-commerce variables of the company, and this way it is the same as when the company has no website at all. Thus, I treated these companies (13 altogether) as ones without an accessible website, which was actually the case at the time of data collection.
  - With regard to usage – and website popularity –, Alexa Rank and PageRank are the most common indicators as well as the most useful ones for the purposes of the current study. 80 companies had no Alexa scores and 85 companies were lacking Google PageRank scores, which means that I can only test the hypothesis about the effects of usage on a significantly smaller sub-sample (of a data set of 104 items). These missing data, however, did not result in any problem.
- **Handling Outliers**: The value of an e-commerce variable is either 0 or 1, and both of these two extremes have a professional meaning and a realistic chance of occurrence. A variable related to usage is a number in ranking calculated on a population of several million, and thus both extremely low and extremely high values can be expected. Outliers were mostly expected in the financial database; however, the occurrence of outliers resulting from measurement error could

basically be excluded there. In this case, I used standard deviation and the visual help of histograms to identify outliers. I regarded as outliers those values which were over three times the value of standard deviation and excluded them during regression analysis due to their significant biasing effect. The reason for such outliers was usually some financial anomaly, including mostly negative equity. Low negative equity and negative result for example may lead to a strikingly high positive ROE indicator, which – without the examination of the basic data – can incorrectly be interpreted as good profitability. In such cases I never used calculated ROE values.

- **Normalization and transformation of indicators:** Each basic variable associated with e-commerce capabilities is dichotomous, namely it can take on the values 0 or 1 (depending on the occurrence of a given keyword on the website). 75 and 99 of the 132 keywords I used to assess e-commerce capabilities turned out to be adequate for measurement on main pages and first-level subpages; accordingly, the result of data collection was stored in a 0/1 dummy variable. Of course, it was worth replacing 75 dichotomous variables with fewer variables. In web-based practice, certain keywords are synonyms, so as a first step I could compress the collected data into 52 variables. (These variables are still dummy ones and their value is 1 if any of the synonymous keywords occurs at least once on the website.) Altogether 39 of the 52 keyword groups occurred on the websites of the sample. I will cover the further reduction of the number of variables related to e-commerce capabilities in Sub-section 8.5, following the descriptive analysis of compressing information.

  All the dependent financial performance variables are ratios (see Annex 3), i.e. they express the proportion of different financial categories relative to sales revenue, asset and liability categories, or headcount data. Their advantage lies in comparability.

  Alexa Rank as one of the most important variables in association with usage assumes a wide range of values from a few thousand to several million, so I had to transform its values. Along with the logic of logarithmic transformation, I assigned a value of 1, 2, 3, 4, or 5 to each magnitude[27]. Finally, in the case of

[27] If the original Alexa Rank value is
- less than 1000, the assigned new value is 1,
- more than 1000 but less than 10000, the assigned new value is 2,
- more than 10 000 but less than 100 000, the assigned new value is 3,
- more than 100 000, but less than 1 000 000, the assigned new value is 4,

usage indicators for the purposes of compression, I used principal component analysis to create a composite index. Table 17 shows the component matrix derived from Alexa Rank, Google PageRank, and Yahoo links indicators with principal component analysis without rotation. One principal component with eigenvalue > 1 (KMO 0.519) was extracted, which mainly reflects the value of the two most important usage variables (Alexa Rank and Google PageRank). The better the position of the website is according to both rankings, i.e. the more popular it is, the higher this value becomes. (In Alexa Rank it means a small value while in Google PageRank it means a larger value – this explains the opposite sign in the component matrix.)

Table 117. Principal Component Analysis of Usage Metrics: Component Matrix

	Usage
	1
Alexa rank categories	-,821
Google PageRank	,817
Yahoo links	,335

Overall, after filtering out companies with missing data or outliers the database consists of 151 companies which serve as a basis for my regression analysis in Section 9. However, for the independent analysis of e-commerce capabilities I will return to the sample with 187 items, which is still available in its entirety. In the next part I will give a brief description of sample-specific descriptive statistics, and the next two large sections will be devoted to data analysis.

7.5 Descriptive statistics

It is time now to provide a short description of the created sample in figures, mainly from the perspective of 2009, i.e. the time focus of the research. According to Act XXXIV of 2004 and company data from 2009, all the companies in the research are small and medium-sized enterprises (SMEs). Further, the sample can be divided into 1 medium-sized, 48 small, and 138 micro-enterprises. 50% of the companies have sales revenues less than HUF100m and total assets less than HUF35m, and approximately 75% of them employ less than 10 people in maximum 3 physical locations. 6 of the 187 enterprises had been liquidated by 2010 and another 6 had no annual report figures for

- more than 1 000 000 but less than 10 000 000, the assigned new value is 5.

2010 at the time of the analysis. In 2010, there is only one medium-sized enterprise in the sample while the others are mainly micro-enterprises (126). The companies included in the sample are characteristically classical micro retail enterprises. They were founded between 1989 and 2007 and their average age was 10 years in 2009. Most of the enterprises started their operation between 2003 and 2006. Based on their principal activity, there are 132 computer retailers and 55 mobile phone retailers. 60 companies are Budapest-based while the other 127 are located in the countryside. Anticipating some of the conclusions outlined drawn in Sub-section 8.1.3, it can be said that the sample had 118 traditional retailers and 69 companies which used a mixed business model (with in-store sales and e-commerce), but no pure virtual e-tailer was included.

Table 18. Descriptive Statistics for Some General Business Metrics

(values in million Hungarian Forints)

		Number of employees 2009	Number of locations, stored 2009	Private equity 2009	Private equity 2010	Sales revenue 2009	Sales revenue 2010	Operating profit 2009	Operating profit 2010
N	Valid	187	187	187	175	187	175	187	175
	Missing	-	-	-	12	-	12	-	12
Mean		8	2	38	47	171	182	5	8
Median		5	2	13	16	98	101	2	2
Standard deviation		9	2	90	104	208	242	24	42
Minimum		-	1	- 79	- 37	-	-	- 70	- 49
Maximum		79	14	861	965	1 715	1 677	253	524

Descriptive statistics clearly show that the year 2009 was not the period of growth for the ICT retail sector – more than half of the enterprises had to face a decrease in sales revenue (see Table 19). The median operating profit margin was HUF 2m and less than 20% of the companies generated operating losses. The growth in 2010, however, exceeded the inflation rate: the average sales revenue increased by 7.6% and the operating profit margin grew one a half times. 2009 profitability indicators reflect a few percentage of profit with the exception of cash flow return on investment (CFROI) which shows that more than half of the companies did not produce a positive cash flow. These figures are also more favorable in 2010, both CFROI and ROIC have a high positive value. The most stable profitability indicator is return on assets (ROA), which is at 5% in both years at sectoral level and thus this performance indicator will come to the fore when the hypothesis is examined.

The average sales revenue per capita characteristic of the retail trade was HUF 27m in 2009, but it was between HUF 8m and HUF 25m with 56% of the companies. There was a slight increase in 2010 and the average was above HUF30m per capita. The other two operational indicators, namely inventory turnover and profit margin, were relatively similar in the two years under review. The distribution of most of the indicators – similarly to the basic data – is skewed left and somewhat peaked, and with reference to most of the companies, return on equity (ROE) and inventory turnover are concentrated in a particularly small interval compared to their magnitude.

Table 19. Descriptive Statistics for Financial Metrics, 2009

(in days Sales per employee in million Forints per employee, Inventory Turnover)

2009		Sales growth	Market share	CFROI	ROE	ROA	Sales per employee	Profit margin	Inventory turnover
N	Valid	187	187	187	187	187	187	185,00	185
	Missing	-	-	-	-	-	-	2,00	2
Mean		- 0,11	- 0,01	- 0,18	0,45	0,05	28	0,02	45
Median		- 0,14	- 0,04	- 0,04	0,16	0,05	19	0,02	23
Standard deviation		0,39	0,44	1,03	2,19	0,16	27	0,10	123
Skewness		2,28	2,28	- 0,39	9,50	0,02	3	-2,24	11
Kurtosis		10,10	10,10	8,57	106,71	4,20	10	11,83	135
Minimum		- 1,00	- 1,00	- 5,31	- 2,77	- 0,53	-	-0,49	0
Maximum		1,97	2,31	5,01	26,29	0,75	169	0,36	1586

I also examined the financial indicators on the subsamples taken on the basis of size and geographical location. I could not detect any difference in the values of the analyzed financial ratios in the particular size categories, and there were only two indicators in the geographical subsample which showed significant differences (t-test, α=0.05). In 2009, the average ROA was around 1% and above 7% in Budapest and in the countryside, respectively. Although the average profit margin was negative in Budapest, the same indicator was 3.4% in the countryside. It can be assumed, thus, that due to stronger competition in the capital, retailers operating there have lower profitability.

The variable co-movement of the financial indicators may also be of interest. In terms of the relevant Pearson's correlation coefficients we can conclude that there is an almost function-like relationship between sales revenue growth and market share (r=0.998). The basic reason for this phenomenon is the common basis for the calculation of the two indicators, thus I decided to omit the market share indicator from the analysis. The correlation (0.663) between ROIC and ROA is also very close, which is of no surprise if we consider their calculation formulas. The profit margin indicator

has a positive linear relationship with almost all the other financial ratios; however, its strongest connection is with ROA (r=0.723). The latter two phenomena do not seem to be invariable in time and did not occur again in 2010. (That year is characterized by the almost opposite movement of ROIC and ROE, due to some prominent negative results and equity turning negative.)

Table 20. Descriptive Statistics for Usage Metrics, 2009

		Alexa rank	Google index	Google pagerank	Yahoo links	Yahoo linkdomain
N	Valid	119	187	187	187	187
	Missing	68	-	-	-	-
Mean		6 562 861	8 062	2	32	1 011
Median		2 414 131	38	2	-	-
Standard deviation		8 543 468	93 859	2	270	12 723
Skewness		1	14	0	13	14
Kurtosis		0	184	- 1	171	186
Minimum		1 427	-	-	-	-
Maximum		28 139 537	1 280 000	5	3 622	173 906
Percentiles	10	116 957	-	-	-	-
	20	243 524	-	-	-	-
	25	286 463	1	-	-	-
	30	779 317	3	-	-	-
	40	1 592 653	10	1	-	-
	50	2 414 131	38	2	-	-
	60	2 781 565	84	3	-	-
	70	7 544 148	122	3	-	-
	75	12 434 627	153	3	-	-
	80	15 354 869	196	4	-	2
	90	22 813 228	488	4	16	46

Table 20 shows the descriptive statistics for ranking data related to usage. The table contains both decile and quartile data, as such arrangement well illustrates certain distribution features. It is clearly visible that the values of Yahoo links only separate the best ones from the majority because this data is zero for the biggest part (80-90%) of the population. Alexa Rank data vary on a fairly wide scale – from a thousand to twenty million –, essentially approximating an exponential distribution. Apart from one outlier, Google index moves within an interval of a hundred thousand, while aside from zero values the distribution of Google PageRank is distributed symmetrically within the interval of 1-5. Alexa Rank is the indicator that best differentiates among sites and expresses the aspect of usage. This data, however, is only available for 119 companies. All in all, Alexa Rank and Google PageRank seem to be important for the embodiment

of the usage dimension, and thus the principal component of usage was created accordingly (see Subsection 7.4 above).

Table 21 gives an overview of the best websites based on Alexa Rank results. Based on the table, it can be concluded that of the 10 most popular ICT retail websites four have a profile of computer retail trade and two engage in general mobile phone retail trade, and the activities of the remaining four websites are more specialized. In respect of the temporal stability of ranking data it can be said that based on Alexa Rank data 13 of the top 20 websites in 2009 remained in the top 20 in 2010 as well.

Table 21. Top 10 ICT Retail Trade Websites Based on Alexa Rank 2009

No.	Activity
1	Distribution of printer and copier supplies
2	Mobile phone, camera, and computer retail
3	Domain registration, hosting and virtual server service
4	Computer retail
5	Computer retail
6	Audio-visual systems
7	Computer retail
8	Mobile phone retail and Telenor partner
9	Computer retail
10	Tourism software development

Although the indicators relevant for the different quality features of e-commerce technology are only available for approximately half of the sample, it is nonetheless worth taking a look at them. The websites examined have an average age of 7 years but at least 13 of them have been operating for over 10 years. Their SEO (Search Engine Optimization) score is 67% on average, and there are 31 websites with a SEO score over 80% (see Table 22).

Table 22. Descriptive Statistics for E-commerce Technology Metrics, 2009

		Website age	SEO Score
N	Valid	83	96
	Missing	104	91
Mean		7	67
Median		8	73
Standard deviation		3	23
Skewness	-	0	- 1
Kurtosis	-	1	- 0
Minimum		2	12
Maximum		12	100

I will devote a separate chapter to the independent and detailed analysis of the identified e-commerce capabilities, as I believe that this analysis in itself is a substantial result of my research.

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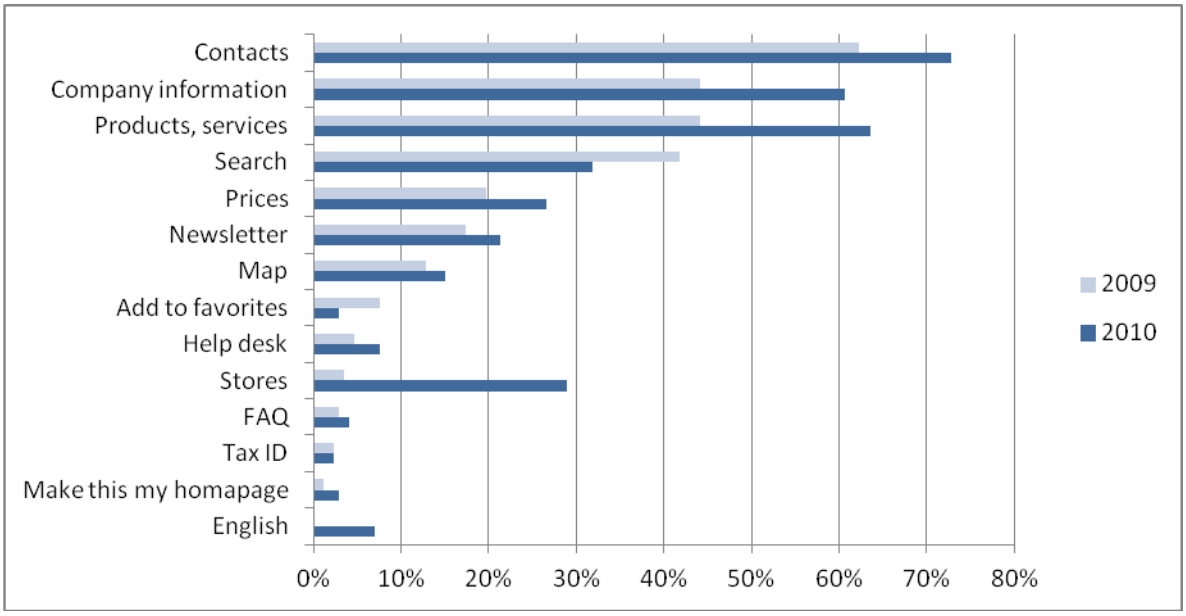
8. The e-commerce capabilities of Hungarian ICT retailers

In this section I will take a detailed look at the identified e-commerce capabilities of Hungarian ICT retailers and compare the findings with similar statistics of the entire domestic market and also advanced economies.

8.1 General characteristics

As data collection has revealed, of the 187 businesses under review 15 do not have online presence; 30 firms are on the Internet via an external operator's company information database while the remaining 142 enterprises have their own websites. In what follows, I will present functions identifiable by way of specific keywords on the sample of (172) businesses having online presence.

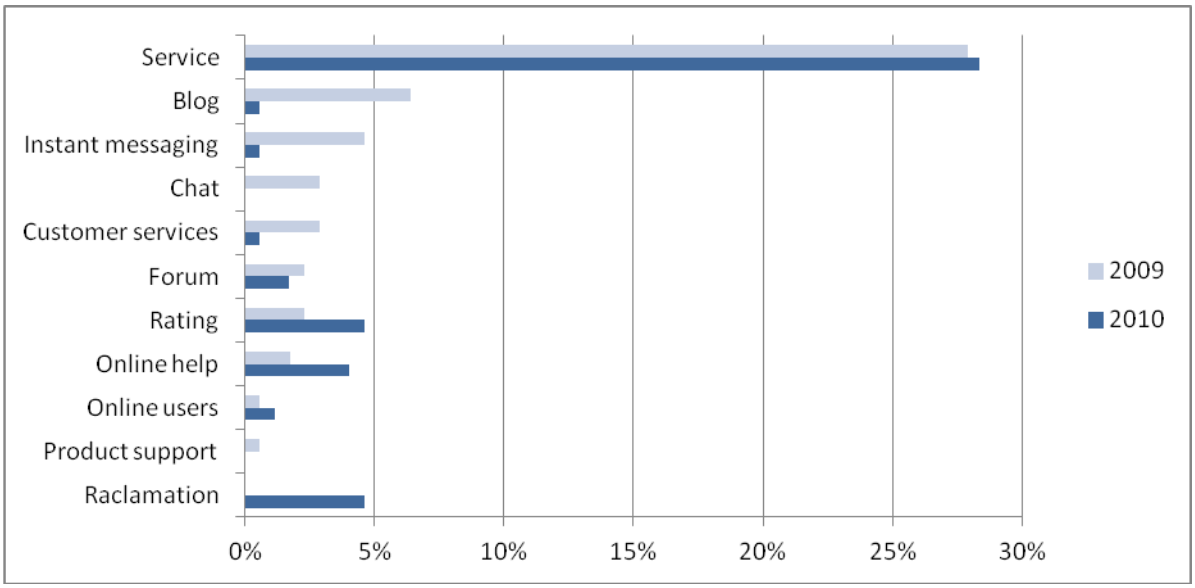
Figure 22. Frequency of Different Information E-Capabilities on the Hungarian ICT Retail Market



As we can expect, the penetration of informational functions is the greatest; of the 10 most frequent functions 7 are of the informational type. I do not think it is by accident, since in companies' life it is mostly these are the first step towards increased presence on the worldwide web and so are the basis and precondition of implementing additional functions. 62% of businesses give their offline availabilities on their websites and 44% also present the firm, thereby helping build customer confidence (see Figure 22). 44% of retailers list their products and services while 42% help customers' orientation by providing a search function. Besides, 17% of companies use regular

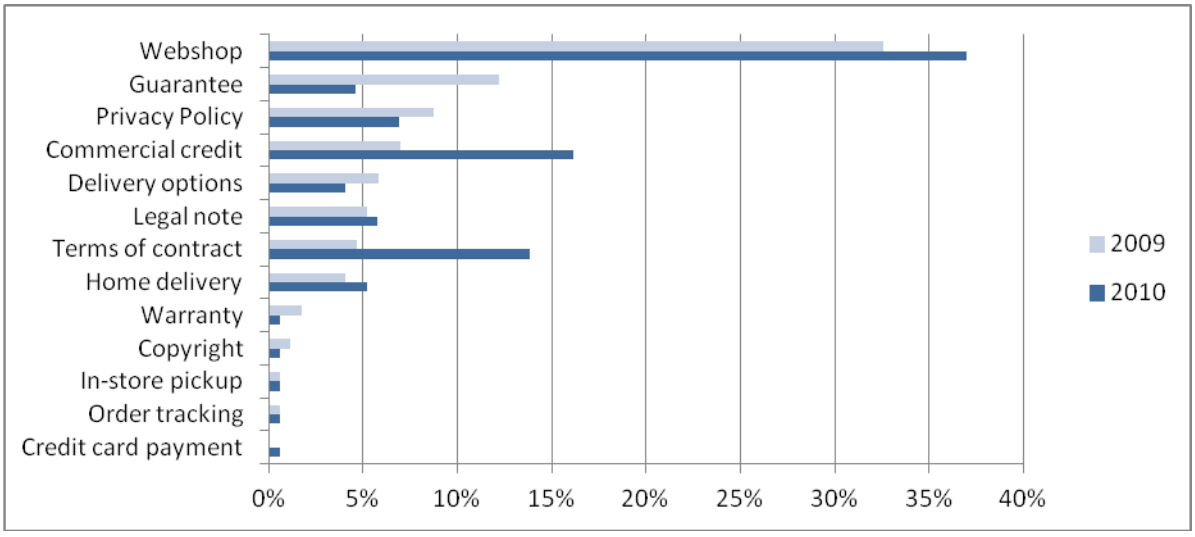
newsletters to stimulate shopping and 13% provide maps for to help access to their shops.

Figure 23. Frequency of Different Interaction E-Capabilities on the Hungarian ICT Retail Market



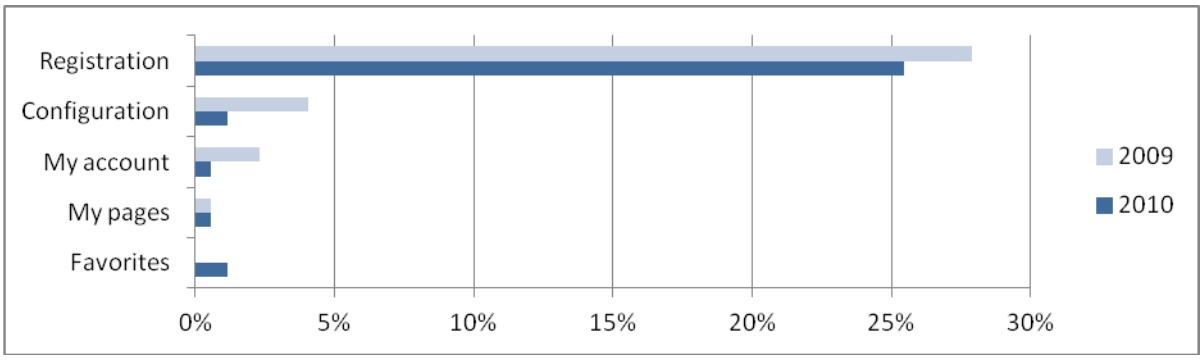
Of keywords referring to interaction with buyers, "service" is the most frequent one as it appears on 28% of the websites (see Figure 23). It, however, basically refers to a complementary offline service – even if earlier studies categorized it as an interactional capability. Many of the functions clearly indicating online communication have low penetration: In 2009, a mere 5% of examined websites offered the option of exchanging messages real time with the firm, 6% had blogs and 2% had a forum function.

Figure 24. Frequency of Different Transaction E-capabilities on the Hungarian ICT Retail Market



The strongest keywords suggesting transactional functions (belonging to the webshop function) were present on one out of three websites (see Figure 24), i.e. the e-commerce sales model is indeed considered widespread in this industry. This is reflected by the 28% proliferation of keywords connected to registration (see Figure 25). In addition, transactional keywords designed to strengthen buyer confidence were also frequent: "guarantee" featured 11% of main pages while "data protection" occurred in 8% of cases. The option to customize the website is rarely available with all related keywords having lower than 5% frequency. Overall, it can be concluded that the presence of customization options is at a minimum, and therefore in the further analysis I will confine myself to discussing the triple categorization of informational/transactional/interactional capabilities. (Registration is the only exception to this last statement, which I consider to be a transactional capability in this market rather than a customization capability since it prepares the placing of orders.)

Figure 25. Frequency of Different Customization E-Capabilities on the Hungarian ICT Retail Market



8.2 Comparison in space and time

Although the figures above already include e-commerce data also for 2010, at this point I'd like to briefly discuss changes that took place during one year.[28] To begin with, there was no change in positions in respect of the most frequent functions (see Table 23), although the proliferation of many of them rose by 5 to 10%. It was primarily the most frequent informational functions that became more frequent: In 2010, as many as over 60% of websites displayed their availabilities, services and not least products. Interestingly enough, in 2010 a list of shops was the 6th most frequent function with a penetration rate of 29%, while in 2009 the same function was available on one third of websites only. A possible explanation is that that is the way retailers explicitly show

[28] Some of the changes may have potentially been caused by a slight modification in the method of data collection – I have examined possible distorting effects as is described in Annex 7.

their strategy related to the complementary nature of the two sales channels. After all, we did not find exclusive e-tailers in 2009 either, i.e. every retailer in the sample using electronic channels also had physical outlets. Therefore, shop-based and online sales channels are increasingly and markedly becoming complementary, rather than alternatives, to each other.

While almost all informational and after-sale transactional functions grew in 2010, data related to online interactional functions (chat, blog, forum, instant messages) and customization options showed a falling tendency compared to their former level. However, some growth was observed in the number of webstores: during one year their penetration increased from 33% to 37%. Concurrently, many more firms refer to contract terms on their main pages, presumably thanks to regulatory tightening. Also, consumer credits are offered by an increasing number of websites (16%), which is probably a proliferating form of sales promotion in a negative economic environment. Generally speaking, it can be concluded that between 2009 and 2010 the examined websites were increasingly focusing on effective sharing of information and sales promotion while foregoing interactivity-stimulating web 2.0 achievements.

Table 23. Top 10 E-commerce Capabilities

Frequency of different capabilities		2009		2010	
		%	rank	%	rank
Contacts	*Information*	62%	1	73%	1
Products, services	*Information*	44%	2	64%	2
Company information	*Information*	44%	3	61%	3
Search	*Information*	42%	4	32%	5
Webshop	*Transaction*	33%	5	37%	4
Service	*Interaction*	28%	6	28%	7
Registration	*Customization*	28%	7	25%	9
Prices	*Information*	20%	8	27%	8
Newsletter	*Information*	17%	9	21%	10
Map	*Information*	13%	10	15%	12

If we want to compare the data of the current research with the results of other similar studies, then on the one hand domestic and international data collections can be useful and on the other hand the results of related scientific research can also serve as a benchmark. If we choose the first option, we can only perform comparison along a few major e-commerce capabilities, such as the proportion of businesses having their own websites, or along informational/interactional/transactional/customization function groups. Table 24 shows clearly that domestic ICT retailers operate their own websites

much more frequently (74.9% in 2009) than is the case on the domestic market (51%), in domestic retail trade (54.1%) or even in other EU member states (64%) in general.

Table 24. Levels of Internet Activity in Different Populations

[Source of benchmark data: KSH, 2010]

Different levels of internet usage (% of total number of firms)	**EU average 2009**	**Hungary, 2009**	**Hungarian retail, 2009**	**This study, 2009**	**This, study 2010**
The firm does not have internet connection	7,0%	13,2%	10,9%	**25,1%**	**24,6%**
The firm has internet connection, but no webpage	29,0%	35,8%	35,0%		
The firm has webpage, but only contains information	51,0%	37,7%	37,3%	**44,9%**	**41,2%**
The webpage is used for business transactions as well (e.g. sales)	13,0%	13,3%	16,8%	**29,9%**	**34,2%**

The more intensive presence of e-commerce in the industry is also observable in frequency statistics on the main individual e-commerce capabilities (see Table 25). Although individual e-commerce functions are more widespread in domestic retail trade than on the entire market, we can find even higher proportions in the case of ICT retail trade. Here more than one out of two businesses make the most important information about them available on the Internet, while on the market in general only one out of six or seven companies offer online transactional functions. That is also the case with one out of three retailers in my sample.

Table 125. E-commerce Capabilities in Different Populations

[Source of benchmark data: KSH, 2008 and 2010]

E-commerce functions (% of total number of firms)	**Hungary,2007**	**Hungary, 2009**	**Hungarian retail, 2009**	**This study, 2009**	**This, study 2010**
Information – corporate and product information on own website	39,4%	44,4%	48,7%	**57,0%**	**67,5%**
Transaction – on-line order placement	14,9%	13,3%	16,8%	**34,2%**	**34,2%**
Interaction – on-line help	2,6%	na	na	**1,6%**	**3,7%**
Customization – website customization options	2,0%	5,6%	7,5%	**3,7%**	**1,1%**

In their study, Mirko Gáti and Krisztina Kolos [2011] analyzed the Internet habits and e-commerce capabilities of 300 Hungarian companies using a mixed business

model. Among domestic studies, theirs is probably the closest to the current research as it scrutinizes similarly specific e-commerce capabilities and is also based on data collection, albeit questionnaire-based, performed in 2009. Based on the comparison of results (see Table 26) we can conclude that ICT retailers have their own website more often also relative to Hungarian SMEs and the industry average, but they use them to present products less frequently. Other than that, however, they offer their customers over twice as many opportunities as the domestic average to buy online and also perform above average in terms of the transactional function of search supporting sales.

Table 136. E-Commerce Functions in this Sample and in Gáti – Kolos [2011]

Results of Gáti – Kolos [2011]	webpage	products, services	online transaction	search
Firm size				
small	85,1%	81,0%	18,1%	31,4%
medium	80,0%	75,0%	11,7%	30,0%
large	90,0%	95,0%	10,0%	30,0%
Ownership structure				
majority of domestic private owners	83,3%	79,5%	16,9%	31,4%
Sector				
retail	81,3%	74,5%	18,8%	18,8%
Total- 2009	***84,3%***	***80,6%***	***16,1%***	***31,0%***
This study - 2009	92,0%	44,0%	33,0%	42,0%
This study - 2010	92,5%	64,0%	37,0%	32,0%

Among related foreign studies, only Merono-Cerdan and Soto-Acosta [2007] provide frequency data on e-commerce capabilities observed on their sample. Table 27 compares functions covered by both their survey and the current research.

Table 27. E-commerce Capabilities in Different Studies

E-commerce capabilities		This study	This study	Marono-Cerdan – Soto-Acosta [2007]
	Year of data collection:	2010	2009	2003
Information	products, services	64%	44%	76%
	prices	27%	20%	13%
	search	32%	42%	12%
	company information	61%	44%	70%
	newsletter	21%	17%	12%
Interaction	forum	2%	2%	3%
Transaction	webshop	37%	33%	17%
Customization	registration	25%	28%	18%

Although the collection of Spanish data relied on mixed industry sampling and presents a picture from 6 years ago, the comparison has produced interesting results. In respect of the most basic informational functions – presentation of products and company information – Spanish data from 2003 suggest a significantly higher penetration rate than my domestic sample from either 2009 or 2010. However, functions more closely connected to shopping – webstore, registration, prices or search – occurred at least one and a half times more frequently (even three times more frequently with certain capabilities) in the case of Hungarian ICT retailers in 2009. In other words, in 2003 Spanish websites were stronger in providing general information, while in 2009 and 2010 Hungarian ICT retailers focused more on sales.

8.3 The role of size, geographical location and sales model in e-commerce

First, I examined the effect of company size on the development of e-commerce capabilities (see Annex 5 for a table presenting comparison by frequency of keywords). Comparing the frequency of functions in each subsample I only found a significant difference between small and micro-businesses[29] in two cases: Prices were displayed by significantly more micro-businesses (22%) than small businesses (8%), while blogs were more characteristic of small businesses (13%) than micro-businesses (4%). When taking a closer look the frequency of individual e-commerce functions, we can see that the seven most frequently occurring (groups of) keywords are identical in the two size categories, even though their order is somewhat different (see Table 28). The search function is found 10 percent more frequently with small businesses, which can be explained by the possibly higher cost of integrating a well-functioning search function. Interestingly enough, while 5% more visitors can register on the main pages of small businesses, the webstore function occurs slightly more frequently in the case of micro-businesses. Overall, therefore, micro-business websites are more focused on sales while small business websites are more sophisticated.

Apart from some of the differences mentioned above, I do not believe that the e-commerce capabilities of micro- and small ICT retailers differ to a significant degree. Even if Merono-Cerdan and Soto-Acosta [2007] found in their Spanish sample differences between the informational and interactional capabilities of firms belonging

[29] Since the sample only included one medium-sized business, which did not have its own website (although it had web presence), I excluded that firm from further analysis by size.

to different size categories in favor of companies hiring over 50 employees, my sample basically includes smaller businesses than that.

Table 148. Most Frequent Keywords – Comparison of Micro and Small Sized Companies, 2009

	micro		small		total	
	rank	%	rank	%	rank	%
N:		138		48		187
contacts	1	56%	1	63%	1	57%
company information	2	41%	4	42%	2	41%
products, services	3	39%	3	44%	3	41%
search	4	36%	2	46%	4	39%
webshop	5	31%	6	27%	5	30%
service	6	25%	7	27%	6	26%
registration	7	25%	5	29%	7	26%
prices	8	22%	12	8%	8	18%
newsletter	9	14%	8	23%	9	16%
map	10	12%	11	10%	10	12%
guarantee	11	11%	9	13%	11	11%

When comparing the e-commerce capabilities of firms registered in the capital and in the countryside, the differences found are even more negligible than in the case of size. Based on statistical tests, the penetration of neither keyword (family) differs significantly in the two groups. This finding squares with the perceived characteristic of e-commerce that it militates toward leveling out geographical differences [e.g. Nemeslaki et al. 2004]. Wherever the business is, with nearly identical capabilities it will have nearly identical chances in competition.

Table 159. Most Frequent Keywords – Comparison of Different Regions, 2009

	Budapest (capital)		Other regions		Total	
	rank	%	rank	%	rank	%
N:		60		127		187
contacts	1	60%	1	56%	1	57%
products, services	2	42%	4	40%	2	41%
company information	3	38%	2	42%	3	41%
search	4	32%	3	42%	4	39%
webshop	5	28%	5	31%	5	30%
service	7	23%	6	27%	6	26%
registration	6	25%	7	26%	7	26%
prices	10	13%	8	20%	8	18%
newsletter	8	18%	9	15%	9	16%
map	9	18%	11	9%	10	12%
guarantee	12	12%	10	11%	11	11%

Among the most frequent functions, search is somewhat more widespread in businesses in the countryside, while the map function appears on the websites of twice as many Budapest-based businesses (see Table 29). Besides, certain interactional functions (chat, forum, review) occur more often in the case of Budapest-based companies than those in the countryside (although they remain rare as standalone functions). The same hold true for some legal functions, such as the frequency of privacy or disclaimers. In other words, e-commerce capabilities are basically independent of location, but the websites of Budapest-based retailers tend to be more sophisticated.

After examining the company size and geographical location, I also investigated the effect of the selected business model on e-commerce capabilities. Based on their classification into business models (see Subsection 7.3.2), I identified 118 conventional ICT retailers and 69 firms using a mixed sales model, while there was no purely virtual e-tailer in the sample. I expected there to be an actual relationship between the chosen sales model and the developed e-commerce capabilities – and I was not disappointed. (E-functions showing significantly different frequency are summarized in Table 30.) The results clearly illustrate the difference between e-capabilities required for the two business models.

Table 30. E-commerce Capabilities in Different Business Models, 2009

(chi-square test for the independency of e-commerce capabilities and business model, α=5%, significantly higher e-capability frequencies with bold)

E-commerce capabilities		traditional retailers	mixed sales model	Total
	N:	118	69	187
Information	products, services	35%	**51%**	41%
	search	31%	**52%**	39%
	stores	1%	**7%**	3%
	map	**17%**	3%	12%
	newsletter	8%	**30%**	16%
Interaction	service	18%	**39%**	26%
Transaction	webshop	5%	**72%**	30%
	delivery options	2%	**12%**	5%
	home delivery	1%	**9%**	4%
Customization	registration	10%	**52%**	26%

For example, the only e-commerce function to occur significantly frequently on traditional retailers' websites is the map function. It is understandable since they promote in-store sales on their websites and it is in their best interest for their potential

buyers to easily find their shops. However, bearing that in mind it is strange that the display of shops on the main page should be more frequent in the mixed model. This phenomenon can stem from the overall underdevelopment of traditional retailers' informational e-commerce functions or from the fact that a quarter of them do not have their own websites.

Naturally enough, differences in respect of webstores and registration functions are predetermined by reason of the definition of the business model and the method used to identify it.[30] Moreover, other functions closely linked to sales also appear to be highly widespread in the mixed model. The presentation and searchability of products and services therefore are available on one out of two websites. With the opening of the electronic sales channel the service function is also becoming increasingly important, since its existence can cause confidence to grow even in absence of personal contact. The newsletter function is a useful tool of electronic sales promotion and it seems that businesses with advanced e-commerce capabilities are more active in this area, too.

Table 31. Most Frequent Keywords – Comparison of Different Business Models, 2009

(significantly different e-capabilities with bold)

	traditional retailers		mixed sales model		total	
	rank	%	rank	%	rank	%
N:		60		127		187
contacts	1	54%	2	62%	1	57%
company information	2	36%	6	49%	3	41%
products, services	**3**	**35%**	**5**	**51%**	**2**	41%
search	**4**	**31%**	**3**	**52%**	**4**	39%
webshop	**14**	**5%**	**1**	**72%**	**5**	30%
service	**5**	**18%**	**7**	**39%**	**6**	26%
registration	**8**	**10%**	**4**	**52%**	**7**	26%
prices	7	15%	9	23%	8	18%
newsletter	**11**	**8%**	**8**	**30%**	**9**	16%
map	**6**	**17%**	**24**	**3%**	**10**	12%
guarantee	9	10%	10	13%	11	11%

The list of the most frequent keywords (see Table 31) also shows that differences between the two business models can be easily tracked on websites, too. The penetration of 7 of the 11 most frequent functions significantly differs in the two groups and the ranking orders themselves are also significantly different. While in the case of

[30] The negligible frequency of webshops in the traditional model basically stems from data collection errors – for an analysis of potential errors connected to data collection see Subsection 9.8.

exclusively shop retailers, informational functions are the strongest, while in the mixed model transactional functions prevail in addition to informational capabilities supporting them.

8.4 Multivariate data analysis

So far I have examined the frequency of each e-commerce function in space and time. At this point, however, it is also worth exploring the relationship between different e-commerce variables. Are there functions that tend to concur?

I set out to answer the above question by preparing a simple contingency table. In the case of categorical characteristics, a chi-square test based on it can be useful. [Hunyadi et al. 2000, p. 460]. In case of the most frequent keywords (with a penetration over 10%), for example, the association of the functions is especially strong (see Table 32). Search and registration functions appear together most often but the concurrence of the newsletter, registration, webshop and product presentation functions are also probable. Products, services, search, registration, webshop and newsletter form an interdependent group of these five functions – representing the logic of the online sales process from product information through purchase to encouraging revisits.

Table 32. Chi-square (χ^2) Test for the Most Frequent Keywords

(significant at α=0,050 with light background

α=0,001 with dark background)

	prices	search	map	contacts	company info	news-letter	service	registration	webshop	guarantee
products, services	2,606	**29,455**	,905	2,753	9,396	7,627	8,378	12,789	4,115	6,642
prices	.	,001	,000	1,846	15,448	3,355	7,413	,973	5,801	,504
search		.	2,710	2,128	4,250	21,980	5,030	**60,024**	14,086	10,831
map			.	,419	1,847	,895	,034	3,591	1,645	,114
contacts				.	19,074	5,521	4,889	,736	5,040	7,847
company information					.	,107	2,344	3,504	4,115	9,295
newsletter						.	5,844	**31,479**	18,986	2,757
service							.	11,065	15,084	,104
registration								.	**46,348**	1,915
webshop									.	5,676

Similarly, we can expect the concurrent presence of certain informational functions. For instance, prices, availabilities, and company and servicing data are interrelated and their display basically serves to inform potential customers in order to encourage their offline or online purchases. In addition, these two function groups can already be detected in 2009 figures and they also show a significant correlation in the 2010 database. Thus, the formation of these two groups is not just understandable and professionally justifiable but seems to be quite stable over time as well. As for the rest of the keywords, there are concurrences as well but the available frequency in the case of these relationships is too low to allow drawing reliable conclusions.

Then I conducted an exploratory principal component analysis[31] in order to further examine the correlations between the variables. When principal component analysis[32] was performed on a narrowed variable group of 23 items, Varimax rotation resulted in the component matrix shown in Table 33. Nine (eigenvalue >1) principal components were formed explaining 63.36 % of the variance of the original variables, while the KMO value of 0.562 indicates a not explicitly strong but acceptable fit.

The majority of the resulting principal components were quite easy to interpret based on the e-commerce logic. The results suggest the separation of the basic informational/interactional/transactional capabilities, as these principal components are obviously related to the main capability groups. Thus, similarly to the research done by Zhu and Kraemer [2002, 2004], factor analysis also confirmed the relevance of information/interaction/transaction categorization, although the categorization of individual capabilities is not always unambiguous.

The keywords related to online shopping were immediately consolidated into the first principal component (T). I have already pointed out the correlation of the elements of this principal component: registration, webshop and finally the newsletter function practically follow the necessary steps in the process of online sales transactions. Product

[31] I have chosen the principal component analysis (and not some factor analysis technique), as, on the one hand, it maximises the explained variance in a calculated way [see Füstös et al., 2004, p. 275], while these methods all lead to the same result with a larger number of variables and higher communality values (such as in my case), on the other [Gorsuch, 1983, p. 123, cited by: Füstös et al., 2004, p. 276]. Based on Jolliffe [2002, p. 68-69] we can conclude that the principal component analysis does not require variables to belong to a known and defined distribution, and even discrete or dichotomous variables can be used as well. (About the inclusion of dichotomous variables, see also Füstös et al., 2004, p. 313-314 and an example on p. 280.)

[32] For the selection of the 23 variables, I have left out e-capabilities with a penetration of under 2% and some variables which did not occur or hardly occured during manual data collection, and thus it is very likely that crawler-based data collection overestimated their frequency. The principal component analysis covering all variables resulted in similar principal components with lower KMO values.

information as support for sales is a transition between the informational and transactional functions. The fourth factor (IT1), for example, compresses information that allows customers to determine what they get for their money: In addition to prices they can also take into account the proximity of shops and additional services (consumer credit, servicing) as well. Thus, the fourth factor was named "customer value". In addition, another three principal components emerged in support of the transactional function and related to service conditions: Customer service and delivery options were dominant in the first one (IT2); products and home delivery in the second (IT3), while in the third it was frequently asked questions and terms of contract (IT4).

Table 33. Principal Component Analysis of E-commerce Capabilities - Component Matrix

(2009, 23 e-capabilities, eigenvalues >1, Varimax rotation, displaying only values > 0,4)

	Principal Components								
Nr.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Capability Group	**Trans-action**	**Infor-mation**	**Inter-action 1**	**Product info 1**	**Company info**	**Trans-action info 1**	**Product info 2**	**Inter-action 2**	**Trans-action info 2**
Code	**T**	**I1**	**N1**	**IT1**	**I2**	**IT2**	**IT3**	**N2**	**IT4**
Name	webshop	special functions	interactivity	customer value	reliable company info	terms of service 1	products, services	online communi-cation	terms of service 2
webshop	,615								
registration	,780								
newsletter	,651								
map		,602							
add to favourites		,849							
privacy		,801							
rating			,814						
forum			,787						
prices				,402					
stores				,584					
service				,580					
commercial credit				,615					
contacts					,669				
legal note					,452				
company information					,718				
cutomer service						,822			
delivery options						,655			
products, services							,732		
home delivery							,440		
instant messaging								,514	
chat								,787	
terms of contract									,595
FAQ									,723

Perhaps the second principal component (I1) is the most difficult to make professional sense of as privacy information and showing a map or the function of "add to favorites" all refer to the informational capability, but professionally there is no relationship between them. However, they obviously move together and hence I will mention them as a component embodying special functions. These three functions,

however, are clearly linked by the fact that all of them occur more often in the traditional retail shop environment. The interpretation of the fifth principal component (I2) is much easier: It consolidates those informational functions which are critical for building customer confidence. Here the display of company information, contacts and a disclaimer are key to identify someone as a reliable seller in the online world.

In addition to all the above transactional and informational factors, interactivity (N1: review, forum) and online communication functions (N2: instant message, chat) were clustered into a markedly separate factor. With statistical features and inner structure of e-commerce variables identified, the next task – reducing the number of e-commerce variables – was an easier challenge.

8.5 Constructing composite e-commerce indicators

Out of the 52 keyword groups surveyed, 39 occurred on the websites of the sample (see Annex 1). These were already mentioned in the previous section. Handling such an amount of variables makes further analysis of the data and testing of my hypotheses rather difficult. Thus, I decided to compress e-commerce information into significantly less indicators. For that I followed the guidelines of the OECD handbook on composite indicators setting the following methodical steps for constructing composite indicators [Nardo et al., 2005, p. 9-10]:

1. Developing a theoretical framework (done, see Section 6)
2. Selecting indicators (done, see Section 7)
3. Multivariate data analysis (done, see Section 8.1.4)
4. Imputation of missing data (done, see Section 7.4)
5. Normalization (done, see Section 7.4)
6. Weighting and aggregation
7. Robustness and sensitivity
8. Association with other variables (not applicable)
9. Visualization (ongoing during the analysis)
10. Feedback to real data (not applicable)

The comments made in the list show that preparatory steps were already taken from developing a theoretical framework to normalization – so now I can focus my attention on discussing alternative aggregation options.

According to related literature, there are different methods that can be suitable for compressing e-commerce variables:

- Aggregation by certain predetermined weights in accordance with the variable structure outlined during operationalization (see Subsection 7.3.2 and Table 16). The results of earlier research can serve as a basis and it is also in favor of this method that it retains the major dimensions of information/transaction/ interaction/customization. Here both equal weighting and weighting with frequencies of occurrence are attractive options (both weightings are subjective). In both cases there are still 24 different variables to work with under the level of the four major dimensions and this number is still too high for a sample of almost 200 items. Naturally, the job can be done without them if the variables are consolidated into the four variables of information/transaction/interaction/customization, but the exploratory principal component analysis has not confirmed completely the clarity of these four categories.

- Still insisting to use the information/transaction/interaction/customization dimensions and their sub-variables of earlier research, we can narrow our focus and examine if there is at least one keyword for each sub-variable on the website (value=1) or there is none (value=0). The above-described problems related to the number of variables will remain valid, however.

- The use of factor and principal component analyzes can be an obvious solution as it happened in the case of similar research [Zhu, 2004; Merono-Cerdan – Soto-Acosta, 2007]. Although this method is objective and retains much of the variance of original variables, it does not lead to variables of a constant composition over time. Here we can use the previously (Section 8.1.4, Table 33) discussed principal components constructed during the principal component analysis.

- We can decide not to construct composite indicators but select a few basic variables which show real interrelation with our dependent variables. This way we can get rid of the delicate issue of aggregation and weighting, but then we

leave many of the original e-commerce variables (keyword families) out of the analysis. Anticipating the results of the statistical analyzes presented in Section 9.2.1: according to the tests, at the 5% significance level there are 15 e-commerce variables which can be related to changes in financial performance indicators (see Table 35 below).

After all these considerations the best choice is perhaps to use the presented nine principal components in the future instead of or in addition to the original e-commerce variables, as this solution offers the most favorable features under the given conditions. On the one hand, aggregation can be objective this way not relying on subjective evaluation during the determination of the weights. Although it does not cover all the original variables, it keeps the most important ones for the research. Furthermore, it basically reflects the originally defined information/ interaction/transaction categorization of capabilities also demonstrated by similar research – individual principal components can be linked to one of the capability groups in most cases. However, we must make mention its most important disadvantage as well: It is not constant in time. The principal component analysis of e-commerce in 2010 leads to an entirely different structure. Based on the above, I will use the nine e-commerce factors shown in Table 33 for the purposes of further analysis.

8.6 Summary of the e-commerce capabilities of Hungarian ICT retailers

As a summary of the findings of the previous section, I have drawn the following conclusions during the analysis of the e-commerce capabilities of Hungarian ICT retailers:

- Out of the originally defined 52 e-commerce functions, only the penetration of 11 functions exceeded 10%; but this is the leading group and the frequency order of the functions in it proved to be constant over time.

- Informational functions constituted the overwhelming majority among the most frequent functions. This is not an unexpected development, as building a few basic informational functions is the first step towards entering the world of web-based business – and a necessary precondition of developing additional e-capabilities.

- We can establish that there was no rearrangement regarding the most frequent functions from 2009 to 2010 either, though the penetration of quite a few of

them increased by 5-10%. Websites in 2010 were even more focused on efficient information transfer and sales promotion mostly focusing on effective sharing of information and sales promotion while foregoing interactivity-stimulating web 2.0 achievements.

- We can establish that Hungarian ICT retailers are more likely to have their own websites in both international and Hungarian comparison. The proportion of online purchase options offered by these businesses to customers is over twice the Hungarian average.

- The geographic location and size of firms do not usually have an influence on the level of their e-commerce capabilities. This is in line with the theoretical statement that e-commerce is capable of bridging the gap between the business and the target markets and ensures all actors equal opportunities for market entry.

- The selected business (sales) model, at the same time, has the expected significant effect on development of e-commerce capabilities: While the information functions are the strongest with businesses selling exclusively through traditional shops, in the mixed model transactional functions come to the fore together with product information capabilities supporting them.

- The multivariate analysis has shed light on frequent concurrences of two key variable groups. One group is made up of products, services, search, registration, webshop and newsletter – representing the logic of the online sales process from product information through purchase to stimulate revisits. In the other group, the display of price, availabilities, company and servicing data serves to inform potential customers in order to boost offline or online sales.

- Finally, I managed to identify those principal components during the principal component analysis which do not only encompass key e-commerce functions but also make professional sense and can be grouped into the information/ interaction/transaction categories of related literature.

I believe this chapter has explored phenomena that are interesting on their own while confirming some theoretical statements on the sample of Hungarian ICT retail business. In the next section I will move further: I will examine the hypothesis I have made on the relationship between e-commerce capabilities and corporate performance.

9. Analysis of hypotheses: E-commerce and corporate performance

In the present section, I will analyze the central research questions, i.e. I will focus on the inter-linkages between e-commerce capabilities and financial performance on the basis of the available sample. However, before going over the hypotheses, let me have a few lines about the most important methodological issues.

9.1 Methodology

Given that the relationship between the two fundamental variable groups – e-commerce capabilities and financial performance – is originally a mixed relationship[33], and after condensing e-commercial variables into factors it is a correlational relationship[34], it can be analyzed with the tools matching these conditions. For mixed relationships, the PRE technique is applied, which is based on the fact that with two closely related criteria, knowledge of one helps to estimate categorization according to the other [Hunyadi et al., 2000, p. 165 and p. 174]. As for the indicators transformed into e-commerce factors, they make it possible to calculate the correlation co-efficient expressing also the strength and direction of the relationship of the two variables besides demonstrating its existence. The common Pearson correlation, however, is excessively sensitive to outliers and to deviation from the linear relationship or from normal distribution. As these can also cause problems in the present case, it is methodologically justified to choose Spearman's rho coefficient and to apply the related non-parametric test [Nagpaul, 2012].

In technical literature, the most common tool for examining similar relationships is regression analysis [e.g. Zhu – Kraemer, 2002; Zhu, 2004 and Merono-Cerdan – Soto-Acosta, 2007], which will therefore certainly be part of the analytical toolkit of the present paper. I will do my best to construct a model as similar as possible to those of regression analyzes used in related research documents so that the results are comparable in space and time. In accordance with the above, the fundamental economic correlation under study is expressed by the following equation:

$$VT = \alpha + \sum \beta_i * E_i + Control\ variables\ (Size, Industry\ segment, VT_{t-1}) + \varepsilon$$

[33] One variable is measurable on the nominal scale and the other on the interval or ratio scale.
[34] Both variables are measurable on the interval or ratio scale.

where VT is the value of the corporate performance index representing the dependent variable; α is a constant member whose inclusion is justified by both statistical and professional considerations; E_i is one of the nine e-commerce factors and VT_{t-1} is the value of the performance variable for the previous year[35].

I have identified nine e-commerce factors in the current research, and this figure not only exceeds significantly the three or four e-commerce variables in comparable studies, but it would actually mean too many dependent variables relative to the size of the sample. Therefore, instead of incorporating the e-commerce factors in the model automatically, I applied the stepwise method ($0.05<p<0.1$). I ran into no multicollinearity problems in any of the presented regression estimations, due partly to the linear independence of factors used as explanatory variables. (The value of correlation coefficients among the independent variables did not exceed the absolute value of 0.160 anywhere.) However, heteroscedasticity could not be excluded[36], and to reduce it I used corporate performance indicators expressed as a rate, filtering out the effect of company size. Besides, the statistical and graphic examination of relationships between the variables made it clear that, because of a few outliers in the financial variables, second- and third-degree curves would fit the data somewhat better than the linear one. However, by omitting outliers falling outside the commonly used triple standard deviation, I obtained linear models representing a good fit. That is to say, the linear regression models to be presented below are based on a narrower sample of 151 elements.

However, in order to be able to understand the co-movement and deeper connections of so many variables of different types, it is worth resorting to the complex methods of multivariate pattern recognition. With the help of cluster analysis, I assigned the companies to distinct groups based on certain financial, usage-related and e-commerce variables [Füstös et al., 2004], and I examined in what e-commerce features the identified clusters differed most. To test that, I used the chi-square test for dichotomous variables (e.g. individual e-commerce capabilities) and the ANOVA table for any other variable measurable on the ratio scale.

---

[35] I am aware of the fact that using the corporate performance variable value of the previous year as control may result in autoregressivity problems. However, since Zhu's [2004] study, which the most closely resembles the present research, also constructs the model this way, I applied it here for the sake of comparability. By the way, this control variable is an attempt to integrate into the model the effect of the previous general management of the company. Later on (Section 9.6.2) I will also present a linear regression model where the operational indices of the reference year are included among the explanatory variables instead of the values of the dependent profitability indicators for the previous year to avoid the autoregressive effect.

[36] Due to the presence of heteroscedasticity, the estimates obtained by the traditional least squares method remain undistorted and consistent, but the method will no longer be effective as there may be a linear estimate the variance of which is smaller.

Finally, the table below provides a summary of the analytical tools associated with each hypothesis:

Table 3416. Hypothesis and Proposed Analytic Methods

No.	Hypothesis	Analytic Methods Used
H1	There is a positive relationship between Hungarian ICT retailers' firm level e-commerce capabilities and the companies' competitiveness.	> Correlation analysis > Regression analysis > Cluster analysis
H2	Different levels of e-commerce development have different performance effect in the Hungarian ICT retail industry.	> Comparison of sub-samples with different e-commerce development levels
H3	Greater e-commerce capability in conjunction with higher levels of website usage is associated with better competitiveness in the Hungarian ICT retail industry.	> Regression analysis > Cluster analysis
H4	Relationship between Hungarian ICT retailers' firm level e-commerce capabilities and company's competitiveness changes with firm size.	> Comparison of sub-samples with different firm size
H5	Relationship between Hungarian ICT retailers' firm level e-commerce capabilities and company's competitiveness changes with sales channel choice.	> Comparison of sub-samples with different business model > Regression analysis > Cluster analysis

Finally, let me say a few words in advance about the interpretation of the results. One of the most important problems of IT value creation studies based on large-sample statistical calculations of this type has been from the start – practically from the roots of research on the IT productivity paradox – the indirect nature of the relationship between IT resources and corporate financial performance. As a matter of fact, it is a rather brave attempt to integrate into a single model as independent and dependent variables of a statistical study the two end-points of effects that can be mapped along this long logical chain – and it also makes it significantly more difficult to interpret the results. The following considerations are to be borne in mind here:

- On the one hand, similar studies have so far demonstrated only a few relatively minor, albeit statistically significant, relationships (see Table 10 above). Even so, they considered the results worthy of analysis and publication, the underlying professional argument being the generally weak financial demonstrability of intangible effects. In other words, with such indirect effects even weak relationships are far more numerous than what others succeeded to demonstrate elsewhere at other times.

- To unravel the mode of action, I integrated into the model a complementary variable (usage) and also the chosen business model as compared to previous studies, which has made the causal relationships suitable for being investigated in greater depth and easier to support professionally. Moreover, it would of course be worth incorporating further intermediate and/or intermediary variables in the model so as to better understand the process of value creation, and to be able to demonstrate tighter relationships between the individual levels of the model, but these fall outside the scope of the present research. However, in addition to regression analysis applied also in similar research, I extended also the range of analytical tools with the help of cluster analysis, and hence I was able to examine my data from several aspects.

After all these methodological considerations, in what follows I will therefore examine my research hypotheses formulated in Subsection 6.3 and try to confirm or disprove them with the statistical tools at my disposal.

9.2 H1 – The relationship between e-commerce capabilities and corporate performance

First, I will look into my basic hypothesis which has been formulated in the context of the resources-based view and refers to a positive relationship between e-commerce capabilities and corporate performance here.

H1: There is a positive relationship between Hungarian ICT retailers' firm level e-commerce capabilities and the companies' competitiveness.

> **H1/A:** There is a positive relationship between firm level e-commerce capabilities and market performance of Hungarian ICT retailers.
>
> **H1/B:** There is a positive relationship between firm level e-commerce capabilities and profitability of Hungarian ICT retailers.
>
> **H1/C:** There is a positive relationship between firm level e-commerce capabilities and operational efficiency of Hungarian ICT retailers.

As a matter of fact, the sub-hypotheses can be expressed not only in terms of the type of corporate performance, but also in terms of the type of e-commerce capabilities (informational/transactional/interactional). In what follows, I will take into consideration both differentiating factors.

9.2.1 Bivariate correlations

First, I examined the relationship between each e-commerce variable and the financial performance variables. Table 35 includes exclusively those commercial functions which cause a significant difference in the average or median of the financial variables[37]. As can be seen, there are functions in all four groups of e-commerce capabilities that can be related to increased financial performance.

Table 35. Relationship of E-commerce and Financial Performance Variables

(the medians are significantly different at α=5% (xx) or α=10% (x);
the averages are significantly different at α=5% (dark-shaded background) or at α=10% (light-shaded background); the minus sign indicates negative correlation; c. stands for customization)

		Sales growth	Market share	ROIC	CFROI	ROE	ROA	Sales per employee	Profit margin	Inventory turnover
Information	products, services							xx		
	prices			x	xx	x		xx		
	stores					xx				
	map	-	x-							
	FAQ				xx					
	contacts				x-	x-	x-		-	
	company information						-			
	newsletter					x				
	add to favourites		xx-		xx-		x-		xx-	
Interaction	instant messaging			x						
	service									
	customer service									
	rating			xx			xx			
	forum			x						
	chat									
Transaction	webshop									
	legal note	x	x	xx			x			
	terms of contract						xx		x	
	privacy								x-	
	delivery options							x		
	home delivery			xx						
	commercial credit					xx				
C.	registration							xx		

The market indicators only correlate with one or two e-commerce functions, and the same is true of the inventory efficiency and profit margin indicators. On the other hand, the Sales Revenue/Capita indicator, typical of the retail industry, shows a positive relationship with relatively many e-commerce functions and, moreover, mostly with frequent common e-commerce functions (products, services, webshop, servicing,

[37] Given the mixed relationship between the two variable groups – some criteria being measurable on the nominal scale and others on the ratio scale – I performed the following statistical tests:
- comparison of group medians by nonparametric testing
- comparison of group averages by asymptotic Z-testing (permissible due to the sufficiently high number of elements)

registration). That is, e-commerce capabilities, primarily of the transactional type, obviously play a role in operational productivity. Of the financial performance variables, most e-commerce capabilities move with the ROIC indicator. As for the ROE, ROA and CFROI indicators, it is to be noted that certain informational capabilities may exert a definitely negative influence on them. The e-commerce capabilities concerned (primarily availabilities and "add to favorites" functions) are in a negative relationship with several performance variables, i.e. their presence is mostly concurrent with deteriorating financial performance. The map variable has a similarly negative effect on market performance. Note that the "add to favorites" and map functions are present simultaneously in the informational e-commerce principal component previously identified as "special functions". In other words, we can expect these capabilities to exert a significant combined effect on corporate performance, but this effect is likely to be negative.

At this point it should be noted that the list of e-commerce variables in closer co-movement with financial variables is relatively stable in time. On the basis of the same test, we could only add a single new keyword (search) to the list in 2010. True, another eight keywords (FAQ; company information; add to favorites; instant message; chat; legal declaration; shipping modes) would be deleted, except for company information, but those refer to very rare functions.

We can learn even more about the relationship between e-commerce capabilities and corporate performance by analyzing the relationship between the principal components we have created and the performance variables, rather than carrying out our investigations at the level of numerous e-commerce functions. Table 36 shows the significant correlations between the variables, where I once again used Spearman's rho coefficient as correlation indicator.

The table covers only the first five principal components, since the other four principal components (buying conditions 1 and 2, products and online communication) showed no significant relationship with any of the performance indicators. The same is also true, by the way, of the sales revenue growth indicator expressing market performance. That is, it can be said about market performance that although it shows a minimum extent of co-movement with e-commerce capabilities in a direction identical with that of profitability rates, that relationship is not significant.

The strongest positive relationship is shown by per capita sales revenue and the online shopping factor. Their co-movement suggests that transactional e-commerce capabilities do have a beneficial effect on retail labor efficiency, even if this effect is less demonstrable at the level of profitability and market performance. Surprisingly enough, however, most positive profitability relationships (ROIC, ROA) are shown by

the interactivity factor (review, forum). That is to say, ITC retailers that had been more open to discussion with potential buyers and had not been afraid to hear their opinion became more successful by 2009. It appears, therefore, that it is in this area by which retailers can distinguish themselves from their competitors rather than by the more widespread informational or transactional functions.

Table 36. Correlation between E-commerce Factors and Corporate Performance Indicators

(Spearman's rho; correlations marked by * and ** are significant at levels 0.01 and 0.05, respectively; based on a two-tailed significance test)

		Sales growth	ROIC	CFROI	ROE	ROA	Sales per employee	Profit margin	Inventory turnover
webshop	Correlation	,093	,030	,021	,005	,016	,250**	,037	-,091
	Sig. (2-tailed)	,206	,681	,774	,947	,825	,001	,619	,228
	N	187	187	187	173	187	187	185	178
special functions	Correlation	-,135	-,006	-,165*	-,050	-,009	-,022	,013	,060
	Sig. (2-tailed)	,065	,936	,024	,510	,905	,762	,863	,424
	N	187	187	187	173	187	187	185	178
interactivity	Correlation	,023	,144*	,044	,123	,154*	,071	,102	,125
	Sig. (2-tailed)	,751	,050	,546	,106	,035	,336	,166	,097
	N	187	187	187	173	187	187	185	178
customer value	Correlation	,043	,103	,107	,061	,016	,148*	-,024	-,073
	Sig. (2-tailed)	,560	,162	,145	,427	,829	,044	,748	,333
	N	187	187	187	173	187	187	185	178
reliable company info	Correlation	-,012	-,146*	-,023	-,076	-,144*	,050	-,177*	-,033
	Sig. (2-tailed)	,871	,047	,755	,320	,050	,500	,016	,665
	N	187	187	187	173	187	187	185	178

The factor blending special functions (map, add to favorites and privacy) is in a negative relationship with almost every performance indicator, i.e. these e-commerce functions are typical mainly of companies characterized by poorer performance. (We expected that on the basis of Table 35.) Since all three functions are more typical of traditional shop-based retailers, they are more strongly affected by the negative performance effect. Interestingly, however, the relationship between online access to reliable company information and corporate performance indicators is also negative, and this result is basically contrary to the empirical evidence found so far on buyer confidence and on its effect on buying propensity [Gefen, 2000; McKnight – Choudhury – Kacmar, 2002]. Therefore, I will return to this issue at a later stage also including the effects of other variables in the examination.

In summary, the correlation coefficients showed a sometimes weak but nevertheless significant relationship between e-commerce capabilities and corporate performance. A positive relationship was demonstrated in particular between online transactional capabilities and per capita sales revenue indicators, and between interactional capabilities and profitability. Knowledge of these e-commerce capabilities reduces the uncertainties concerning corporate performance by 2-6 per cent. This relationship is therefore weak − but not insignificant −, which is not surprising considering the indirect nature of the relationship. After all I did not and could not expect e-commerce capabilities representing only a small segment of company strategy to have an order-of-magnitude greater effect on financial performance than that. In what follows, I will try to explore in depth the nature of the relationship by means of more complex multivariate analytical techniques.

9.2.2 Regression model

Each of the studies [Zhu – Kraemer, 2002; Zhu, 2004; Merono-Cerdan – Soto-Acosta, 2007] most closely resembling the present one tested their hypotheses by constructing a linear regression model following the consolidation of e-commerce variables into factors. For the comparability of the results, below I will reproduce the regression models of earlier authors with the help of the regression equation presented in Subsection 9.1[38]. For the regression estimation, I used the data for 2009, representing the focus of the research.

Table 37 summarizes my regression results and compares them to earlier empirical data. The e-commerce variables I included reduce the uncertainty concerning corporate performance indicators by 2.9 to 11.6%. This explanatory power is consistent with what was experienced in similar studies: Zhu [2004] only found R^2 improvement exceeding 3% concerning the inventory turnover of American retailers, whereas in my case as many as three indicators' effects exceed that. Hence, it remains obvious that the effect of e-commerce indicators on corporate performance is demonstrable but weak and therefore it explains performance differences to a small extent only. Nor can we expect a much stronger effect, since e-commerce decisions represent only a minor subset of the strategic portfolios of companies.

The results also show that the various corporate performance indicators are subject to various significant effects of e-commerce capabilities. Only the special informational capability had a significant – negative – effect on return on total assets

[38] $VT = \alpha + \sum \beta_i * E_i + Kontroll\ változók\ (Méret, Iparági\ szegmens, VT_{t-1}) + \varepsilon$

(ROA). In other words, if this e-commerce capability of a company is strong, that will be concurrent with a poorer profitability index, as was seen already on the basis of the correlation matrix. The same e-capability deteriorates the profit margin indicator even more, i.e. it has a dampening effect on profitability at operational as well as corporate level. Since this capability is associated mainly with the map function, the negative effect may conceal a business model relying heavily on in-store sales.

Table 37. Comparison of Regression Analysis results from Different Studies

(significance: * p<0.01; ** 0.01<p<0.05; *** 0.05<p<0.1

[1] Results of this study; e-commerce variables entered with stepwise method at an F value of 0.05<p<0.1; the values shown here are standardized betas [2] The size indicator here is the logarithm not of number of employees but of total assets; only one of the eight industrial variables is significant [3]The table includes the results of the high-tech industrial sub-sample

		This study[1]				Zhu, 2004[2]			Zhu - Kraemer, 2002[3]		Merono-Cerdan - Soto-Acosta, 2007
		ROA	Sales per employee	Inventory turnover	Profit margin	ROA	Sales per employee	Inventory turnover	Inventory turnover	Profit margin	EVA
Sample		Hungarian ICT retailers (N = 151)				USA retailers (N = 114)			USA production industry (N = 260)		Spanish SME-s (N = 288)
Model											
	R^2	0,141*	0,473*	0,625*	0,276*	0,361*	0,379*	0,312*	0,556*	0,160	0,570
	p value	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,002	0,140	
	Constant	0,031**	15,519*	5,886**	0,012**						
E-commerce variables - Betas											
I2	reliable company info				-0,107						0,065
I1	special functions	-0,200*			-0,300*						
IT1	customer value		0,118***								
IT2	terms of service 1										-0,036
IT3	products, services					0,104	0,251**	0,129***			
IT4	terms of service 2			0,021					0.029		
T1	webshop		0,134**						0.097***		0,129*
N1	interactivity										
N2	online communication								0.104		0,076**
E-commerce incremental R^2		0,045	0,074	0,029	0,116	0,026	0,029	0,117			0,021
Control variables - Betas											
	Size (number of employees)	0,062	-0,035	0,004	0,025	0,011***	0,044	-0,013***			0,692*
	Industry segment	-0,031	-0,094	0,185*	0,035	-	-	-			0,029
	Prior year's performance	0,303*	0,610*	0,735*	0,388*	0,686**	0,013***	-			

Interestingly enough, other similar studies found no e-capability with a significantly negative beta. In case of other operational indicators typical of retail trade I did find e-commerce capabilities with a positive effect as well. Hungarian ICT retailers, for example, that not only offer the option of online shopping, but also support the customer's decision-making with appropriate information and services (customer value creation factor: prices, shops, servicing, consumer credit) can actually produce higher per capita sales revenues. Kreamer and Zhu [2002] and Merno-Cerdan and Soto-Acosta [2007] equally measured the strongest positive effect on corporate performance in the case of transactional e-commerce capabilities. This effect is consistent with our expectations since transactional capabilities (and the informational ones supporting them directly) must have a direct effect on revenue-based performance indicators.

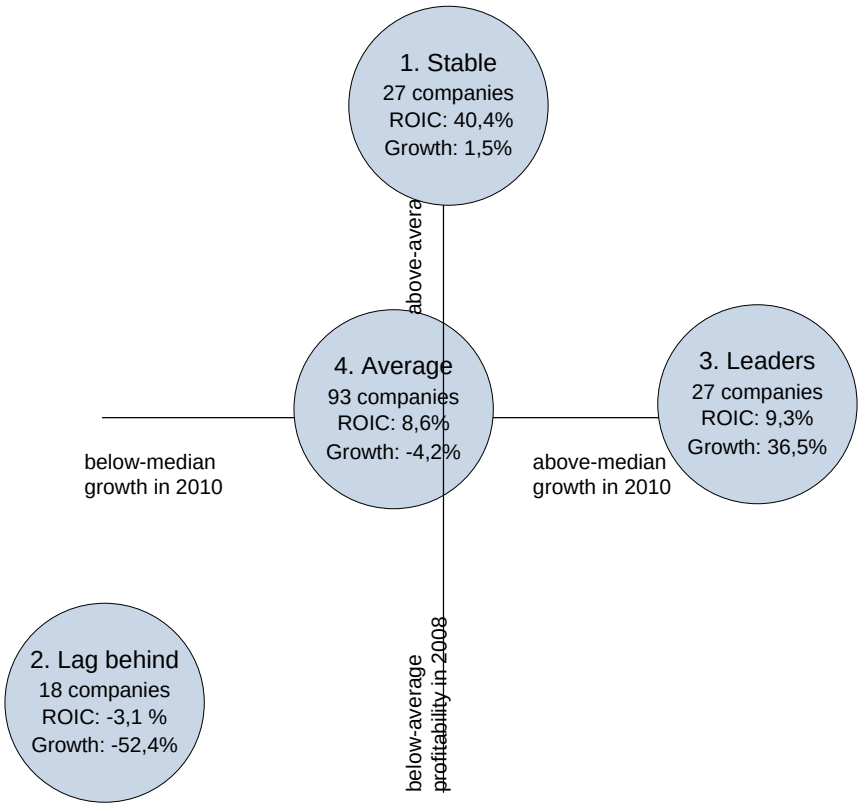
In regard to operational performance indicators, both Zhu [2004] and Zhu and Kraemer [2002] found that the relationship between e-commerce capabilities and corporate performance was the strongest for inventory turnover. The situation is overall quite the opposite with the Hungarian e-tailers: Practically, in the case of inventory turnover the beta of neither e-commerce capability under study differs significantly from zero in the regression model. In other words, whereas in similar studies the positive relationship between inventory efficiency and (primarily transactional) e-commerce capabilities was obvious, this effect could not be demonstrated here with a similarly structured regression model.

In summary, by reproducing earlier regression analyzes, the empirical results were possible to reproduce in part only. The explanatory power of e-commerce variables is similar in the Hungarian sample to that in the American or Spanish studies, and better transactional e-commerce capabilities exert a significant positive effect also on the sales per employee revenue indicator. It is equally true of Hungarian ICT retailers that the explanatory power of e-commerce indicators is less significant for cumulative profitability rates. But contrary to previous research, negative correlation was also found in some cases: some special functions (map, add to favorites, privacy) had a definitely negative effect on ROA and profit margin indicators in the sample. On the other hand, the significant positive effect on inventory efficiency could not be observed at all in the Hungarian sample – I will return to the analysis of this topic later on.

9.2.3 Cluster analysis

I relied on the method of cluster analysis [partly based on Aranyossy – Juhász, 2012] in order to gain a deeper understanding of connections between financial performance and e-commerce capabilities. I took into consideration the fact that in the year of the research, 2009, the protracted effects of the economic crisis exerted a significant influence on domestic retailers' performance [e.g. Salamonné Huszty, 2011], and so I formed clusters by financial indicator accordingly. Thus, one of the criteria of forming the groups was profitability (ROIC) in 2008, an indicator showing the pre-crisis business profitability relatively clearly. In addition, I took market performance into account by using a sales revenue growth indicator for 2010 clearly showing which businesses were able to increase or at least retain their market share even in the years of the crisis. Based on these two financial indicators, four[39] distinct clusters were assembled within the sample universe (see Figure 26).

Figure 26. Distinct Clusters by Financial Profile



One group of high-performing enterprises (3) with slightly above-average profitability in 2008 showed market stagnation and losses in 2009, but gathered strength by 2010 and produced not only an extraordinary sales revenue increase, but also higher-

[39] I identified a total of 9 clusters by cluster analysis, but three of them had a single item, one had two items and one three. Moreover, these small clusters were characterised by outstanding financial indicator values along at least one dimension, so I excluded them from further analysis.

than-average profits (see Table 38). Performance in another successful cluster (1) took a different course of development: The companies concerned had profitability rates well above the average in all three years under review, but the crisis weakened their market position. They recorded a 15% drop on average in terms of revenues and suffered significant market share losses in 2009, but they managed to retain their shrunk markets in 2010.

More than half of the retailers can be assigned to the mediocre cluster (4) in every respect. They are characterized by average positive profits and decreasing turnover in the crisis years – that is what the performance of an average domestic ICT retailer looked like at the end of the last decade. Finally, companies in the last cluster (2) were already loss-makers in 2008, they produced passable but weak indicator values in 2009, but finally lost half their revenues and generated a definite deficit in 2010.

Table 38. Key Differences Between Clusters Formed on the Basis of Financial Performance

(including only cluster features showing significant differences based on ANOVA and chi-square tests; averages and, for individual e-functions, ratios; above-average values are highlighted)

		Cluster averages					
		1. Stable	**2. Lag behind**	**3. Leaders**	**4. Average**	**Total average**	**Sig. Level**
Cluster features	N	27	18	27	93		
	ROIC 2008	40,4%	-3,1%	9,3%	8,6%	6,3%	
	Sales growth 2010	1,5%	-52,4%	36,5%	-4,2%	7,6%	
Performance features	ROA 2008	31,8%	-1,0%	7,1%	7,0%	10,2%	0,000
	Profit margin 2008	9,2%	-0,2%	2,4%	2,7%	3,4%	0,000
	Sales per employee 2008	34,0	59,2	29,4	30,1	33,7	0,013
	ROIC 2009	44,9%	3,8%	-1,4%	15,5%	16,3%	0,006
	ROA 2009	16,6%	4,9%	4,1%	5,7%	7,1%	0,002
	Profit margin 2009	6,4%	-1,0%	2,1%	2,1%	2,5%	0,014
	ROA 2010	10,0%	-11,7%	11,6%	3,4%	4,2%	0,000
	Profit margin 2010	8,1%	-56,2%	3,9%	2,0%	-2,7%	0,006
	Usage 1	-,394	-,139	,226	-,013	-,050	0,105
E-commerce factors 2009	interactivity	,576	-,188	,058	-,117	,018	0,019
	customer value	-,187	-,438	-,212	,104	-,054	0,061
	terms of service 2	-,132	-,017	,321	-,032	,011	0,043
E-commerce functions	rating 2009	11%	0%	0%	1%	2%	0,015
	forum 2009	7%	0%	7%	0%	2%	0,038
	commercial credit 2009	0%	0%	0%	11%	6%	0,041
	prices 2010	19%	6%	22%	33%	26%	0,058
	online help 2010	4%	0%	15%	2%	4%	0,026

Having identified the ICT retailer clusters characterized by different financial profiles, I was able to examine which e-commerce capabilities were typical of each group. Table 38 also shows the significant differences between the e-commerce profiles of each cluster ($\alpha<5\%$ and $\alpha<10\%$, based on ANOVA and chi-square tests, respectively). The e-commerce capability distinguishing the financially successful clusters (1 and 3) from their under-performing peers in 2009 is the factor of interactivity (including the functions of forum and evaluation). That is, good market and profitability performance is clearly associated with businesses which use the Internet not only as a one-way communication channel, but also for interaction. It is also interesting, however, that the members of the same two successful clusters paid below-average attention to the factor of "customer value creation", i.e. prices, shops, servicing and consumer credit functions. These functions were more in the focus of attention of the cluster of average performers, and their choice was obviously enough for no more than stagnation. Thus it seems that easier access to consumer credits in the crisis years no longer represented sufficient attraction for consumers to actually buy things, whereas previously it used to be quite effective for ICT devices (laptops, mobile phones).

It can also be seen that in each of the functions, apart from the customer value creation factor mentioned before, the cluster characterized by outstanding profitability (1) performs best and the loss-making and market-losing cluster (2) is characterized by having the weakest e-commerce capabilities, i.e. nearly the total absence thereof. The two profitability extremes thus go with a clearly opposing e-commerce strategy. This can be interpreted merely as a sign that companies still making profits in 2008 had enough resources to develop their e-commerce capabilities later on, but it is equally quite possible that they were saved from market losses in the crisis years exactly by their advanced e-commerce capabilities. For, as we have seen, only companies at the cutting edge of interactive e-commerce capabilities (clusters 1 and 3) could report positive sales revenue growth in 2010.

Nevertheless, the fact is that the clusters characterized by different financial profiles did not differ significantly, contrary to any expectations, in the areas of transactional capabilities or even company and product information functions. This, however, does not necessarily imply the absence of such a relationship; it may as well point to its greater complexity. To understand that, in what follows I will examine the effect of website popularity along with the differentiating power of company size and of

the selected business model. First, however, let me sum up the findings related to the first hypothesis.

9.2.4 Summary of the results concerning Hypothesis H1

The following table (Table 39) sums up the results obtained in connection with Hypothesis H1 pertaining to the relationship between e-commerce capabilities and corporate performance. The table – as the investigation itself – separated the assumed relationships along two dimensions: by the type of e-commerce capability (informational, transactional, interactional) and by the type of corporate performance under review (market performance, profitability, operational efficiency). In each test, I examined every grid point of this 3*3-dimensional matrix.

We were not able to confirm the sub-hypothesis referring to a positive relationship between e-commerce capabilities and market performance (H1/A) on the data for 2009. Cluster analysis, on the other hand, revealed that only those ICT retailer clusters managed to increase their sales revenue in 2010 which significantly outperformed their rivals in rare interactional functions.

The relationship between company-level profitability and e-commerce capabilities has been confirmed by several tests, although the results are mixed in respect of the sign of the relationship. Special functions (map, add to favorites) typical mainly of traditional retailers are in a significantly negative relationship with profitability indicators, whereas retailers with stronger interactional capabilities are at an advantage in this area. In other words, in connection with this sub-hypothesis (H1/B), the results are ambiguous, depending on the type of the e-capability – the sub-hypothesis has only been confirmed for the interactive capabilities.

Finally, as far as the anticipated closer relationship between operational efficiency indicators and e-commerce capabilities (H1/C) is concerned, the results are again ambiguous. First, the profit margin indicator – similarly to ROA and ROIC – seems to have a negative relationship with special informational capabilities and, what is more, also with company informational capabilities. Secondly, the inventory turnover of Hungarian ICT retailers is obviously not connected to their e-commerce capabilities – whereas in international research this was the strongest demonstrated relationship. However, looking at the sales revenue per capita indicator we get the anticipated result: The online transactional capability and the product information functions supporting it have a positive effect on Hungarian retail labor efficiency. In other words, the sub-hypothesis could thus be confirmed only with regard to the relationship between the labor efficiency indicator and transactional e-capabilities. That is, for Hungarian ICT webshops, we have managed to disconfirm the classical productivity paradox by

demonstrating that although webshops abound on the Internet, their positive productivity effect is still demonstrable.

Table 39. Summary of Results Testing Hypothesis H1

(the + and – signs indicate the positive and negative direction, respectively, of significant relationships)

Bivariate correlations at the level of individual e-capabilities:

		Corporate performance		
		Market performance H1/A	Profitability H1/B	Operational efficiency H1/C
e-commerce	information	-: map, add to favorites	+: prices -: contacts; add to favorites	+: only concerning to Sales per employee and products and prices
	transaction	weak +: terms of service	weak +: terms of service	+: only concerning Sales per employee and webshop
	interaction		+: only for ROIC and ROA	

Bivariate correlations at the level of e-commerce principal components:

		Corporate performance		
		Market performance H1/A	Profitability H1/B	Operational efficiency H1/C
e-commerce	information		-: special functions and company information	-: only concerning Profit margin and company information
	transaction			+: only for Sales per employee
	interaction		+: only for ROIC and ROA	

Regression:

		Corporate performance		
		Market performance H1/A	Profitability H1/B	Operational efficiency H1/C
e-commerce	information		-: for special functions	-: only concerning Profit margin and company information
	transaction			+: only for Sales per employee
	interaction			

Cluster analysis:

		Corporate performance		
		Market performance H1/A	Profitability H1/B	Operational efficiency H1/C
e-commerce	information	+: in 2010, only clusters with good interactional capability could grow	+: In the comparison of the clusters representing the two profitability extremes, the high-performing one is clearly better in every e-capability	
	transaction			
	interaction			

9.3 H2 – E-commerce development stages

As was seen during the analysis of the first hypothesis, the informational/transactional/interactional capability groups have largely different effects (if any) on corporate performance. In next hypothesis, we will explore this issue in more detail, assuming a stage-by-stage development of e-commerce capabilities.

H2: Different levels of e-commerce development have different performance effect in the Hungarian ICT retail industry.

Of course, this hypothesis can only be tested in merit by stage of e-commerce development, of which I have distinguished the following ones based on Hungarian ICT retailers' e-capabilities in 2009:

1 – No online presence (N=14)

2 – Online presence on a link list/portal site only (N=32)

3 – Own website but without online sales function (N=89)

4 – Own website with webshop (N=52).

This type of classification coincides by and large with the ones applied in statistical surveys [see e.g. KSH, 2010], except for distinguishing the first two groups, which, however, seems justified in view of the statistics to be presented below. Table 40 shows the differences between the company groups identified on the basis of the four development stages in terms of the mean value of their financial performance indicators.

Table 40. Average Financial Performance Indicators Associated with Various E-commerce Development Stages

(values in the same row not sharing the same subscript are significantly different at p< ,05 in the two-sided test of equality for column means)

Group averages		E-commerce development stages			
		Not online	Info page only	Own info page	Webshop
	N	14	32	89	52
2009	Sales growth	$.0531_{a}$	$-.2304_{b}$	$-.1356_{a.b}$	$-.0434_{a}$
	ROIC	$.0991_{a}$	$.1238_{a}$	$.0764_{a}$	$.1957_{a}$
	CFROI	$-.7359_{a}$	$-.4257_{a.b}$	$-.0379_{b}$	$-.1095_{b.c}$
	ROE	$.1170_{a}$	$.0257_{a}$	$.1026_{a}$	$.3245_{a}$
	ROA	$.0387_{a}$	$.0633_{a}$	$.0524_{a}$	$.0504_{a}$
	Sales per employee	$33.9687_{a.b}$	17.2181_{a}	$26.9195_{a.b}$	33.9726_{b}
	Profit margin	$.0196_{a}$	$.0082_{a}$	$.0191_{a}$	$.0116_{a}$
	Inventory turnover	20.11_{a}	170.31_{a}	64.78_{a}	17.71_{a}
2010	Sales growth	$-.0295_{a}$	$-.0510_{a}$	$.1368_{a}$	$.0759_{a}$
	ROIC	$.2698_{a}$	$.1767_{a}$	$.0243_{a}$	1.3813_{a}
	CFROI	$2.3680_{a.b}$	$1.1811_{a.b}$	$.2752_{a}$	3.3772_{b}

Group averages		E-commerce development stages			
		Not online	Info page only	Own info page	Webshop
	ROE	21.1473$_{a}$	2.6407$_{a}$	10.5890$_{a}$	12.6507$_{a}$
	ROA	.0633$_{a}$	.0733$_{a}$	.0389$_{a}$	.0332$_{a}$
	Sales per employee	39.6011$_{a}$	15.9648$_{b}$	30.4862$_{a.b}$	36.0148$_{a}$
	Profit margin	.0179$_{a}$	.0184$_{a}$	-.0602$_{a}$	.0013$_{a}$
	Inventory turnover	27.50$_{a.b}$	153.19$_{a}$	50.10$_{b}$	17.69$_{b.c}$

Now let's review each sub-hypothesis on the basis of the table.

H2/A: Moving from the state of a total lack of e-commerce capabilities to the online informational level is related to sales growth.

This statement is basically true of domestic ICT retailers, but its direction is counterintuitive. It can be said of every significant difference associated with revenues (sales revenue growth and per capita sales revenue indicators for 2009) that the best performance is shown by retailers with no online presence at all. Although the second best value was produced by companies with webshops, the performance of the firms concentrating on the informational functions was always poor. (Although this sales revenue growth tendency had reversed slightly by 2010, the differences are not significant there.) That is to say, to develop informational e-functions in themselves did not contribute to sales revenue growth – the best performers in this area were the two extremes: offline businesses and retailers with webshops. Thus, this sub-hypothesis could not be confirmed on the sample of Hungarian ICT retailers.

H2/B: Moving from information e-commerce capabilities to an online transaction level is related to both sales growth and retail efficiency.

I have already mentioned in connection with the previous sub-hypothesis that ICT retailers with webshops were top performers in terms of sales revenue growth in 2009. That is, although they did not leave offline businesses standing, they suffered much smaller sales revenue losses in this crisis year than their peers with no more than informational online presence. Consequently, this hypothesis cannot be disconfirmed from the aspect of market performance: significant market progress was found in moving from the informational to the transactional development level.

Considering an operational efficiency indicator typical of retail trade, i.e. sales per employee, it can be said for both years that companies having online transactional capabilities were clearly in the lead, neck and neck with their offline trader peers. As with the statement concerning growth, significant progress was observed here as well, mainly compared to retailers appearing only on info pages.

The tendency shown by inventory turnover, however, is contrary to our expectations. Strange as it may seem, offline and webshop retailers – presented as the most successful before – have the highest relative inventory levels. Apparently, in the case of these enterprises the business model is associated with higher inventory levels and faster availability, but further in-depth investigations would be needed to understand this difference.

Interestingly enough, what we have seen here is that the most similar performance levels were achieved by the two extremes: traditional ICT retailers avoiding the Internet completely on the one hand and those with an advanced transactional e-commerce function on the other. Similar international studies [Brynjolfsson et al., 2009] have also shown that in the case of mass products, shop-based retailers can be strong competitors to e-tailers, and the competitive edge from the online sales channel exists only with niche products.

Now that I have thoroughly examined the effect of various e-commerce capabilities on corporate performance also by e-development stage, I will try and add further color to the picture. In the following subsections I will review the effects of usage, size and business model on the original relationship under review.

9.4 H3 – The intermediary effect of usage

I plan to examine the role of website visits, website usage and website popularity in e-commerce value creation. The relevant hypothesis is the following:

H3: Greater e-commerce capability in conjunction with higher levels of website usage is associated with better competitiveness in the Hungarian ICT retail industry.

Consequently, in this section I will examine primarily the complementary effect of usage, i.e. an impact mechanism where value creation requires the concurrent presence of outstanding websites e-capabilities and visitors attracted to the page.

A different, chain-type logic is also conceivable, however, namely that (a group of) e-commerce capabilities affect the intensity of website usage, and then this usage determines directly the business value thus created. In the latter case, usage would be an intermediary, rather than a complementary variable of e-commerce value creation, as is also suggested by a school of thought in literature [e.g. DeLone – McLean, 2003]. The correlations between the principal components of e-commerce and the principal component of usage (See Annex 8) indicate the presence of a demonstrable, albeit weak, relationship. In particular, online shopping (Spearman's rho: 0.316), customer value creation (0.279) and reliable company information (0.200) have a significant positive effect on website popularity. In other words, more advanced e-commerce capabilities can attract visitors to the website and assist progress in the online ecosystem. However, if we pursue the same train of thought and take a look at the relationship between the principal component of usage and financial performance indicators (again Annex 8), we can see that the relationship discernible here is negligible indeed. Only ROA growth in 2009 (-.146) and revenue growth in 2010 (.192) are in a weak, but significant, relationship with usage. That is, website popularity has no demonstrable, immediate and positive effect on corporate performance, so it would not be expedient to study usage as an intermediary variable.

On the basis of the above, I will continue to treat usage rather as a complementary variable in the analysis and try to test its complementary effect partly with the help of the regression model, and partly by way of cluster analysis techniques.

9.4.1 Regression model

First, I invoked the aid of the linear regression model presented in subsection 9.2.2 to examine the intermediary effect of usage. To do so, I modified the model as follows:

$$VT = \alpha + \sum \beta_i * E_i * H + \ Control\ variables\ (Size, Industry\ segment, VT_{t-1}) + \ \varepsilon$$

where VT is the value of the corporate performance indicator representing the dependent variable; α is the constant member; E_i is one of the nine e-commerce factors; H is the principal component of usage (described in Subsection 7.4) and VT_{t-1} is the value of the performance variable in the previous year. That is, in this case, plain e-capabilities are replaced in the model by the interactions of usage and e-commerce capabilities (expressed in the form of a product). This models the assumption that good e-commerce capability is not enough: if the website is not visited by potential consumers, the anticipated performance growth cannot be realized. Hence, e-commerce capabilities and usage are complementary variables, and I will try to demonstrate the existence of this complementary effect also empirically.

Table 41 sums up the results of regression analysis and compares them to the results of the previously presented model without interactions. I did the calculations for each corporate performance variable, but interactional e-commerce variables appear in the model with a significant beta only for the three operational indicators shown in the table. This, of course, foreshadows the extrapolation of my previous statements: The direct effect of e-commerce capabilities on corporate profitability or market performance cannot be demonstrated even in the presence of complementary information on website popularity.

However, at the level of operational efficiency, the inclusion of usage in the investigation holds in store interesting information. It is revealed in respect of the retail labor efficiency indicator, for example, that in the case of taking into account website usage, the online transactional capability loses its differentiating power and information concerning products and buying comes to the fore. The same pieces of information, complemented with a good indicator of usage have a beneficial effect also on inventory turnover. Informational capabilities associated with buying and shipping conditions, on the other hand, are already concurrent with significantly worse inventory turnovers. This may be attributable for example to the fact that retailers already displaying shipping information on the main page usually promise fast and flexible delivery, but that, in turn, might require the keeping of larger inventories. Clearly, however, whereas e-commerce capabilities did not seem decisive from the aspect of inventory efficiency in the previous regression analysis, they did produce significant betas when weighted with usage. That now makes it possible, on the one hand, to demonstrate the relationship found by previous researchers between inventory and e-commerce

capabilities [Zhu, 2004 and Zhu – Kraemer, 2002], and, on the other hand, to uncover the contrary effects underlying neutral results obtained originally.

Table 41. Interaction between Usage and E-commerce Capabilities in the Regression Model

(significance: * p<0.01; ** 0.01<p<0.05; *** 0.05<p<0.1

Results of the model constructed for the present research; e-commerce variables entered with stepwise method at an F value of 0.05<p<0.1; the values shown here are standardized betas)

		Sales per employee	Inventory turnover	Profit margin	Sales per employee	Inventory turnover	Profit margin
The model							
	N	147	140	149	151	151	151
	R^2	0.468*	0.648*	0.277*	0.473*	0.625*	0.276*
	p value	0.000	0.000	0.000	0.000	0.000	0.000
	Constant	15.152*	6.567*	0.016*	15.519*	5.886**	0.012**
Betas		**Interactions of e-commerce variables and use**			**E-commerce variables**		
I	reliable company info						-0.107
IT1	special functions			0.279*			-0.300*
IT2	customer value	0.120***	0.100***		0.118***		
IT3	products, services						
IT4	terms of service 2		-0.156*			0.021	
T1	webshop				0.134**		
T2	terms of service 1	0.079	-.095***	-.176**			
N1	interactivity						
N2	online communication						
E-commerce incremental R^2		0,076	0.159	0.137	0.074	0.029	0.116
Control variables – Betas							
	Size (number of employees)	-0.023	0.014	0.027	-0.035	0.004	0.025
	Industry segment	-0.143**	0.179*	0.011	-0.094	0.185*	0.035
	Prior year's performance	0.599*	0.691*	0.371*	0.610*	0.735*	0.388*

Regression results for the profit margin are also interesting. However, buying and shipping conditions (favoring the customer, by the way) have a dampening effect also on the profit margin. However, weighted with usage, the negative beta shown in connection with special functions (map, add to favorites, privacy) turns strongly positive – the strength of its effect approximates the carryover effect of the profit margin of the previous year. That is, where these capabilities are developed on a more popular website, that fact may increase the value of the attainable profit margin significantly. This reinforces the assumption that special functions are concurrent with falling profitability only in the group of traditional retailers possessing with e-capabilities, whereas in a well-designed and really well-visited page they can turn into value

All in all, we can understand the relationship between e-capabilities and corporate performance in greater depth with the help of the e-commerce variables weighted with usage, i.e. we have reached our goal in part. It has also been shown that variables expressed as interactions between usage and e-commerce capabilities diminish the uncertainties concerning the dependent variables more markedly; this is especially true for inventory turnover, where the incremental R^2 rose from 2.9% to 15.9%. However, it is equally clear that so far the integration of the usage dimension has not led to a model carrying a decisively greater explanatory power. Therefore, in the following subsection I will investigate the effect of website usage on e-commerce value creation by yet another methodological approach.

9.4.2. Cluster analysis

For a better understanding of the effect of website usage intensity and its embeddedness in the online ecosystem on the relationship between e-commerce capabilities and financial performance, I once again relied on cluster analysis [partly based on Aranyossy – Juhász, 2012]. Figure 27 shows the inter-linkages of the five company groups formed along the dimensions of continuous financial performance (average ROIC indicator of the years 2008-2009-2010) and of usage. I measured the dimension of usage here in the simplest possible way by transforming ranking data: the indicator was assigned a value corresponding to the number of ranking databases (Yahoo, Bing, Ruch Rank) that registered the retailer's website[40].

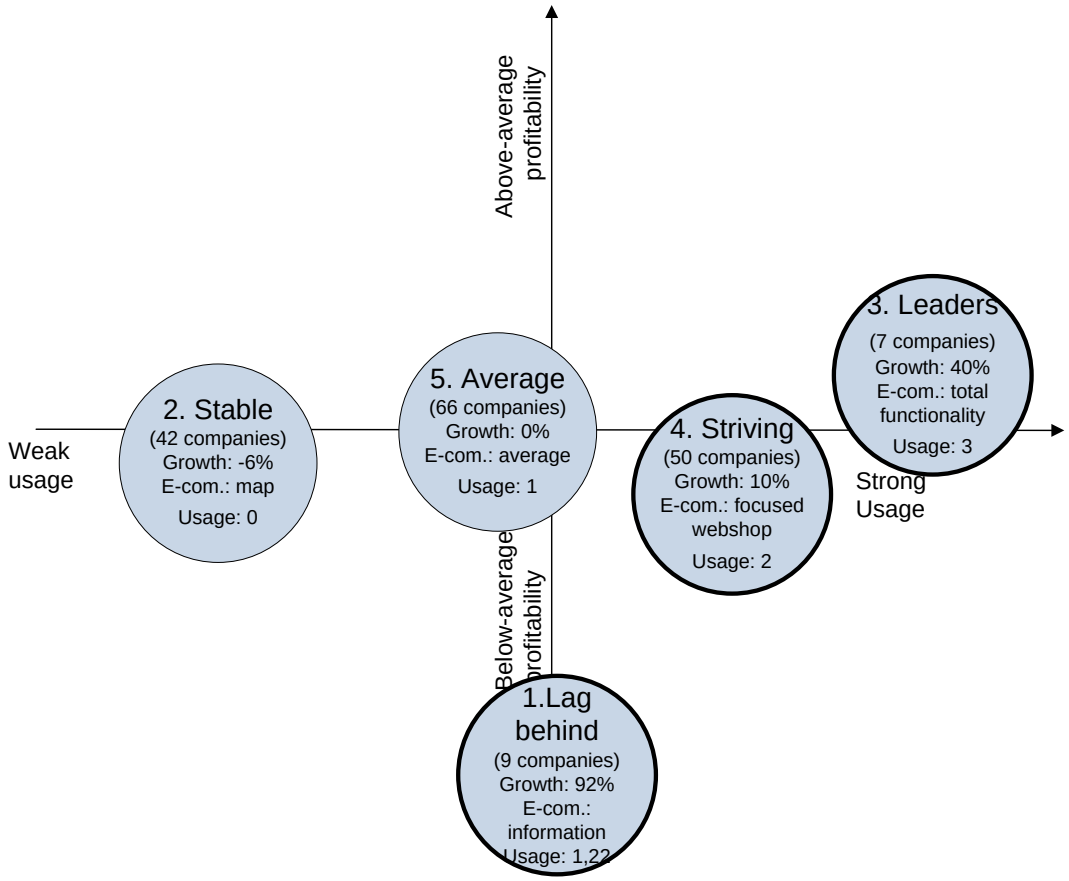
Cluster analysis clearly defined a top flight with only a few members (3) and a group of laggards generating extraordinary losses (1), with a numerous average middle-rank group (5) along with two relatively large clusters with weaker positive profitability (2 and 4) in between. The three-year ROIC is mostly in co-movement with the profitability indicators of companies in 2009 (see Table 42). What may be worth adding to the above is that the "average ones" performed somewhat better than the average in 2009, that is, they coped quite well amidst more difficult market conditions.

The capacity for growth of the companies, however, is less well adjusted to their general profitability profile: in 2010, only Clusters 1, 3 and 4 managed to achieve revenue growth. These clusters were exactly the ones which had above-average characteristics of usage in 2009, i.e. that cared about their online presence and could

[40] This method of measurement made it possible on the one hand to consider simultaneously several ranking indicators and, on the other hand, to disregard the measure of rank figures exerting a potentially strong distorting effect with such small webpages, and the indicator still expresses quite well how strongly the website is connected to the Internet ecosystem. Moreover, this indicator was available for almost 30 companies more than was the principal component of use, and thus it does not leave a significant part of the sample out of the analysis. (Median: 1, Average: 1.139)

actually attain an adequate number of links and visitors. This seems to imply that, over time, effective online presence (i.e. one that actually reaches the target population) can really be converted into additional sales revenues. The fact that this occurred only in 2010 is easily explained by the frequently mentioned delayed effect of IT value creation [e.g. Lee – Kim, 2006]. I already showed a similar revenue growth effect manifesting itself only by 2010 in connection with my first hypothesis.

Figure 27. Clusters by Profitability and Usage



Now let us see what e-commerce capabilities characterize each cluster. Table 42 lists only the capabilities in which the clusters showed significant ($\alpha<5\%$ and $\alpha<10\%$, ANOVA and chi-square tests, respectively) differences. For example, the seven leading companies (3) have extensive e-commerce capabilities which are, moreover, well above the average in almost every respect. Naturally enough, their transactional functions (from web-shops to price information supporting them) are also stronger, together with complementary services (mainly servicing). Interestingly, however, the cluster at the other extreme from the aspect of profitability (1) also performs at outstanding levels in certain e-commerce capabilities, company and product information. Moreover, according to usage indicators, their websites actually reaches quite a number of potential customers. That is, they also rely on the Internet quite intensively, but usage it

primarily as an information tool rather than to support their traditional in-store sales. Their efforts, although not reflected in their profits, are all the more evident when we look at their sales revenues: in 2010, they almost doubled their revenues.

Table 42. Main Differences in Financial Profile between Usage-based Clusters

(significantly different cluster characteristics based on ANOVA and chi-square tests; averages and, in the case of individual e-functions, ratios; above-average values are highlighted)

		Cluster averages						
		1. Lag behind	2. Stable	3. Leaders	4. Striving	5. Average	Total average	Sig. Level
Cluster characteristics	N	9	42	7	50	66		
	Usage (how many ranking database lists the webpage)	1,22	0	3	2	1,00	1,14	
	Average ROIC 2008-2010	-60,0%	15,0%	34,0%	9,0%	20,0%	22,2%	
Financial characteristics	ROIC 2009	-27,1%	17,9%	56,2%	2,5%	21,6%	14,0%	0,019
	CFROI 2009	-56,6%	-48,2%	46,6%	-7,6%	-0,5%	-16,9%	0,001
	ROA 2009	-8,0%	7,3%	6,4%	3,5%	10,4%	6,5%	0,006
	Profit margin 2009	-4,9%	2,2%	2,7%	1,6%	4,3%	2,4%	0,028
	Sales growth 2010	92,3%	-5,7%	39,7%	9,9%	-0,7%	7,6%	0,030
E-commerce factors	webshop	-0,221	-0,395	0,502	0,365	-0,108	-0,011	0,001
	special functions	-0,074	0,414	0,306	-0,130	-0,251	-0,025	0,009
	reliable company info	0,325	-0,381	0,227	0,044	0,152	0,001	0,106
E-commerce functions	products, services	67%	36%	57%	54%	30%	41%	0,052
	prices	22%	2%	43%	16%	24%	17%	0,029
	map	11%	31%	14%	0%	6%	11%	0,000
	contacts	56%	38%	71%	70%	58%	57%	0,052
	company information	78%	24%	29%	48%	45%	42%	0,026
	tax ID	11%	5%	14%	0%	0%	2%	0,042
	newsletter	22%	2%	29%	30%	8%	15%	0,000
	set as homepage	0%	0%	14%	0%	2%	1%	0,035
	service	0%	7%	57%	44%	21%	25%	0,000
	registration	22%	12%	29%	40%	23%	26%	0,025
	webshop	22%	10%	57%	38%	32%	29%	0,009
	warranty	0%	0%	14%	2%	0%	2%	0,000

The third cluster which boasts relatively more significant e-commerce capabilities is company group (4), characterized by modest profits, but also positive revenue growth. Its members are also active e-tailers, but their website functionality is not as comprehensive as that of those in the leading group. Certain pieces of

information are missing almost completely (map, VAT number) as well as certain customization functions (home page, configuration): they obviously focus first and foremost on functions that are closely related to online sales. Taken together, the three clusters (1, 3, and 4) with the best indicators of usage run rings round the other two clusters also in terms of e-commerce capabilities.

"Average performers" (Cluster 5) are average also in terms of their e-commerce capabilities, except for some positive deviation in some information functions. Finally, the stable cluster with near-average profitability (Cluster 2) is characterized by minimum Internet presence; these companies have foregone the use of Internet media for the time being. However, the map function is the most frequent in this group, consistent with the fact that they prefer traditional in-store sales, and all they want is to give their customers a little help to find their shops.

In summary, it is possible to achieve sound profitability even without "real" Internet appearance (see Cluster 2). However, considering also market growth, the option of engaging in e-commerce, albeit riskier, has a revenue-increasing potential. Moreover, such revenue growth is not necessarily dependent on the nature of e-commerce capabilities but on their quality and the capacity to convey the information to the target population. The cluster boasting the highest financial performance is also the one characterized by the best usage indicators. More generally, the clusters showing the fastest growth have outstanding usage indicators while representing different e-commerce models at a high level: one (Cluster 1) focuses on company and product information, the other (Cluster 3) on online sales. The example of the last two company groups shows that online sales are clearly a model successful also from the aspect of profitability. That is, if outstanding online appearance becomes part and parcel of corporate strategy (Cluster 1, 3 and 4), and the company turns increasingly towards transactional capabilities and complements them with high-quality informational functions in every respect, it may become more profitable besides recording growth.

9.4.3 Summary of the results related to Hypothesis H3

The methods applied to study the role of usage are complementary to each other: the regression model offers more conclusions concerning operational efficiency, whereas cluster analysis yields results mainly on the long-term profitability and growth potential of retailers. Accordingly, it can be said on the basis of the latter that the presence of good e-commerce informational and transactional capabilities at many levels coupled with the best usage indicators are typical only of the leading companies characterized by the highest profitability. However, it is also perceivable that loss-makers bringing up the rear also generate above-average usage and informational

indicators. In terms of market performance, the results are clearer: only the companies with good e-commerce capabilities and above-average usage indicators managed to increase their revenues in 2010. That is, a popular website can help retailers to achieve growth, but not necessarily higher productivity.

Table 4317: Results Related to Hypothesis H3 – Testing the Role of Usage

		Cluster Analysis		*Regression*
		Corporate Performance		
		Market performance	Profitability	Operative efficiency
		H3	H3	H3
e-commerce	information	+: only firms with havy website Usage and information capabilities could grow in 2010	(The most proftable cluster with high level of Usage has the best e-capabilities. But the cluster with havy losses also has above-average Usage and information capabilities..)	+: the effect of special functions on Profit Margin turns positive a +/-: terms of service have an ambivalent effect on Inventory Turnover
	transaction			(Transaction functions become less, product information more important.)
	interaction			

The introduction of a usage variable into the regression model finally explained some earlier results which were counterintuitive. Among other things, special functions examined in interaction with usage have a positive influence on the profit margin indicator (instead of the previous significantly negative one); nor does the inventory turnover indicator appear to be independent of the e-commerce capabilities. Thus the inclusion of the usage indicator facilitated better understanding of e-commerce value creation by domestic ICT retailers.

All things considered, however, we were not able to confirm the third hypothesis to a satisfactory degree. Although e-commerce capabilities are actually complemented to some extent by usage, this effect manifests itself only for a few operational performance indicators and does not modify previous results radically. In my opinion, this negative result is definitely interesting, and it can be explained in several ways. It may mean, first of all, that the high number of page visits is not an absolute necessity: strong e-commerce capabilities can have an impact and convert even a few visits into actual buying. Secondly, it may also mean, of course, that the ranking indicators and indices which are so frequently used in the Internet ecosystem do not approximate the dimension of usage so closely after all – this, however, would mean a major obstacle not only for the present research, but also for many corporate decision-makers. In 2012, the main marketing tool of Hungarian e-tailers was search engine optimization used by 84% of them, whereas 69% of companies use Google Analytics to measure their online

performance [WebShop-Experts, 2012, p.16. and p. 20]. However, the results shown here may be indicative of the fact that it would definitely be an advantage to gain a more accurate understanding and also measurement of buyer habits.

9.5 H4 – The role of size

Let us review now the impact of company size on the relationship between e-commerce capabilities and corporate performance. My fourth hypothesis formulated is as follows:

H4: Relationship between Hungarian ICT retailers' firm level e-commerce capabilities and company's competitiveness changes with firm size.

To examine this hypothesis is necessary because relevant literature has considered the role of company size in IT value creation important from the start [Dehning – Richardson, 2002 or Zhu, 2004]. The present research, however, has already shown (Sub-section 8.1.3) that there are no major differences between the e-commerce capabilities of ICT retailers in the same (micro or small or medium-sized) size categories. Similarly, as we have seen, although the regression model applied (Subsection 9.2.2) included headcount, company size is a better control variable, but the related betas were not significant in any of the cases. This, by the way, is true also of previous American studies [Zhu, 2004; Zhu – Kraemer, 2002]: With the exception of corporate performance, company size had no significant effect on indicators there either. Although in the research of Merono-Cerdan and Soto-Acosta [2007], size was the key determinant of performance, this was attributable in my opinion to the absolute nature of the financial indicator (EVA) chosen as dependent variable.

If, however, we examine the relationship between e-commerce variables and corporate performance indicators separately in the groups of micro and small enterprises (see Table 44), we can make an interesting observation. In the sub-sample of 138 micro-businesses, significant correlational relationships are observable between the same variables as in the complete industry sample. However, the positive relationship between the interactivity and customer-value-creation factors and performance indicators is not typical here. That is, as far as the smallest businesses are concerned, it is true that only transactional capabilities can be connected to performance growth, and even that is true more at the level of labor efficiency than of productivity. On the other hand, the relationship between special functions and sales growth is already significantly negative in this size category, meaning that the exclusive use of the map function (the most important component of the special functions factor) to attract people

to shops is not enough for market share growth; on the contrary, companies which were strong in that respect tended to lag behind relative to their peers.

Even more interestingly, however, the previously shown relationships cease to be significant among small enterprises that are somewhat larger in size, but we can identify two new (and somewhat stronger) relationships instead. For example, the retail labor efficiency indicator is positively affected by the more thorough presentation of products and the critical importance of home delivery rather than by basic transactional capabilities. The provision of detailed buying information coincides with a higher inventory demand and a longer inventory period. As I have mentioned above, this can be explained by the fact that retailers highlighting shipping information are typically the ones who offer their customers favorable conditions in this respect, but that implies the need for keeping larger inventories.

Table 44: Correlation between E-Commerce Factors and the Corporate Performance Indicators in Different Size Categories

(* and **: the correlation is significant at α=0.01 and 0.05, respectively, based on a two-tailed significance test)

	Spearman'srho		Sales growth	ROIC	CFROI	ROE	ROA	Sales / employee	Profit Margin	Inventory Turnover
Micro enterprises	webshop	Correlation	,104	,085	-,003	,061	,082	,288**	,104	-,039
		Sig. (2-tailed)	,225	,322	,977	,498	,339	,001	,228	,656
		N	138	138	138	127	138	138	136	130
	special functions	Correlation	**-,181***	-,015	-,178*	-,068	-,015	-,066	,004	,107
		Sig. (2-tailed)	,034	,865	,037	,448	,864	,445	,965	,226
		N	138	138	138	127	138	138	136	130
	reliable company info	Correlation	-,075	**-,205***	-,021	-,128	-,193*	-,021	-,209*	-,097
		Sig. (2-tailed)	,384	,016	,808	,153	,024	,806	,015	,270
		N	138	138	138	127	138	138	136	130
Small enterprises	terms of service 1	Correlation	,058	-,050	-,004	-,092	-,085	,166	-,146	**-,337***
		Sig. (2-tailed)	,696	,737	,980	,547	,566	,258	,323	,020
		N	48	48	48	45	48	48	48	47
	products, services	Correlation	-,050	,015	,036	,014	,039	**,291***	,104	,024
		Sig. (2-tailed)	,737	,919	,806	,927	,794	,045	,482	,875
		N	48	48	48	45	48	48	48	47

Overall, there is some difference in e-commerce value creation between micro and small enterprises in the sample: the different size categories are characterized by different e-commerce capabilities as distinctive features. Of course, this statement applies only to the domestic ICT retailer sample and, in my opinion, the sample characteristics are partly related to the results obtained. For the sample basically consists of relatively small enterprises differing only in the "degree of their smallness" – given the sampling criteria, some really big market actors were finally left out. (The profile of large shop-based ICT retailers is not exclusively ICT, and e-commerce "big shot" E-digital also fell outside the scope of the sample based on its core activity based

on TEÁOR (Hungarian Standard Classification of Economic Activities) codes. Nevertheless, in the future it would be worth processing the case of E-digital and comparing it to the results of the present research. The role of size, however, could not be compared to the relevant American research results either, even by including these larger enterprises, so the possibility to generalize my results in terms of size is rather limited.

Contrary to the role of size, I definitely expect the differences inherent in the business model to show significant differences in e-commerce value creation – that is what I will examine in the next subsection.

9.6 H5 – The role of business model

Previous studies on e-commerce value creation rarely took into account the strategic decision of companies as to whether to use the Internet as their sales channel. In my opinion, this decision is a crucial component of the retail business model, and it may determine the existence and nature of e-commerce value creation. This is what I expressed in my last hypothesis:

H5: Relationship between Hungarian ICT retailers' firm level e-commerce capabilities and company's competitiveness changes with sales channel choice.

In the following subsections, I will look into the effect of the business model by following the same methodological approaches as before. In what follows, I distinguish two fundamental business/sales models in the sample of domestic ICT retailers[41]:

1. traditional retailers who chose exclusively in-store sales,
2. businesses choosing the mixed model, applying both shop and Internet sales channels.

9.6.1 Bivariate correlations

First, I examined exclusively the relationship between the chosen business model and corporate performance. In doing so, I compared the corporate performance indicators of ICT retailers applying the traditional and the mixed business model in the sample cleared of outliers (t-test, α=5%). The results are partly in line with expectations: the mixed model, i.e. the two sales channels used side by side, is concurrent with significantly better revenue-type indicators. On the one hand, the e-tailers concerned lost a smaller part of their revenues in 2009: 9.35% on average instead of 19.78%. On the other hand, the online sales channel partly replaces human resources:

[41] The method to identify the business model is presented in detail in Subsection 7.3.2. In the sample I found no pure e-tailers pursuing the third possible strategy relying exclusively on electronic sales.

the per capita sales revenue was much higher in the mixed model in both years (2009: HUF 26.7 million/cap. instead of HUF 21 million/cap while e-tailers' advantage grew to HUF 10 million/cap in the year 2010).

Table 185: Average Corporate Performance in Different Business Models

(significant differences between the two group averages indicated by different letters, at α=0.05)

% and HUF M/cap, day, turn		Business model	
		traditional	mixed
N		96	55
2009	Sales growth	**-.1978$_a$**	**-.0934$_b$**
	ROIC	.0776$_a$	.1101$_a$
	CFROI	-.2078$_a$	-.1049$_a$
	ROE	.1221$_a$	.2624$_a$
	ROA	.0557$_a$	.0553$_a$
	Sales revenue/employee	**20.9858$_a$**	**26.7141$_b$**
	Profit margin	.0281$_a$	.0205$_a$
	Inventory turnover	**27.7382$_a$**	**41.7431$_b$**
	Inventory turn	**30.40$_a$**	**17.79$_b$**
2010	Sales growth	.0928$_a$	.0988$_a$
	ROIC	.0812$_a$	.1122$_a$
	CFROI	.5399$_a$	1.6567$_a$
	ROE	.5131$_a$	.5561$_a$
	ROA	.0560$_a$	.0413$_a$
	Sales revenue/employee	**21.7238$_a$**	**31.8571$_b$**
	Profit margin	.0249$_a$	.0045$_a$
	Inventory turnover	**27.6438$_a$**	**40.7285$_b$**
	Inventory turn	**35.86$_a$**	**19.84$_b$**

Interestingly, however, whereas we have managed to confirm the sales advantage provided by the electronic channel, the situation with inventory efficiency was the opposite. The inventory turnover rate of retailers using shop-based and online sales channels side by side is much slower, and the inventory period is almost 1.5 times that of traditional retailers. (I have shown a similar effect in connection with Hypotheses H1 and H2.) That is, e-commerce implies a greater inventory need, and hence no efficiency-improvement can be achieved this way. Besides, Table 45 also shows that as far as the aggregate profitability indicators are concerned, there is no significant difference between the two groups; in all probability, the advantages and drawbacks reflected by operational indicators offset each other. In summary, the labor efficiency of domestic ICT retailers establishing also an electronic sales channel is better, but their inventory efficiency is worse than that of their traditional rivals, and hence no profitability difference has evolved between the two groups.

Table 46. Correlation Between e-commerce Factors and Corporate Performance Indicators in Different Business Models

(* and **: significant correlation at 0.01 and 0.05, respectively, based on a two-tailed significance test)

	Spearman'srho		Sales growth	ROIC	CFROI	ROE	ROA	Sales / employee	Profit Margin	Inventory Turnover
Traditional retailers	special functions	Correlation	**-,211***	-,063	-,196*	-,018	**-,191***	-,095	**-,239****	,036
		Sig. (2-tailed)	,022	,499	,033	,855	,038	,307	,010	,708
		N	118	118	118	111	118	118	116	109
	interactivity	Correlation	,168	,401**	,247**	,122	,291**	,029	,089	,177
		Sig. (2-tailed)	,069	,000	,007	,202	,001	,758	,340	,065
		N	118	118	118	111	118	118	116	109
	customer value	Correlation	-,018	,086	,055	,202*	,137	-,007	,023	,069
		Sig. (2-tailed)	,843	,355	,553	,034	,139	,944	,803	,474
		N	118	118	118	111	118	118	116	109
	reliable company info	Correlation	-,123	-,200*	-,007	-,220*	-,209*	-,043	**-,152**	,051
		Sig. (2-tailed)	,183	,030	,938	,020	,023	,646	,103	,598
		N	118	118	118	111	118	118	116	109
	terms of service 2	Correlation	-,126	,090	-,243**	-,120	-,012	-,026	-,018	-,021
		Sig. (2-tailed)	,175	,333	,008	,208	,898	,781	,846	,830
		N	118	118	118	111	118	118	116	109
Mixed sales model	webshop	Correlation	-,173	-,095	-,078	-,253*	-,096	,252*	-,177	,075
		Sig. (2-tailed)	,156	,436	,522	,047	,433	,037	,145	,539
		N	69	69	69	62	69	69	69	69
	customer value	Correlation	-,171	-,084	-,002	-,236	**-,282***	,266*	**-,265***	-,199
		Sig. (2-tailed)	,159	,494	,989	,065	,019	,027	,028	,102
		N	69	69	69	62	69	69	69	69
	terms of service 1	Correlation	**,296***	-,205	-,101	-,124	-,054	,168	-,192	,054
		Sig. (2-tailed)	,014	,091	,409	,337	,657	,168	,114	,657
		N	69	69	69	62	69	69	69	69
	online communication	Correlation	,091	,118	,060	,012	,163	-,048	**,237***	,007
		Sig. (2-tailed)	,455	,336	,622	,927	,181	,693	,050	,952
		N	69	69	69	62	69	69	69	69

Then I examined separately the relationship between e-commerce variables and corporate performance indicators on the subsamples of enterprises using the traditional and the mixed commercial channels, respectively. On the basis of Table 46, it can be concluded beyond doubt that e-commerce capabilities concurrent with market success are different in the two types of sales models. Most interestingly, in the case of the traditional business model most company and product information is in a negative relationship with profitability indicators. (The only exception is price information in the customer value creation factor.) In other words, focus on these e-commerce capabilities yields no return for retailers earning their living on shop-based sales; it is part of an ineffective online strategy. On the other hand, however, this group makes the importance of interactional capabilities obvious: This segment of e-commerce

capabilities shows a definitely positive relationship with profitability. There is a +0.401 correlation between the interactivity factor and ROIC, which can be considered strong for such an indirect impact mechanism. Thus the weak interaction-profitability correlation shown for the entire sample is essentially due to traditional retailers and means that they, too, should go along with the online community, but not exclusively by providing reliability-improving information (in their case, shops actually offer a better opportunity for that) but by initiating interaction with potential customers.

The group of enterprises relying also on the electronic commerce channel places emphasis on quite different e-commerce capabilities. Per capita sales revenue shows a positive relationship with the factors of both webshop and customer value creation – this is the anticipated classical relationship between transactional capabilities and retail performance. Interestingly, however, higher labor efficiency is concurrent with a lower profit rate. The same is true of terms of service: this capability is in relationship with higher revenue increase and, at the same time, lower profitability. That is, market success and sales revenue growth are well-supported by transactional e-commerce capabilities, but the retailer is forced to sacrifice a major part of the resulting added value due to competition. This argument already appeared in the early explanations of the IT productivity paradox [e.g. Hitt – Brynjolfsson, 1996]. On the online market, where potential buyers can more easily compare prices and services offered, price competition may intensify [Brynjolfsson – Smith, 2000] and that leads to a falling margin and profit rates. In other words, my findings are clearly consistent with Porter's [2001, p. 66] theoretical conclusions that the Internet extends the borders of the market, promotes sales and marketing but at the same time makes it more difficult for companies to convert the advantages obtained into profits.

9.6.2 Regression model

I used the linear regression model presented before to examine the effect of the business model, but this time I estimated the parameters for traditional shop-based retailers (N=94) and enterprises using also the e-commerce channel (N=55) separately. Table 47 compares the results of the regression analysis for the ROA and profit margin indicators. As for other performance indicators, the betas estimated for e-commerce factors were not significant. This also means that, contrary to previous analyzes, through the breakdown of the sample by business mode I finally obtained results suitable for interpretation also for profitability indicators.

Table 197. The Effect of Business Model in the Regression Model

(significance: * p<0.01; ** 0.01<p<0.05; *** 0.05<p<0.1

results of the model constructed for the present research; e-commerce variables entered stepwise, at F = 0.05<p<0.1; the values shown here are standardized betas)

		ROA		Profit margin	
Business model		**Traditional**	**Mixed**	**Traditional**	**Mixed**
The model					
	N	94	55	94	55
	adj. R^2	0.660*	0.841*	0.307*	0,151***
	p value	0.000	0.000	0.000	0,010
	Constant	0.008	0.011***	0.006	0,018*
E-commerce factors – Betas					
I	reliable company info			-0.113	
IT1	special functions	0.049		-0.341*	
IT2	customer value				
IT3	products, services				
IT4	terms of service 2				
T1	webshop				
T2	terms of service 1				
N1	interactivity	0.114***			
N2	online communication				
E-commerce incremental R^2		0,107	-	0.163	-
Control variables – Betas					
	Size (number of employees)	0.020	0.010	0.044	-0,027
	Industry segment	-0.036	-0.144**	-0.017	-0,018
	Prior year's performance			0.432*	0,454*
	Profit margins	0.820*	0.914*		
	Sales growth				
	Sales revenue/employee				

The most important and most exciting conclusion to be drawn from the regression results I have obtained is, in my opinion, that while certain e-commerce capabilities can be decisive from the perspective of profitability in the traditional model, they lose their differentiating quality in the group of e-tailers. As has been seen with correlation analysis, traditional retailers can achieve higher ROA through their better interactional capabilities, but special functions are concurrent with a falling profit margin. The latter e-capability has a strong negative effect on the profit margin, which is almost as strong as the determining power of performance in the previous year. Knowledge of e-commerce capabilities reduces uncertainty concerning the relevant performance indicators by 10.7% and 16.3% for shop retailers, whereas in the mixed model, the same information does not influence corporate performance significantly.

Thus, I have managed to demonstrate a positive relationship between certain e-commerce capabilities and corporate profitability also in the regression model but, interestingly, not among e-tailers but among those focusing on traditional in-store sales. Although this fact may seem to be counterintuitive, it is nevertheless relatively easy to make sense of: those who (also) live off the Internet will naturally pay more attention to their e-capabilities that can be measured here, whereas the online presence of traditional retailers moves on a much wider quality scale and can become a distinctive feature.

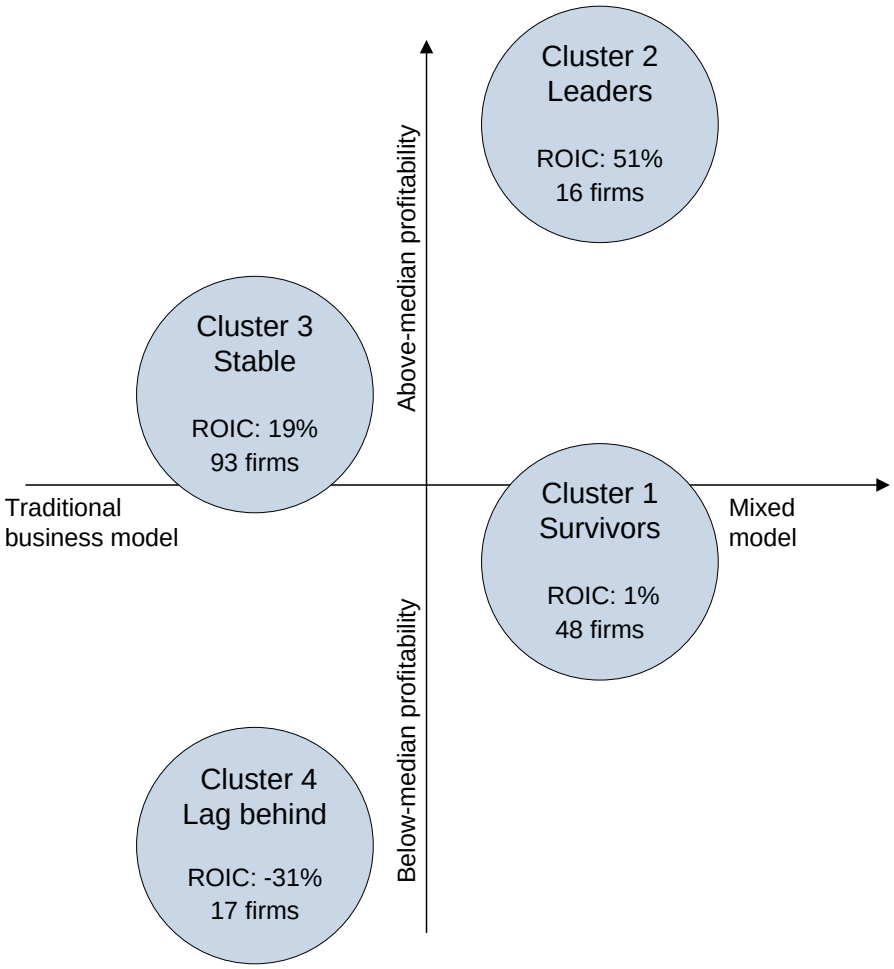
9.6.3 Cluster analysis

In order to get a deeper insight into the role of the business model, I turned to cluster analysis again to explore the complex interrelations between different variables. One aspect of cluster formation was the uninterrupted financial performance of the firm (the average ROIC for the years 2008, 2009 and 2010) and the other was the selected business model. Based on these attributes, four clearly distinct[42] groups of firms were identified during cluster analysis [based partly on Aranyossy – Juhász, 2012].

There are above- and below-average profitability clusters both among the firms using a traditional business model and those adopting a mixed one (Figure 28). While 84% of businesses selling through traditional stores (Clusters 3 and 4) belong to the higher profitability group (3), the ratio is just the opposite with the ones using electronic channels as well (Clusters 1 and 2): 75% of them are in the below-average profitability group. A possible explanation may be the crudeness of the e-commerce business model and the lack of necessary experience and complementary corporate capabilities, which hinders the success of companies using this business model. On the other hand, however, we can also see that of companies with below-average financial performance those adopting a mixed model (1) are far more profitable than their traditional counterparts (4) and they even manage to produce a slightly positive bottom line from time to time. Thus it is quite possible that changing from traditional to mixed sales models in times of economic downturn can provide an "escape route" for financial survival. Similar differences are seen in the clusters of high ROIC indicators as well: while the profitability of the traditional retailer group (3) is just near-average, the leaders adopting a mixed model (2) produce strikingly high profitability figures.

[42] Although clustering resulted in the creation of a fifth cluster with one item only, as the ROIC indicator of this company was 35 times higher than that of the average index of the highest profitability cluster, this single-item cluster was excluded from my study and from the tests as well.

Figure 28. Clusters Formed Based on Profitability and Business Model



If we look at the more detailed financial profile of the clusters in 2009 we can draw a similar conclusion as above. Table 48 compares the clusters' financial variables that were proved significantly ($\alpha<5\%$) different by the tests. Here the financial performance of the best e-tailers (2) is unquestionably outstanding according to all indicators while the worst performers are clearly those belonging to the cluster of traditional retailers lagging behind. Furthermore, special emphasis should be placed on the unambiguous advantage of the mixed business model reflected by an increase in sales revenue as only businesses adopting this method were able to achieve sales revenue growth in 2009. This is also in line with national trends during the recession: The research conducted by GKIeNET [2012a] also found that only retailers involved in electronic sales could realize a major turnover increase in Hungary in 2011. Thus, it is also possible that the worse picture presented by the profitability indicators of e-tailers with weaker financial profiles (1) is also temporary and partly due to growth. This suggestion is also supported by the fact that although the profitability of this group was still somewhat below average in 2010, its profit margin indicator, which better reflects operational performance, was already above average. Looking at the 2010 performance

from another aspect, we find that the ROIC of traditional retailers with stable performance (3) is below average, meaning that their profitability figures steadily fell during the 2008-2010 period indicating the erosion of the long-term advantages of selling exclusively through traditional shops.

Table 208. Major Differences in Financial Profile Between Business Model Clusters

(bold numbers are above average)

Financial profile of clusters, 2009		Business model			
		Traditional		Mixed	
Long term financial performance	above average	**3. Stable**		**2. Leaders**	
		Sales growth:	-12,9%	Sales growth:	**6,6%**
		ROIC:	**17,9%**	ROIC:	**66,3%**
		CFROI:	**-14,0%**	CFROI:	**31,6%**
		ROA:	**8,7%**	ROA:	**18,3%**
		Profit margin:	**3,6%**	Profit margin:	**5,6%**
	below average	**4. Lag behind**		**1. Survivors**	
		Sales growth:	-27,6%	Sales growth:	**-7,1%**
		ROIC:	-32,5%	ROIC:	5,8%
		CFROI:	-64,2%	CFROI:	**-15,2%**
		ROA:	-9,5%	ROA:	4,1%
		Profit margin:	-5,2%	Profit margin:	1,6%

And now let us have a look at differences between clusters in e-commerce capabilities. Table 49 contains those e-commerce factors (underlined) and individual capabilities where significant differences were detected between the clusters (ANOVA and chi square tests with $\alpha<5\%$ and $\alpha<10\%$). Naturally the majority of the e-commerce capabilities of retailers using a mixed business model (1 and 2) are stronger than that of traditional retailers (3 and 4), which, in the case of the functions used to identify the business model (webshop and registration), is inherently guaranteed by the methodology applied. More interesting are those e-capabilities where traditional traders perform better. Such is the map function where we can assume that traditional traders with their minimum Internet presence attempt to direct potential customers to their shops as efficiently as possible – as already mentioned earlier. Besides that, privacy is the only function to appear more frequently on the websites of the traditional model but as the number of firms in each cluster is below five I consider it less relevant. It should be noted, however, that both functions are part of the "special functions" principal component which has a negative impact on the performance of traditional retailers as has been demonstrated earlier. Another interesting finding might be that concerning the

USE variable, traditional traders with good financial performance underperform their loss-making counterparts as if they did not need the online channel even as an information tool.

Table 49. Major Differences in E-Commerce Profile Between Business Model Clusters

(Bold numbers are above average)

E-commerce profile of clusters, 2009		Business model			
		traditional		Mixed	
Long term financial performance	above average	**3. Stable**		**2. Leaders**	
		webshop	-,458	webshop	**,835**
		customer value	-,109	customer value	**-,001**
		map	**16%**	map	0%
		newsletter	9%	newsletter	**31%**
		service	18%	service	**38%**
		registration	11%	registration	**50%**
		webstore	4%	webstore	**81%**
		search	30%	search	**50%**
		chat	0%	chat	**6%**
		warranty	10%	warranty	**31%**
		legal note	3%	legal note	**19%**
		terms of contract	2%	terms of contract	**19%**
		privacy	2%	privacy	**13%**
		delivery options	2%	delivery options	**13%**
		home delivery	0%	home delivery	**13%**
		usage	-,333	usage	**,693**
	below average	**4. Lag behind**		**1. Survivors**	
		webshop	-,352	webshop	**,641**
		customer value	-,348	customer value	**,268**
		map	**12%**	map	4%
		newsletter	6%	newsletter	**23%**
		service	6%	service	**40%**
		registration	12%	registration	**50%**
		web store	6%	web store	**67%**
		search	35%	search	**50%**
		chat	0%	chat	**8%**
		warranty	**12%**	warranty	6%
		legal note	**6%**	legal note	2%
		terms of contract	0%	terms of contract	**4%**
		privacy	**24%**	privacy	4%
		delivery options	0%	delivery options	**13%**
		home delivery	0%	home delivery	**8%**
		usage	-,182	usage	**,478**

Last – but certainly not least – let us examine the key differences between the e-commerce profiles of e-tailers with higher and lower profitability (1 and 2). In general

we can say that firms in the strikingly high-profitability cluster showed the best results in almost every e-commerce capability. The only exceptions to this are the map function as mentioned above and the customer value creation factor (incorporating the customer credit, servicing and prices functions). In addition, what may also contribute to the success of leading e-commerce firms is that their online presence is not only functionally outstanding but also the best- performing with regard to use as well. The area of security functions, however, is where loss-making firms truly lag behind leaders and, in certain cases, even behind those working in the traditional model. Guarantee, legal note and privacy – in all of these functions e-tailers with low financial performance are far behind their profit-making counterparts and even the sample average. It is quite possible that the lack of these e-capabilities also lead to their underperformance in building customer confidence, which is a key factor of e-commerce success according to both international [Kotha et al., 2004; Gefen et al., 2003] and the Hungarian literature [GKIeNET, 2009]. The growth of the Hungarian e-commerce market, for instance, has been moving together for years with the proportion of people using online banking services "which is evidently related to confidence in electronic transactions" [GKIeNET – T-Mobile, 2010, p. 5]. Investing in consumer confidence – partly through facilitating informational functions (warranty, legal note, privacy) – seems to be profitable in the light of international data and the characteristics of the Hungarian market, as well as the e-commerce profile differences between the ICT retailer clusters demonstrated above.

Overall, we can say that according to the cluster analysis, investing in e-commerce and switching from the traditional to the mixed sales model seems to be a good business decision for Hungarian ICT retailers from the aspect of profitability and growth as well. However, what makes a difference is the quality of the developed e-commerce capabilities: based on the sample, success requires wide-range and high-quality e-commerce capabilities and also paying increased attention to attracting visitors and building customer confidence.

9.6.4 Summary of the results in related to hypothesis H5

No matter what methodology I use to analyze my sample and from what aspect, it is evident that the choice of the business/sales model is key to e-commerce value creation. Interestingly, though, with regard to performance certain information and interaction capabilities are important primarily for traditional retailers. Seemingly the basic e-commerce capabilities are not really decisive for e-tailers and the key to their success is to be found in the details. The latter is also reflected by cluster analysis: some high profitability businesses have a wide range of e-commerce capabilities and also pay

attention to increasing the number of visitors and building customer confidence. Thus, the transactional e-commerce capability can contribute to increasing the market share and achieving higher sales revenue/capita even under difficult macroeconomic conditions – but it is not enough in itself to increase profits.

Table 50. Results Related to Hypothesis H5 – Testing the Role of Business Model

Bivariate relationships and regression (results confirmed by regression are highlighted in bold):

		Company performance		
		Market performance	Profitability	Operational efficiency
Traditional model		H5	H5	H5
e-commerce	Information		-: special functions, company and purchase information	**-: concerning only profit margin and special functions**
	Transaction			
	Interaction		**Strong +**	
Mixed model				
e-commerce	Information	+: only in case of terms of service		-: concerning profit margin and company information
	Transaction		-	+: only in case of sales revenue /employee
	Interaction			-: profit margin and online communication

Cluster analysis:

		Company performance		
		Market performance	Profitability	Operational efficiency
		H5	H5	H5
e-commerce	Information	+: Only the clusters having e-commerce capabilities and working in the mixed model were able to grow.	+: Both among the leaders and the laggards the clusters having e-commerce capabilities and working in the mixed model perform better.	
	Transaction			
	Interaction			

Based on the above we can conclude that on this Hungarian sample the choice of business model significantly influences e-commerce value creation and what type of capabilities become important – thus, my assumptions in this regard have been confirmed.

9.7 Summary of the of hypothesis testing

The next table gives a brief summary of the research outcomes in the order of the formulated hypotheses. While some of these hypotheses had to be rejected, others were partly or entirely confirmed by my research. One thing seems to be evident,

however: the relationship between some e-commerce capabilities and certain corporate performance indicators is demonstrable, and the inclusion of the usage and, especially, business model dimensions in the investigation has led to a better understanding of this relationship.

In the next summary chapter I will return to the outcomes of the hypothesis testing process and the related practical conclusions.

Table 51. Summary of the Results of Hypothesis Testing

No	Hypotheses	Analytic methods used	Results	
H1/A	There is a positive relationship between firm level e-commerce capabilities and market performance of Hungarian ICT retailers.	> Bivariate relationships > Regression analysis > Cluster analysis	No relationship was found in 2009, but in 2010 only the clusters with good interactional capabilities were able to grow.	X
H1/B	There is a positive relationship between firm level e-commerce capabilities and profitability of Hungarian ICT retailers.		The interactional e-capabilities and the ROIC and ROA ratios show a positive relationship, but the impact of special informational capabilities – typical to offline sellers primarily – are definitely negative.	√ X
H1/C	There is a positive relationship between firm level e-commerce capabilities and operational efficiency of Hungarian ICT retailers.		There is a definitive positive relationship between the transactional e-commerce capability and retail labour efficiency.	√
H2/A	Moving from the state of a total lack of e-commerce capabilities to the online informational level is related to sales growth.	> Comparison of group averages	Both pure play offline retailers and advanced e-tailers are the best concerning market performance.	X
H2/B	Moving from information e-commerce capabilities to an online transaction level is related to both sales growth and retail efficiency.		The market performance and labour efficiency of advanced e-tailers are better than those maintaining only an information site – but their inventory indicators are the worst.	√ X
H3	Greater e-commerce capability in conjunction with higher levels of website usage is associated with better competitiveness in the Hungarian ICT retail industry.	> Regression analysis > Cluster analysis	The introduction of the usage variable to the model explains certain previous results (the negative effect of the special functions, the impact of e-capabilities on inventory or growth) but its importance falls short of expectations.	√
H4	Relationship between Hungarian ICT retailers' firm level e-commerce capabilities and company's competitiveness changes with firm size.	> Correlation analysis	In the case of micro-businesses, the informational functions have a significant negative while transactional capabilities a significantly positive impact, whereas in the case of small businesses sales information comes becomes much more important.	√
H5	Relationship between Hungarian ICT retailers' firm level e-commerce capabilities and company's competitiveness changes with sales channel choice.	> Correlation analysis > Regression analysis > Cluster analysis	Certain informational and interactional capabilities are important to traditional offline retailers for achieving better financial performance. The mixed sales model is more favourable from the aspect of growth, but here more diverse and sophisticated e-commerce capabilities are needed to achieve a profitability advantage.	√

10. Summary

10.1 Overview and innovative approaches in the dissertation

As a financial researcher and enthusiastic follower of the latest IT and e-business trends, it has now been for ten years that I have dealt with the issue of whether corporate IT investments worth hundreds of millions of HUF or EUR can be financially justified. In this regard, my interest is driven by the following two fundamental questions [based on Mellwille et al.; 2004, p. 298]: "Is the IT resource associated with improved operational efficiencies or competitive advantage?" If so, how can this value creation process be mapped? Although only the first question seems to be related to corporate finance, my specialization, the essence of valuation is actually much better expressed by the second question: One of the first steps of any financial valuation is to identify value-creating factors and understand the logic of value creation. Therefore, it can be stated that in my research projects I have always looked for the existence and characteristics of IT-based corporate value creation and my dissertation is also dedicated to this subject.

In Section 1, I already tried to explain why in my opinion this was an interesting and topical subject. The practice of valuing IT projects – worth millions of EUR at corporate level and billions of EUR at national economy level – from a financial perspective, with shareholder value in mind, only started to spread during the last decade. In Hungary, this value based decision approach is in its infancy, not to mention ex-post financial valuation following the implementation of the investment and supplementing the ex-ante valuation, which is extremely rare. In my opinion the key role of financial valuation would be – addition to the concrete numeric results – to support IT management by identifying the main value-creating factors and drawing attention to them. In other words, future project success can greatly be promoted if the main sources of revenue and expenditure are identified in the course of valuation, as this kind of consciousness is one of the primary criteria of successful IT projects. Although, due to uncertainty encountered in relation to IT valuation, numerical results received may significantly deviate from reality, the magnitude of various value creation factors still shows a relatively reliable picture.

In Section 2, I clarified some basic concepts connected to IT business value research, as the boundaries and most important research questions of my study theme could only be identified on the basis of these definitions. In Section 3, I gave an

overview of possible systemization methods in the related literature, also including my earlier experiments, and formulated three fundamental questions which serve as a basis for the literature review in Section 4:

- Does IT create business value?
- How does IT create business value?
- How to measure business value created by IT?

Thus, I classified diverse interdisciplinary scientific literature in the fields of economics, information technology, strategy and corporate finance, and even sociology and psychology along these questions. Beyond systemization, the most important novel aspect and added value of the literature review presented here lies in the coverage of normative finance/evaluation literature and the insertion of the question of usage in the main research stream. In other words, this literature review has a much broader focus than most international reviews of the subject.

One of the most important lessons of related research is that despite the demonstrability of an actual relationship between certain IT investments and corporate or even national economic value creation, this relationship is far from being deterministic. Generally speaking, the results are contingent not only on technology but also management activity, simultaneous organizational changes, human capabilities, and success is ultimately conceivable only if the information systems are appropriately used. Based on the above, my conclusion is that further research should be underpinned by theories that take into consideration these effects complementary to technology [Wade – Hulland, 2004]. Therefore, I have built my research model on the basis of the resource-based view and supplemented it with indicators related to usage and business model.

However, I did not only have to choose the most promising theoretical approach for my research, but also had to identify the focus of empirical analysis from technological point of view. I chose corporate e-commerce applications not only because we live in an era of outward-looking IT systems connecting business partners, but also because this theme enabled large-sample data collection based on public data.

Therefore, the research presented here focused on the following basic question: Is there any positive relationship between firm-level e-commerce resources and corporate competitiveness? For this question, I have conceptualized e-commerce resources in the form of a capability ladder including information/transaction/interaction/customization, and for measuring competitiveness I used financial indicators and market growth performance as compared to competitors. The first part of the research seeks to reproduce the regression results of some previous

US and Spanish studies [Zhu – Kraemer, 2002; Zhu, 2004; Merono-Cerdan – Soto-Acosta, 2007] under our special market conditions. It is an interesting – and certainly novel idea – to analyze e-commerce value creation in the Central and Eastern European environment, especially during the years of recession following the financial crisis. The population under review consisted of Hungarian ICT retailers as this industry is particularly e-commerce-intensive but under-researched in our country.

Furthermore, the aim of my research model and hypotheses building was to get a deeper insight into e-commerce value creation factors by including a few new variables. On the one hand, adding the usage variable to the model is based on the assumption that e-commerce capability in itself cannot be enough on its own, since if a website is not visited by potential consumers the anticipated performance growth cannot be realized. On the other hand, theoretical and practical experience has clearly shown that the strategic environment of IT value creation cannot be overlooked, and therefore the decision on selecting sales channels adds further color to the picture in my research.

In addition to a broader interdisciplinary perspective and new aspects incorporated into the research model, my dissertation contains yet another innovation related to data collection: In assessing e-commerce capabilities I relied on the data collection automatisms of web spiders (crawlers). This not only assisted efficient and objective large-sample data collection but also enriched the crawler-based methodological research ongoing at the E-Business Research Center of the Corvinus University of Budapest [Nemeslaki – Pocsarovszky, 2011 and 2012] with a new area of application.

10.2 Results and opportunities for practical use

My overall expectation from the proposed research was to dispel or confirm some myths about the existence and characteristics of e-commerce value creation. And by resource-based modeling and the inclusion of usage and business model variables, I was hoping to gain a deeper understanding of the value creation process supported by technology – through the example of e-commerce.

In carrying out a thorough analysis of the Hungarian ICT retail market I was able to confirm a few basic “urban legends”. From both international and domestic comparisons it can be clearly concluded that Hungarian ICT retailers have their own homepages significantly more frequently than the average and the proportion of those providing customers an opportunity to buy online is over twice the domestic mean. In other words, selecting the industry for the purpose of this research was appropriate; it is

indeed a highly e-commerce-intensive market. Furthermore, it can be concluded that informational functions represent the overwhelming majority of the most frequent capabilities. This comes as no surprise since the first step towards entry into the online business world – and a necessary condition for building further e-capabilities – is to establish some basic informational functions. That in my sample geographical location and company size normally do not affect the level of e-commerce capabilities does not contradict e-commerce literature either. This is consistent with the theoretical statement that e-commerce is able to bridge geographical distance from the target markets and provides actors of all sizes the same opportunities to enter the market.

Let us now review my central hypothesis that corresponds to the fundamental question of the resource-based view: Is there then a positive relationship between the e-commerce resources and corporate performance of Hungarian ICT retailers? The strongest positive relationship in my sample can be demonstrated between sales revenue per employee and transactional e-capabilities. This co-movement suggests that online sales indeed have a beneficial effect on retail labor efficiency even if at the level of profitability or market performance this effect can only be demonstrated to a lesser extent. Similar foreign studies [Kraemer – Zhu, 2002; Merono-Cerdan – Soto-Acosta, 2007] also measured the strongest positive effect on corporate performance indicators in the case of transaction e-commerce capabilities. In other words, regarding online sales the classical productivity paradox [Solow, 1987] was disconfirmed: Even if the Internet is full of webshops it has a demonstrable positive effect on productivity.

It is a surprising result, however, that most positive profitability relationships are revealed in the case of interactional e-commerce factor. This means that in 2009 those Hungarian ICT retailers were more successful who were more open to a dialogue, an interaction with potential customers and were not afraid to hear their opinions. It seems therefore that it is this aspect – rather than more widespread informational or transactional functions – that sets retailers apart from their competitors.

Interestingly, similar studies identified no e-capability with a significantly negative effect; therefore, in this respect my research has also produced a surprising result. The e-factor combining special functions (map, “add to favorites”, privacy) shows a negative relationship with nearly each performance indicator, i.e. these e-commerce functions are characteristics of low-performing companies. Since it is traditional shop-based retailers that are mainly characterized by all three of these functions, they also tend to be the ones that are impacted by this negative performance effect.

Although related research showed a clearly positive relationship between inventory efficiency and (primarily transactional) e-commerce capabilities [Zhu, 2004 and Zhu – Kraemer, 2002], in my case the reproduced regression model did not demonstrate this effect. On the contrary, the comparative tests show that it is mainly the most successful online retailers with wide-ranging capabilities that have proportionately high inventory levels. It seems to be evident that the business model of these enterprises entails higher inventory levels. A reason for this can be that these successful e-tailers usually promise fast and flexible delivery, which may require larger inventories.

The relationship between e-commerce and inventory efficiency were further shaded by analysis performed in the light of website popularity and usage. This helped to clear the relationship between inventories and e-commerce capabilities identified by previous research, and the contradictory effects concealed by the original neutral results also become visible. Similarly, the negative profitability effect of special functions is also explained: Weighted by usage, the relationship becomes strongly positive, i.e. the achievable profit rate can be increased considerably if these capabilities are developed on a more frequented website. Moreover, only those company clusters were able to increase their revenues in 2010 which had above-average usage characteristic in 2009, i.e. focused on their Internet presence and thereby managed to acquire the appropriate number of links and visitors. The fact that this positive effect on growth only occurred in 2010 can be clearly explained by the delayed value creation effect frequently mentioned in connection with IT value creation ["lag-effect" e.g. Lee – Kim, 2006].

The introduction of the usage variable did not, however, change earlier results radically. This could possibly mean that Hungarian ICT retailers do not necessarily need high website attendance as they can convert even a small number of visitors into buyers. Furthermore, this can of course also suggest that ranking indicators and indices frequently used in the web ecosystem are also not perfect. This means that e.g. search engine optimization is not necessarily a guaranteed way to succeed and measuring marketing effectiveness by the click-through rate may also need revisiting. These days this issue has also raised the attention of business analysts and decision-makers as according to a recent survey there is practically no relationship between the click-through rate of Internet display advertisements and actual purchases [Lipsman, 2012].

The analysis performed with the inclusion of the business/sales model variable has rendered the conclusions reached so far more unambiguous and crystallized. Therefore, it seems that it is primarily offline retailers with physical outlets in whose case certain informational and interactional capabilities are important for improving

performance. However, in the mixed sales model – being more beneficial in terms of growth, – increased profitability requires wide-ranging and sophisticated e-commerce capabilities. Another interesting finding is that loss-making e-tailers mainly lag behind their leading peers in terms of security e-capabilities (guarantee, disclaimer, privacy). Quite possibly, in absence of these capabilities they also under-perform in building customer confidence, which is one of the important factors of success in e-commerce as shown by both international professional literature and domestic practice.

It is also interesting to observe that during the years of economic recession two business models were operating successfully, namely: the model focusing on traditional in-store sales not using the Internet, and that of e-tailers with sophisticated e-capabilities who also maintain physical outlets as a supplementary sales channel. Although the best traditional retailers were characterized by somewhat higher and more stable profitability rates also during the years of crisis, e-tailers were clearly more successful in retaining and increasing their markets. Therefore, building outstanding e-commerce capabilities amidst adverse market conditions proved to be an effective survival strategy for Hungarian ICT retailers.

If I was to formulate a few pieces of practical advice for Hungarian ICT retailers considering online developments, these would be the following:

- Traditional in-store retailers are also recommended to build up some kind of online presence, since it is in this group that advanced e-capabilities represent a real differentiating factor. The right decision could be to construct their own websites filled with high-quality information also offering the opportunity to interact with potential buyers (and not to be present only on an info portal page). Profitable operations were of course possible even without all this, but then continuously falling profit rates and market losses were to be reckoned with.
- Those who decide (or have decided) in favor of creating a webshop should consider supplementing transactional e-capabilities by sophisticated informational functions to build customer confidence. There is no business without buyers, of course, which means that they should be mindful of the importance of attracting visitors but in doing so it might be advisable for them not to focus on traditional web-based measuring methods only (e.g. various Google measures). E-commerce may enable their companies to increase market share or improve labor efficiency but if they try to attract buyers by offering fast product availability, some of the extra profit might be eroded by the need for a higher inventory level.

On the whole, it can be stated that if outstanding online presence is incorporated into corporate strategy then by relying increasingly on transactional capabilities combined with high-quality informational functions in every respect and achieving high attendance the company may increase sales revenues as well as becoming more profitable. This can however be reached by a limited number of companies and in such a turbulent technological and market environment the concrete individual success factors may change rapidly. During the recent period, in respect of interactional functions the use of social networks (e.g. Facebook) has come to the fore; with regard to the customer value creation factor, coupon or community purchases should be mentioned; or concerning security, increasingly sophisticated electronic and mobile payment opportunities should be talked about. The contents and tools of various e-capabilities, but not necessarily the basic conclusions, are changing rapidly.

As an illustration of the fact that the relationship between transactional e-commerce functions and market performance has not disappeared to date let us take a glance at the fate of some major players on the Hungarian ICT retail market. Online market leader Extreme Digital (who is not neglecting sales via their supplementary physical outlets either) has reached a nearly 25 % turnover growth. At the same time, eBolt Kft. (having a slightly wider product range but being a nearly 100% e-tailer) has increased its sales revenue by 30%. Meanwhile, Electro World (operating an offline retail chain) was liquidated in 2011 and one of its previous owners has since created Digidog.hu Zrt [HVG.hu, 2012] with the intention to supplement online commerce by a smaller retail chain[43].

[43]Digidog is currently closing its real and virtual doors as well, but this failure is probably coased by some unfortunate business and strategic dicisions, and not by the online sales channel. [Demeter, 2012]

10.3 Limitations and further research directions

I am of course aware that a study on an IT subject is considered obsolete as soon as it leaves the print shop. It is true of statistical figures and results related to individual e-commerce capabilities, but may however be less true of my basic questions and the relevant answers. My most important goal by carrying out this research was to analyze whether the IT value creation effect can be demonstrated on a large sample in Hungarian market environment. Despite the differing conclusions I have drawn in respect of the various hypotheses, I believe that the answer to my main question is unambiguous: Although the relationship between the analyzed technological capabilities and corporate performance is weak in my sample, it is far from being insignificant. I did not, and could not, expect that e-commerce capabilities of retailers would have an order-of-magnitude greater effect on financial performance, as they represent only a small segment of the business strategy.

It is however obvious that the indirect nature of the relationship between technological capabilities and business performance does not only explain the weak statistical relationship but also makes it questionable. Therefore, I would mention here a few issues that could serve as a basis for further research but were not covered by this analysis due to their extreme complexity and the scarcity of research resources:

- Naturally, it would be worth supplementing the model with some other resources that are complementary to e-commerce resources. Recent RBV studies often place the emphasis on these complementarities. Zhuang and Lederer [2006, p. 253.] analyzed the effect of complementary business resources such as partner relations, buyer relations, relationship between the IT and business areas, process re-engineering, market monitoring and e-commerce planning. They represent the general IT resource categories set up by Wade – Hulland [2004] well. That said, I believe that the temporary disregard of these complementarities can be defended in the case of e-commerce resources, as the organizational embeddedness of other, less outward-looking IT projects focused on a less specific activity would be much more significant.
- If we step out of the framework of the RBV we could also focus our attention on certain environmental factors, e.g. competitive pressure and regulatory environment representing the outer environment in the model of Zhu and

Kraemer [2005]. It can be said, however, that focusing on a single industry greatly neutralizes the modifying effect of external environmental factors.

- It could be worth wedging further intermediary variables between variables located at the two ends of the value creation chain. In this case, indicators directly measuring the operation of e-commerce resources (e.g. e-commerce sales trends or online efficiency metrics [Zhuang, 2006]) or operational performance indicators (e.g. inventory turnover) could be considered. I included the latter into the model in addition to bottom-line financial metrics measuring competitiveness, while instead of the former I only concentrated on the question of usage.
- Furthermore, it is naturally not only e-commerce resources that influence corporate performance; they can only be an important part of the value creation process in certain industries and on certain markets. From e-commerce literature on business modeling [ld. Móricz, 2009] and, of course, from business practice it is clear that corporate performance is basically determined by the target market selected by the retailer; the promotion tools used on that market; the product ranges offered and their prices; and how warehousing and distribution are organized. As part of this, IT resources including e-commerce capabilities can have an important role regarding promotion and distribution, but the latter is also fundamentally determined by the business model. In my research model, I only focus on the effect of e-commerce resources and therefore other effects are condensed into performance variance not explained by the model.

Considering the narrow theme of this research, some further research opportunities logically arise from it. It would be worth having a closer look at the large market actors, e.g. by conducting case study research on Extreme Digital's success. Furthermore, the analysis based on the 2009-2010 data could later be repeated, thus enabling the capturing of long-term e-commerce value creation effects. It would also be interesting to collect more accurate and direct data for the usage variable, or identify and build in motivations behind usage.

Looking at the theme in broader terms again, there are still numerous interesting areas to be explored in IT business value literature. As financial professional, I naturally consider it important to develop more accurate models and methodological frameworks for IT project valuation [see e.g. Szatmári's experiment, 2011] that could also be effectively used in practice. In addition, it would be particularly exciting to carry out an

exploratory research on the actual background and – organizational and psychological [pl. Jáki, 2008] – motivation of corporate IT investment decisions, and analyze that to what extent these decisions reflect value creation considerations [from a somewhat different aspect: Brynjolfsson – Hitt – Kim, 2011]. After all, my dissertation ultimately addresses the question of whether the corporate fortunes spent on information technology will ever be recovered. Is this issue also a concern to corporate decision-makers or do they make their decisions about the fate of millions of Euros driven by entirely different considerations?

References

(1) 2000. évi C. törvény a számvitelről. http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A0000100.tv (2010.03.03.)

(2) 2001. évi CVIII. törvény az elektronikus kereskedelmi szolgáltatások, valamint az információs társadalommal összefüggő szolgáltatások egyes kérdéseiről. http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A0100108.TV (2010.06.02.)

(3) 2004. évi XXXIV. törvény a kis- és középvállalkozásokról, fejlődésük támogatásáról. http://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A0400034.TV (2011.09.14.)

(4) Abel, A. B. – Dixit, A. K. – Eberly, J. C. – Pyndick, R. S. [1996]: Options, the value of capital, and investment. The Quarterly Journal of Economics. MIT Press. Vol. 111. No. 3. pp. 753-777.

(5) Acedo, F. – Barroso, C. – Galan, J. [2006]: The resource-based theory: dissemination and main trends. Strategic Management Journal. Vol. 27. No. 7. pp. 621 – 636.

(6) Agarwal, R. – Venkatesh, V. [2002]: Assessing a Firm's Web Presence: A Heuristic Evaluation Procedure for the Measurement of Usability. Information Systems Research. Vol. 13. No. 2. pp. 168-186.

(7) Alchian, A. – Demsetz, H. [1972]: Production, information costs, and economic organization. American Economic Review. Vol. 62. No. 5. pp. 777-795.

(8) Alpar, P. – Kim, M. (1990): A microeconomic approach to the measurement of information technology value. Journal of Management Information Systems. Vol. 7. No. 2. pp. 55-69.

(9) Alter, A. E. [2006]: July 2006 survey: What's the value of IT? At many companies, it's just guesswork. CIOInsight. July 25, 2006. http://www.cioinsight.com/article2/0,1540,1987873,00.asp (2006.09.10.)

(10) Amit, R. – Schoemaker, P.J.H. [1993]: Strategic assets and organizational rent. Strategic Management Journal. Vol. 14. No. 1. pp. 33–46.

(11) Amit, R. – Zott, C. [2000]: Value Drivers of e-Commerce Business Models. Paper presented at the 20th Annual International Conference of the Strategic Management Society, Vancouver, Canada

(12) Anandarajan, A. – Wen, H. J. [1999]: Evaluation of information technology investment. Management Decision. Vol. 37. No. 4. pp. 329-337.

(13) Anderberg, M. R. [1973]: Cluster Analysis for Applications. New York. Academic Press

(14) Anderson, C. [2004]: The Long Tail. Wired Magazine. Issue 12.10. October 2004. http://web.archive.org/web/20041208042735/www.wired.com/wired/archive/12.10/tail.html?pg=1&topic=tail&topic_set= (2010.06.21.)

(15) Anderson, M.C. – Banker, R.D. – Ravindran, S. [2003]: The New Productivity Paradox. Communications of the ACM. Vol. 46. No. 3. pp. 91-94.

(16) Applegate, L. M. – McFarlan, F. W. – McKenney, J. L. [1996]: Corporate Information System Management: The Issues facing snior executives. Irwin, Chicago

(17) Aral, S. – Brynjolfsson, E. – Wu, D. J. [2006]: Which Came First, it or Productivity? Virtuous Cycle of Investment and Use in Enterprise Systems. Twenty Seventh International Conference on Information Systems, Milwaukee 2006

(18) Aral, S. – Weill, P. [2007]: IT Assets, Organizational Capabilities, and Firm Performance. Organization Science. Vol. 18. No.5. pp. 763–780.

(19) Arnold, T. – Crack, T. F. [2004]: Using the WACC to value real options. Financial Analysts Journal. Vol. 60. No. 6. pp. 78-82

(20) Badinszky, P. [2009]: Hazai kis- és középvállalkozások elektronikus üzletvitelét segítő és akadályozó tényezők. E-business adaptáció. PhD értekezés. Szent István Egyetem, Gödöllő

(21) Badinszky, P. – Kulcsár, L. [2008]: E-business-adaptáció a vállalati menedzsmentben. Vezetéstudomány. Vol. 39. No. 4. pp. 35-50.

(22) Bakos, Y. [1998]: The emerging role of electronic marketplaces ont he Internet. Communication of the ACM. Vol. 41. No. 8. pp. 35-42.

(23) Banker, R.D. – Kauffman, R.J. [1991]: Quantifying the business value of information technology: an illustration of the 'business value linkage' framework. New York University Working Paper Series. Stern School of Business

(24) Barney, J. [1991]: Firm Resources and Sustained Competitive Advantage. Journal of Management. Vol. 17. No. 1. pp. 99-120.

(25) Barney, J. [2001]: Is the resource-based "view" a useful perspective for strategic management research? Yes. Academy of Management Review. Vol. 26. No. 1. pp. 41-56.

(26) Barney, J. [2002]: Gaining and sustaining competitive advantage. Upper Saddle River, NJ. Prentice Hall.

(27) Bartelsman, E. – Bassanini, A. – Haltiwanger, J. - Jarmin, R. – Scarpetta, S. – Schank, T. [2002]: The spread of IKT and productivity growth is europe really lagging behind in the new economy? OECD draft report presented at Conference ″The Information Economy: Productivity Gains and the Digital Divide,″ Catania, Szicília, 2002.06.15.

(28) Bartelsman, E. – Hinloopen, J. [2002]: Unleashing animal spirits: Investment in IKT and economic growth. in: The economics of the digital economy, Cheltenham: Edward Elgar.

(29) Bartis, E – Mitev, N. [2008]: A multiple approach to information system failure: A successful system that failed. European Journal of Information System, Vol. 17. No. 2. pp. 112-124.

(30) Barua, A. – Konana, P. – Whinston, A. B. (2004): An empirical investigation of net-enabled value. MIS Quarterly. Vol. 28. No. 4. pp. 585-620.

(31) Barua, A. – Kriebel, C.H. – Mukhopadhyay, T. [1995]: Information technology and business value: An analytic and empirical investigation. Information System Research. Vol. 6. No. 1. pp. 3-23.

(32) Barua. A. – Mukhopadhyay. T. [2000]: Information technology and business performance: Past, present and future. In: Zmud, R. W. [ed.] [2000]: Framing the Future of IT Management: Projecting the Future Through the Past. Cincinnati. Pinnaflex Education Resources. pp. 65-84.

(33) Baskerville, R. L. – Myers, M. D. [2009]: Fashion waves in information systems research and practice. MIS Quarterly. Vol. 33. No. 4. pp. 647-662.

(34) Becker, P. – Turner, A. – Varsány, J. – Virág, M. [2005]: Értékalaú stratégiák. A pénzügyi teljesítmény értékvezérelt menedzsmentje. Akadémiai Kiadó. Budapest

(35) Bélyácz, I. [2011]: Kockázat, bizonytalanság, valószínűség. Hitelintézeti Szemle. Vol. 10. No. 4. pp. 289-313.

(36) Benaroch, M. – Kauffman, R. J. [1999]: A case for using real options pricing analysis to evaluate information technology investment. Information System Research Vol. 10. No. 1. pp.70-86.

(37) Benaroch, M. – Kauffman, R. J. [2000]: Justifying electronic banking network expansion using real options analysis. MIS Quarterly. Vol. 24. No. 2. pp. 197-225.

(38) Benaroch, M. – Lichtenstein, Y. – Robinson, K. [2006]: Real options in information technology risk management: An empirical validation of risk-option relationship. MIS Quarterly. Vol. 30. No. 4. pp. 827-864.

(39) Benbasat, I. – Barki, H. [2007]: Quo vadis, TAM? Journal of the Association of for Information Systems. Vol. 8. No. 4. pp. 211-218.

(40) Benbasat, I. – R. W. Zmud [2003]: The Identity Crisis Within The IS Discipline: Defining And Communicating The Discipline's Core Properties. MIS Quarterly Vol. 27. No. 2. pp. 183-194.

(41) Bernstein, F. – Song, J. – Zheng, X. [2006]: „Bricks-and-Mortar" vs. „Clicks-and mortar": An equilibrium Analysis. European Journal of Operational Research. Vol. 187. No. 3. pp. 671-690.

(42) Bharadwaj, A. S. [2000]: A resource-based perspective on information technology capability and firm performance: An empirical investigation. MIS Quarterly. Vol. 24. No. 1. pp. 169-196.

(43) Bharadwaj, A. S. – Bharadwaj, S. G. – Konsynski, B. R. [1999]: Information Technology Effects on Firms Performance as Measured by Tobin's q. Management Science. Vol. 45. No. 6. pp. 1008-1024.

(44) Bhatt, G. D. – Grover, V. [2005]: Types of Information Technology Capabilities and Their Role in Competitive Advantage: An Empirical Study. Joumal of Management Information Systems. Vol. 22. No. 2. pp. 253-277.

(45) Black, F. – Scholes, M. [1973]: „The Pricing of Options and Corporate Liabilities", Journal of Political Economy, Vol. 81, pp.637-654.

(46) Bőgel, Gy. [2003]: Informatikai beruházások üzleti értékelése. CEO. Vol. 4. No. 3. Melléklet pp. 1-12.

(47) Bőgel, Gy. [2005]: Az infokommunikációs piac állapotáról. Competitio. Voil. 4. No. 2. pp. 89-105.

(48) Bőgel, Gy. [2009a]: Üzleti elvárások – Informatikai megoldások. HVG Kiadó. Budapest

(49) Bőgel, Gy. [2011]: Az adatrobbanás mint közgazdasági jelenség. Közgazdasági Szemle, 2011. október, Vol. 58. 2011. október. pp. 877-889.

(50) Bőgel, Gy. – Forgács A. [2004]: Informatikai beruházás - üzleti megtérülés. Műszaki Könyvkiadó. Budapest

(51) Brandenburger, A. M. – Stuart, H. W. [1996]: Value-Based Business Strategy. Journal of Economics and Management Strategy. Vol. 15. No. 1. pp. 5-24.

(52) Brealey, – Myers, [1999]: Modern vállalati pénzügyek. Első kötet. Panem. Budapest

(53) Brin, S. – Page L. [1998]: The anatomy of a large-scale hypertextual Web search engine. Computer networks and ISDN systems. Vol. 30. No. 1-7. pp. 107–117.

(54) Brown, S. J. – Hagel, J. [2003]: Does IT Matter? Harvard. Business Review. July 2003, pp. 109-112.

(55) Brynjolfsson, E. – Hitt, L. M. [1995]: Information Technology as a Factor of Production: the Role of Differences among Firms. Economics of Innovation and New Technology. Vol. 3. pp. 183-199.

(56) Brynjolfsson, E. – Hitt, L. M. [1996]: Paradox lost? Firm-level evidence on the returns to information systems spending. Management Science. Vol. 42. No. 4. pp. 541–558.

(57) Brynjolfsson, E. – Hitt, L. M. [2000]: Beyond computation: Information technology, organizational transformation and business performance. Journal of Economic Perspectives. Vol. 14. No. 4. pp. 23-48.

(58) Brynjolfsson, E. – Hitt, L. M. – Kim, H. [2011]: Strength in Numbers: How does data-driven decision-making affect firm performance? Proceedings of the Thirty Second International Conference on Information Systems, Shanghai 2011. Economics and Value of IS.

(59) Brynjolfsson, E. – Hitt, L. M. – Yang, S. [1998]: Intangible assets: How the interaction of information systems and organizational structure affects stock market valuation. In: Proceedings of the International Conference on Information Systems. Helsinki, Finland

(60) Brynjolfsson, E. – Hitt, L. M. – Yang, S. [2002]: Intangible assets: Computers and organizational capital. Brookings Papers on Economic Activity. 2002/1. pp. 137-198.

(61) Brynjolfsson, E. – Hu, Y. – Rahman, M. [2009]: Battle of the Retail Channels: How Product Selection and Geography Drive Cross-channel Competition. Journal of Management Science. Vol. 55. No. 11. pp. 1755-1765.

(62) Brynjolfsson, E. – Malone, T. – Gurbaxani, V. [1991], Does Information Technology Lead to Smaller Firms? MIT Center for Coordination Science Technical Report No. 123.

(63) Brynjolfsson, E. – Smith, M. D. [2000]: Frictionless Commerce? A comparison of Internet and Conventional Retailers. Management Science, Vol. 46. No. 4. pp. 563-585.

(64) Brynjolfsson, E. – Yang, S. [1996]: Information Technology and Productivity: A Review of the Literature. Advances in Computers. Vol. 43. Academic Press. pp. 179-214.

(65) Cappuccio, D. – Keyworth, B. – Kirwin, W. [1996]: Total cost of ownership: The impact of system management tools. Technical Report. Gartner Group.

(66) Carr, N. G. [2003]: IT Doesn't Matter. Harvard Business Review. May 2003, pp. 41-49.

(67) Cataings, W. – Tarantola, S. [2008]: The 2007 European e-Business Readiness Index. European Commission. Joint Research Centre. Institute for the Protection and Security of the Citizen. EUR 23254 EN

(68) Chakrabarti, S. [2003]: Mining the web: Analysis of hypertext and semi structured data. Morgan Kaufmann. New York

(69) Chan, Y. E. [2000]: IT Value: The Great Divide Between Qualitative and Quantitative and Individual and Organizational Measures. Journal of Management Information Systems. pp. 225-261.

(70) Changchit, C. – Joshi, K.D. – Lederer, A.L. [1998]: Process and reality in information systems benefit analysis. Information Systems Journal, Vol. 8. Issue 2. pp.145–162.

(71) Chatterjee, D. – Pacini, C. – Sambamurthy, V. [2001]: Stock market reactions to IT infrastructure investments: An event study analysis. Journal of Management Information Systems, Vol. 19. No. 2. pp. 7–43.

(72) Chen, Y. – Zhu, J. [2004]: Measuring information technology's indirect impact on firm performance. Information Technology and Management. Vol. 5. No. 1-2. pp. 9-22.

(73) Chikán, A. [1997]: Vállalatgazdaságtan. Aula Kiadó. Budapest

(74) Chikán, A. – Czakó, E. – Kazainé Ónodi, A. [2006]: Gazdasági versenyképességünk vállalati nézőpontból − Versenyben a világgal 2004-2006 kutatási program zárótanulmánya. Budapesti Corvinus Egyetem. Versenyképesség Kutató Központ

(75) Clemons, E. K. [1986]: Information systems for sustainable competitive advantage. Information & Management. Vol. 11. No. 3. pp. 131-136.

(76) Clemons, E. K. – Gu, B. [2002]: Justifying information technology investments: balancing the need for speed of action with certainty before action. Proceedings of the 36th Hawaii International Conference on System Sciences

(77) Clemons, E. K. – Kleindorfer, P. R. [1992]: An Economic Analysis of Interorganizational Information Technology. Decision Support Systems. Vol. 8. No. 5. pp. 431-446.

(78) Clemons, E. K. – Row, M. C. [1991]: Sustaining IT Advantage: The Role of Structural Differences. MIS Quarterly. Vol. 15. No. 3. pp. 275-292.

(79) Clemons, E. K. – Weber, B. W. [1990]: Strategic information technology investments: Guidelines for decision making. Journal of Management Information Systems. Vol. 7. No.2. pp. 9-28.

(80) Copeland, T. – Koller, T. – Murrin, J. [1999]: Vállalatértékelés. Panem – John Wiley & Sons. Budapest

(81) Corbitt, B. J. – Al-Quirim, N. A. Y. [2004]: E-business, e-government & small and medium-size enterprises: opportunities and challenges. Idea Group Inc., Hershey

(82) Cox – Ross – Rubinstein [1979]: Option Pricing: A Simplified Approach. Journal of Financial Economics. No. 7. pp. 229-263.

(83) Craighead, C. W. – Shaw, N. G. [2003]: E-commerce value creation and destruction: A resource-based, supply chain perspective. Advances in Information Systems. Vol. 34. No. 2. pp. 39-49.

(84) Creswell, J. W. [2003]: Research design: Qualitative, quantitative, and mixed methods approaches. 2. edition. Sage Publicatios. Thousand Oaks.

(85) Crook, T.R. – Ketchen, D.K. – Combs, J.G. – Todd, S.Y. [2008]: Strategic Resources and Performance: A meta-analysis. Strategic Management Journal. Vol. 29. No. 11. pp. 1141-1154.

(86) Csányi, T. – Dolgos, O. – Wimmer, Á. [1997]: Költséggazdálkodás, teljesítménymérés és hatékonyság a magyar vállalati gyakorlatban. Versenyben a világgal. A magyar gazdaság nemzetközi versenyképességének mikrogazdasági tényezői kutatási program Költséggazdálkodás alprojekt zárótanulmánya. Z27 kötet

(87) Dai, Q. – Kauffman, R.J. – March, S.T. [2000]: Analyzing Investments in Object-oriented Middleware: An Options Perspective. Working Paper. Carlson School of Management. University of Minnesota

(88) Damodaran, A. [2002]: Investment Valuation. Tools and Techniqes for Determining the Value of Any Asset. University Edition. John Wiley & Sons. New York

(89) Damodaran, A. [2006a]: Valuation Approaches and Metrics: A Survey of the Theory and Evidence. http://pages.stern.nyu.edu/~adamodar/ (2009.01.03)

(90) Damodaran, A. [2006b]: Dealing with intangibles: Valuing brand names, flexibility and patents. http://pages.stern.nyu.edu/~adamodar/ (2006.05.03)

(91) Dankó, D. [2004]: Az erőforrás-alapú elmélet kései születése és fejlődésének lehetőségei. Vezetéstudomány. Vol. 35. különszám, pp. 4-15.

(92) Dankó, D. – Kiss, N. [2006]: A teljesítménymenedzsment-eszköztár változása Magyarországon 1996 és 2004 között. Versenyben a világgal 2004 – 2006 gazdasági versenyképességünk vállalati nézőpontból című kutatás. 32. sz. műhelytanulmány

(93) Dao, V. – Shaft, T. – Zmud, R. [2007]: An examination of lag effects in relationships between information technology investment and firm-level performance. Twenty Eighth International Conference on Information Systems, Montreal 2007

(94) Datamonitor [2004]: Feature Analysis, CIO ROI, Datamonitor, May 2004, www.datamonitor.com (2007.10.18.)

(95) D'Aveni, R. A. [1994]: Hypercompetition: Managing the Dynamics of Strategic Maneuvering. The Free Press. New York

(96) Daveri, F. [2000]: Is growth an information technology story in Europe too? Working paper. Universita di Parma, Parma, Italy.

(97) Davern, M. J. – Wilkin, C. L. [2010]: Towards an integrated view of IT value measurement. International Journal of Accounting Information Systems. Vol. 11. No. 1. pp. 42–60.

(98) Davis, F. D. [1989]: Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Ouarterly. Vol. 13. No. 3. pp. 319-339.

(99) Dedrick, J. – Gurbaxani, V. – Kraemer, K. L. [2003]: Information Technology and Economic Performance: A Critical Review of the Empirical Evidence. ACM Computing Surveys. pp. 1-28.

(100) Dehning, B. – Dow, K. E. – Stratopoulos, T. [2003]: The Info-Tech "Productivity Paradox" Dissected and Tested. Management Accounting Quarterly. Vol. 5. No. 1. pp. 31–40.

(101) Dehning, B. – Richardson, V. J. [2002]: Return on investment in Information Technology a Research Sysnthesis. Journal of Information SystemsVol.. 16. No. 1. pp. 7-30.

(102) Dehning, B. – Richardson, V. J. – Urbaczewski, A. – Wells, J. D. [2004]: Reexamining the Value Relevance of E-Commerce Initiatives. Journal of Management Information Systems. Vol. 21. No. 1. pp. 55–82.

(103) Deloitte [2006]: Valuing intangible assets. What are they really worth? January 2006 http://www.deloitte.com/dtt/cda/doc/content/dtt_ie_intangibleassetsJan06.pdf (2006.04.25)

(104) DeLone, W. H. – E. R. McLean [1992]: Information Systems Success: The Quest For The Dependent Variable. Information Systems Research Vol. 3. No. 1. pp. 60-95.

(105) DeLone, W. H. – E. R. McLean [2003]: The Delone And Mclean Model Of Information Systems Success: A Ten Years Update. Journal of Management Information Systems. Vol. 19. No. 4. pp. 9-30.

(106) Demeter, K. [2012]: Vége a Digidognak is. Világgazdaság Online. 2012. 06. 21. http://www.vg.hu/vallalatok/kereskedelem/vege-a-digidognak-is-378000 (letöltve: 2012.06.21.)

(107) Demeter, K. – Matyusz, Zs. [2006]: Értékteremtés funkcionális alapokon – az értékteremtés projekt zárótanulmánya. Versenyképesség kutatás című műhelytanulmány sorozat. 43. számú kötet. 2006. április

(108) Devaraj, S. – Kohli, R. [2002]: Information technology payoff in the health care industry: A longitudinal study. Journal of Management Information Systems Vol. 16. No. 4. pp. 41–68.

(109) Devaraj, S. – Kohli, R. [2003]: Performance Impacts of Information Technology: Is Actual Usage the Missing Link? Management Science. Vol. 49. No. 3. pp. 273-289.

(110) Dewan, S. – Min, C. K. [1997]: Substitution of information technology for other factors of production: A firm level analysis. Management Science Vol. 43. No. 12. pp. 1660–1675.

(111) Dewan, S. – Shi, C. – Gurbaxani, V. [2003]: Investigating the risk-return relationship of information technology investment: Firm-level empirical analysis. Graduate School of Management. University of California. Irvine. Working paper. July, 2003

(112) de Jong, B. – Ribbers, P. M. A. – van der Zee, H. T. M. [1999]: Option pricing for IT valuation: a dead end. Electronic Journal of Information Systems Evaluation. Vol. 2. No. 1. http://www.ejise.com/volume-2/volume2-issue1/issue1-art1.htm

(113) Doherty, N. F. – Ellis-Chadwick, F. [2006]: New perspectives in internet retailing: a review and strategic critique of the field. International Journal of Retail and Distribution Management. Vol. 34. No. 4/5. pp. 411–428.

(114) Dos Santos, B.L. [1991]: Justifying Investment in New Information Technologies. Journal of Management Information Systems. Vol. 7. No. 4. pp. 71-89.

(115) Dos Santos, B. L. – Peffers, K. – Mauer, D. C. [1993]: The Impact of Information Technology Investment Announcements on the Market Value of the Firm. Information System Research.Vol. 4. No. 1. pp. 1-23.

(116) Draca, M. – Sadun, R. – Van Reenen, J. [2006]: Productivity and IKT: A Review of the Evidence. CEP Discussion Paper No 749. August 2006

(117) Drótos, Gy. [2001]: Az információrendszerek perspektívái. Ph. D. értekezés. Budapesti Közgazdaságtudományi és Államigazgatási Egyetem, Budapest

(118) Drótos, Gy. – Gast, K. – Móricz, P. – Vas, Gy. [2006]: az információmenedzsment fejlettsége és a versenyképesség. Versenyképesség kutatások műhelytanulmány-sorozat. 28. sz. műhelytanulmány.

(119) Drótos, Gy. – Szabó, Z. [2001]: Vállalati informatika Magyarországon az ezredfordulón. Mítosz és valóság. Vezetéstudomány. Vol. 32. No. 2. pp. 17-23.

(120) e-Business Watch [2008]: The European e-Business Report 2008. The impact of IKT and e-business on firms, sectors and the economy. 6th Synthesis Report of the Sectoral e-Business Watch. http://www.ebusiness-watch.org/key_reports/documents/EBR08.pdf (2010.05.10.)

(121) Egger, F. [2000]: "Trust me, I'm an online vendor": towards a model of trust for e-commerce system design. Proceedings of CHI EA ’00. CHI '00 extended abstracts on Human factors in computing systems ACM. pp. 101-102.

(122) Eisenhardt, K. – Martin, J. [2000]: Dynamic Capabilities: What Are They? Strategic Management Journal [21]. pp. 1105-1121.

(123) Ellison, R. J.– Moore, A. P. [2003]: Trustworthy Refinement Through Intrusion-Aware Design [TRIAD]. Carnegie Mellon University, Software Engineering Institute. Technical Report CMU/SEI-2003-TR-002

(124) Ellram, L. M. [1993]: Total Cost of Ownership: Elements and Implementation. International Journal of Purchasing and Material Management. Vol. 29. No. 4. pp. 3-10.

(125) Ekström, M. A. – Björnsson, H. C. [2003]: Evaluating IT investments in construction. Accounting for strategic flexibility. Stanford University. Center for Integrated Facility Engineering. Technical Report No. 136

(126) Fazekas, G. – Gyulai, L. – Martin Hajdu, Gy. – Mohai, Gy. – Sebestyén, G. – Virág, M. – Zsembery, L. (2004) Vállalati pénzügyi döntések. Tanszék Kft. Budapest

(127) Fehér, P. [2006]: Informatikai beruházások pénzügyi értékelése. Egyetemi jegyzet. BCE Információrendszerek Tanszék, Budapest.

(128) Fiáth, A. [2004]: Értékközpontú vállalat irányítás. A vezetéstudományi irányzat elméleti háttere és gyakorlata a MOL Rt. példáján szemléltetve. Doktori (Ph.D.) értekezés. Tézisgyűjtemény. Budapesti Közgazdaságtudományi és Államigazgatási Egyetem

(129) Fiáth, A. – Virág, M. [2011]: A vállalkozások kreatív könyvelésének jellemzőire és azok felismerési módszereinek kidolgozására irányuló kutatás. Kutatási jelentés. www.szik.uni-corvinus.hu

(130) Financial Accounting Standards Board [2001]: Summary of Statement No. 142 Goodwill and Other Intangible Assets. Issued 6/01. http://www.fasb.org/st/summary/stsum142.shtml (2006.12.28)

(131) Foss, N. J. [1996]: More critical comments on knowledge-based theories of the firm. Organization Science, Vol. 7. No. 5. pp. 519-523.

(132) Foss, N. J. – Knudsen [2003]: The resource-based tangle: towards a sustainable explanation of competitive advantage. Managerial and Decision Economics. Vol. 24. No. 4. pp. 291.

(133) Fowler, J. – Horan, P. [2009]: Information Systems Success and Failure – Two Sides of One Coin, or Different in Nature? An Exploratory Study. in: Clarke, S. (ed.)(2009): Evolutionary Concepts in End User Productivity and Performance: Applications for Organizational Progress. IGI Global, Hershey

(134) Friedman, M. [1970]: The social responsibility of business is to increase its profits. The New York Times Magazine. 1970.09.13.

(135) Füstös, L. – Kovács, E. – Meszéna, Gy. – Simonné Mosolygó, N. [2004]: Alakfelismerés – Többváltozós statisztikai módszerek. Új Mandátum Könyvkiadó. Budapest

(136) Gable, G. G. – Sedera, D. – Chan, T. [2008]: Re-conceptualizing Information System Success: The IS-Impact Measurement Model. Journal of the Association for Information Systems. Vol. 9. No. 7. pp. 377-408.

(137) Gábor, A. – Szabó, Z. – Ternai, K. – Kő, A. – Lovrics, L. – Fehér, P. – Molnár, B. – Kovács, B. – Vas, R. [2007]: Üzleti informatika. Aula Kiadó, Budapest

(138) Gartner [2012]: Forecast Alert: Enterprise IT Spending by Vertical Industry Market, Worldwide, 2010-2016, 1Q12 Update. http://www.gartner.com/id=1993415 (letöltve: 2012.05.23.)

(139) Gáti, M. – Kolos, K. [2011]: Az e-business és a vállalati versenyképesség összefüggései. Műhelytanulmány. BCE Vállalatgazdaságtan Intézet, Versenyképesség Kutató Központ

(140) Gefen, D. [2000]: E-commerce: the role of familiarity and trust. Omega. The International Journal of Management Science. Vol. 28. pp. 725-737.

(141) Gefen, D. – Karahann, E.– Straub, D. [2003]: Trust and TAM in Online Shopping: An Integrated Model. MIS Quarterl. Vol. 27. No. 1. pp. 51-90.

(142) Gefen, D. – Straub, D. [2000]: The Relative Importance of Perceived Ease of Use in IS Adoption: A Study of E-Commerce Adoption. Journal of the Association for Information Systems. Vol. 1. No. 8. pp. 1-28.

(143) Gillett, F. [2001]: Making Enterprise Portals Pay. Forrester Research.

(144) GKIeNET [2009]: Egyelőre válságmentes az online kiskereskedelem. 2009. augusztus 16. http://gkienet.hu/hu/hirek/gyorsjelentes-%E2%80%93-az-online-kiskereskedelmi-aruhazak-helyzete-egyelore-valsagmentes-az-online-kiskereskedelem-osszefoglalo-a-sajto-szamara/ (2010.06.08.)

(145) GKIeNET [2010]: Nincs válságban a magyarországi e-kereskedelem – új forgalom csúcs született 2009-ben. 2010. augusztus 6. http://gkienet.hu/hu/hirek/nincs-valsagban-a-magyarorszagi-e-kereskedelem-%e2%80%93-uj-forgalom-csucs-szuletett-2009-ben/ (2010.08.16.)

(146) GKIeNET [2011]: Tavaly is szárnyalt a magyarországi e-kereskedelem. 2011. augusztus 30. http://gkienet.hu/hu/hirek/tavaly-is-szarnyalt-a-magyarorszagi-e-kereskedelem/ (2011.12.01.)

(147) GKIeNET [2012a]: E-kereskedelmi trendek 2011-ben, 2012. január 6. http://gkienet.hu/hu/hirek/e-kereskedelmi-trendek-2011-ben/ (2012.03.12.)

(148) GKIeNET [2012b]: Egyre több webkosarat tol a magyar, 2012. május 23. http://gkienet.hu/hu/hirek/egyre-tobb-webkosarat-tol-a-magyar/ (2012.05.29.)

(149) GKIeNET – T-Mobile [2010]: Jelentés az internetgazdaságról – Gyorsjelentés. http://www.szek.org/tudasbazis/64-adatok-elemzesek (2012.03.12.)

(150) Goedhart, M. – Koller, T – Wessels, D. [2005]: Do fundamentals – or emotions – drive the stock market? The McKinsey Quarterly. Special edition: Value and performance. pp. 7-15.

(151) Google [2010]: Google PageRank. http://www.google.com/corporate/tech.html [2010.03.03]

(152) Google Scholar [2012]: http://scholar.google.hu/scholar?cites=10989156643716779592&as_sdt=5&sciodt=0&hl=hu [2012.05.18]
(153) Gorsuch, R. L. [1983]: Factor Analysis. Lawrence Erbaum Associates. London
(154) Grant, R.M. [1991]: The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. California Management Review. Vol. 33. No. 3. pp. 114–135.
(155) Green, C. – Maranhao, C. [2006]: „Beyond budget”. PM Network. September 2006. www.pmi.org. [08.12.2006] pp. 56-60.
(156) Grenadier, S. – Weiss, A. [1997]: Optimal migration strategies for firms facing technological innovations: An option pricing approach. Working Paper. Stanford Business School
(157) Griliches, Z. [1994] Productivity, R&D, and the data constraint. American Economic Review. Vol. 84. No. 1. pp. 1-23.
(158) Grover, V. – Kohli, R. [2012]: Cocreating it value: New capabilities and metrics for multifirm environments. MIS Quarterly. Vol. 36. No. 1. pp. 225-232.
(159) Gurbaxani, V. – Kraemer, K. – Vitalari, N. [1997]: Note: An economic analysis of IS budgets. Management Science. Vol. 43. No. 12., pp. 1745-1755.
(160) Gurbaxani, V. – Melville, N. – Kraemer, K. [2000]: The production of information services: A firm-level analysis of information systems budgets. Information Systems Research. Vol. 11. No. 2. pp. 159-176.
(161) Gurbaxani, V. – Whang, S. [1991]: The impact of information systems on organisations and markets. Communications of the ACM. Vol. 34. No. 1. pp. 59-73.
(162) Hámori B. – Kapás J. [200]: Merre tovább a vállalatelméletben? Egy lehetséges fejlődési út. Competitio Vol. 1. No. 1. pp. 13-26.
(163) Hares, J. – Royle, D. [1994]: Measuring the Value of Information Technology. Wiley. Chichester
(164) Hayes, D. C. – Hunton, J. E. – Reck, J. L. [2001]: Market Reactions to ERP Implementation Announcements. Journal of Information Systems. Vol. 15. Issue 1. pp. 3-18.
(165) HBR Letters to the Editor [2003]: Does IT Matter? Harvard Business Review, June 2003
(166) Hitt, L. M. [1999]: Information technology a nd firm boundaries: Evidence from panel data. Information Systems Research. Vol. 10. No. 2. pp. 134-149.

(167) Hitt, L. M. – Brynjolfsson, E. [1994]: The three faces of IT value: theory and evidence. Proceedings of 15th International Conference on Information Systems. December. pp. 263-277.

(168) Hitt, L. M. – Brynjolfsson, E. [1996]: Productivity, business profitability, and consumer surplus: Three different measures of information technology value. MIS Quarterly. Vol. 20. No. 2. pp. 121-142.

(169) Hitt, L. M. – Frei, F. X. – Harker, P. T. [1999]: How Financial Firms Decide on Technology. Working Paper. The Warton School. University of Pennsylvania

(170) Hitt, L. M. – Wu, D. J. – Zhou, X. [2002]: Investment in enterprise resource planning: Business impact and productivity measures. Journal of Management Information Systems. Vol. 19. No. 1. pp. 71-98.

(171) Hofmeister, Á. – Simon, J. – Kozák, Á. [2011]: The Retail Industry in Hungary. European Retail Research. Vol. 25. No. 2, pp. 113-140.

(172) Hoopes, D.G. – Madsen, T.L. – Walker, G. [2003]: Guest Editors' Introduction to the Special Issue: Why is There a Resource-Based View? Toward a Theory of Competitive Heterogeneity. Strategic Management Journal.Vol. 24. pp.889–902.

(173) Hull, J.C. [2003]: Options, Futures, and Other Derivatives. Fifth Edition. Prentice-Hall. New Jersey

(174) Hulland, J. – Wade, M. R. – Antia, K. D. [2007]: The Impact of Capabilities and Prior Investments on Online Channel Commitment and Performance. Journal of Management Information Systems. Vol. 23. No. 4. pp. 109–142.

(175) Hunter, S. – Kobelsky, K. – Richardson, V. J. [2003]: Information technology and the volatility of firm performance. MIT Sloan School of Management. Working Paper 4449-03. November 2003

(176) Hunyadi, L. – Mundruczó, Gy. – Vita, L. [2000]: Statisztika. Aula Kiadó. Budapest

(177) HVG.hu [2012]: Százból négy hazai üzlet lehúzza a rolót egy éven belül. Hvg.hu\Vállalkozás. 2012. február 14. http://hvg.hu/kkv/20120214_kiskereskedelmi_jelentes (2012.05.10)

(178) ICIS [2011]: Track 5: Economics and Value of Information Systems. ICIS 2011 Shanghai. http://icis2011.aisnet.org/track5.htm (letöltve: 2012.05.18)

(179) International Financial Reporting Interpretations Committee [2002]: Interpretation SIC-32 Intangible Assets – Web Site Costs. http://www.iasplus.com/pressrel/sic32.pdf (2007.01.04)

(180) Im, K. S. – Dow, K. E. – Grover, V. [2001]: Research report: A reexamination of IT investment and the market malue of the firm – an event study methodology. Information Systems Research. Vol. 12. No. 1. p. 103-117.

(181) International Accounting Standards Board [2004]: IAS 38: Intangible Assets. http://www.iasb.org/NR/rdonlyres/149D67E2-6769-4E8F-976D-6BABEB783D90/0/ias38sum.pdf (2006.12.15.)

(182) Jáki, E. [2008]: Beruházás értékelés döntéselméleti megközelítése. Tavaszi Szél Konferencia 2008. Budapest.

(183) Johnston, D.A. – Wade, M. – McClean, R. [2007]: Does e-Business Matter to SMEs? A Comparison of the Financial Impacts of Internet Business Solutions on European and North American SMEs. Journal of Small Business Management. Vol. 45. No. 3. pp. 354–361.

(184) Jolliffe, I. T. [2002]: Principal Component Analysis, Second Edition. Springer. New York

(185) Jonscher, C. [1983]: Information Resources and Economic Productivity. Information Economics and Policy. Vol. 1. pp. 13-35.

(186) Jordan, E. [1995]: A global strategy for building information assets: an agenda for information professionals. Proceedings of ACIS '95. Perth. 26-29. September. pp. 915-26.

(187) Jorgenson, D. W. [2001]: Information technology and the U.S. economy. Presidential address to the American Economic Association. American Economic Review Vol. 91. No. 1. pp. 1–32.

(188) Juhász, P. [2004]: Az üzleti és könyv szerinti érték eltérésének magyarázata: Vállalatok mérlegen kívüli tételeinek értékelési problémái. Doktori [Ph.D.] értekezés. Budapesti Corvinus Egyetem

(189) Juhász, P. [2012]: A mérlegen kívüli tételek a magyar vállalatok működésében. Hitelintézeti Szemle Vol. 11. No.1. pp. 24-46.

(190) Kalakota, R. – Robinson, M. [2001]: e-Business 2.0 – Roadmap for Success. Addison Wesley, Kanada

(191) Kauffman, R. J. – Walden, E. A. [2001]: Economics and Electronic Commerce: Survey and Directions for Research. International Journal of Electronic Commerce. Vol. 5. No. 4. pp. 5–116.

(192) Kauffman, R. J. – Weill, P. [1989]: An Evaluative Framework for Research on the Performance Effects of Information Technology Investment. Information Systems Working Papers Series. NYU Working Paper No. IS-89-083

(193) Kazainé Ónodi, A. [2008]: Az értékközpontú vállalatvezetést szolgáló teljesítménymérési rendszer. Ph.D. értekezés. Budapesti Corvinus Egyetem

(194) Keil, M. [1995]: Pulling the plug: software project management and the problem od project escalation. MIS Quarterly. Vol. 19. No. 4. pp. 421-447.

(195) Keil, M. [1999]: Turning around trubling software projects: an exploratory study of commitment to failing courses of action. Journal of Management Information Systems, Vol. 15. No. 4. pp. 63-87.

(196) Kim, K. – Mithas, S. [2011]: How does Bond Market View IT investments of Firms? An Empirical Evidence of Bond Ratings and Yield Spreads. Proceedings of the Thirty Second International Conference on Information Systems, Shanghai 2011. Economics and Value of IS.

(197) King, W. – He, J. [2006]: A meta-analysis of the technology acceptance model. Information & Management. Vol. 43. No. 6. pp. 740-755.

(198) Kis Gergely [2009]: Ki-mit vesz az interneten és hogyan fizet? SZEK Konferencia. Budapest, 2009. május 07.

(199) Kogut, B. – Kulatilaka, N. [2001]: Capabilities as real options. Organization Science. Vol. 12. No. 6. pp. 744-758.

(200) Kohli, R. – Grover, V. [2008]: Business Value of IT: An Essay on Expanding – Research Directions to Keep up with the Times. Journal of the Accosiation for Information Systems. Vol. 9. No. 1. pp. 23-39.

(201) Korper, S. – Ellis, J. [2001]: The E-commerce book. Building the empire. Second Edition. Academic Press. San Diego

(202) Kotha, S. – Rajgopal, S. – Venkatachalam, M. [2004]: The role of online buying experience as a competitive advantaga: Evidence from third-party ratings for e-commerce firms. Journal of Business. Vol. 77. No. 2. pp. 109-133.

(203) Koufaris, M. [2002]: Applying the Technology Acceptance Model and Flow Theory to Online Consumer Behavior. Information Systems Research. Vol. 13. No.2. pp. 205-223.

(204) Központi Statisztikai Hivatal [2007a]: TEÁOR'08-'03 fordítókulcs 4-számjegyű. http://portal.ksh.hu/pls/portal/url/ITEM/435A0290BC366DB5E04400306E4816D2 (2009.06.01.)

(205) Központi Statisztikai Hivatal [2007b]: TEÁOR'08 Struktúra http://portal.ksh.hu/pls/portal/url/ITEM/4359FF8689626CA0E04400306E4816D2 (2009.06.01.)

(206) Központi Statisztikai Hivatal [2008]: A magyarországi üzleti szektor infokommunikációs [IKT-]eszközökkel való ellátottsága és azok használatának jellemzői 2006/2007. Budapest. http://www.ksh.hu (2009.11.04.)

(207) Központi Statisztikai Hivatal [2009]: A vállalkozások és a háztartások IKT-eszközökkel való ellátottsága és ezek használata, 2008. http://www.ksh.hu (2009.11.04.)

(208) Központi Statisztikai Hivatal [2010]: Infokommunikációs (IKT-) eszközök a vállalati (üzleti) szektorban, 2009. http://www.ksh.hu (2011.09.20)

(209) Központi Statisztikai Hivatal [2011]: Az információs és kommunikációs technológiák használata az üzleti szférában, 2010. http://www.ksh.hu (letöltve: 2012.05.21.)

(210) Kraaijenbrink, J. – Spender, J.-C. – Groen, A. [2010]: The Resource-Based View: A Review and Assessment of Its Critiques. Journal of Management. Vol. 36. No. 1. pp. 349-372.

(211) Krishnamurthy, S. [2007]: E-Commerce Management.Text and Cases. Thomson South-Western, Mason, Ohio

(212) Kudyba, S. – Diwan, R. [2002]: Research report: Increasing returns to information technology. Information Systems Research. Vol. 13. No. 1. pp. 104-111.

(213) Kumar, R. L. [1997]: Understanding the value of information technology enabled responsiveness. Electronic Journal of Information Systems Evaluation. Vol. 1. No. 1. www.ejise.com/volume-1/ volume1-issue1/vol1-issue1-papers.htm

(214) Kumar, R. L. [2002]: Managing risks in IT projects: an option perspective. Information & Management. No. 40. 2002. pp. 63-74.

(215) Kumar, K. – Van Dissel, H. G. – Bielli, P. [2002]: The Merchant of Prato-Revisited: Toward a Third Rationality of Information Systems. MIS Quarterly. Vol. 22. No. 2. pp. 199-226.

(216) Lederer, A. L. – Mirchandani, D. A. – Sims, K. [2001]: The Search for Strategic Advantage from the World Wide Web. International Journal of Electronic Commerce. Vol. 5. No. 4. pp. 117-133.

(217) Lee, H. G. – Clark, T. H. [1996]: Intenational Journal of Electonic Commerce. Vol. 1. No. 1. pp. 127-149.

(218) Lee, S. – Kim, S. H. [2006]: A Lag Effect of IT Investment on Firm Performance. Information Resources Management Journal. Vol. 19. No. 1. pp. 43-69.

(219) Lee, Y. – Kozar, K. A. – Larsen, K. [2003]: The technology acceptance model: Past, present, and future. Communications of the Association for Information Systems. Vol. 12, No. 50. pp. 752-780.

(220) Lewis, W. – Agarwal, R. – Sambamurthy, V [2003]: Sources of influence on beliefs about information technology use: An empirical study of knowledge workers. MIS Quarterly. Vol. 27. No. 4. pp. 657-678.

(221) Liang, T. – You, J. – Liu, C. [2010]: A resource-based perspective on information technology and firm performance: a meta analysis. Industrial Management & Data Systems. Vol. 110. No. 8. pp. 1138-1158.

(222) Lichtenberg, F. R. [1995]: The output contributions of computer equipment and personnel: A firm level analysis. Economic Innovations New Technologies Vol. 3. No. 3-4. pp. 201–217.

(223) Lipsman, A, [2012]: For Display Ads, Being Seen Matters More than Being Clicked. comScore, Inc. http://www.comscore.com/Press_Events/Press_Releases/2012/4/For_Display_Ads_Being_Seen_Matters_More_than_Being_Clicked (2012.05.10.)

(224) Lo, B.W.N. – Sedhain, R.S. [2006]: How reliable are Website rankings? Implications for E-business advertising and Internet search. Issues in Information Systems, Vol. 7. No. 2. pp. 233-238.

(225) Lopes, A. B. – Galletta, D. [1997]: Resource-Based Theory and a Structural Perspective of Strategy Applied to the Provision of Internet Services. in: Proceedings of the Third Americas Conference on Information Systems, Indianapolis

(226) Loukis, E. – Soto-Acosta, P. – Pazalos, K. [2011]: Using structural equation modelling for investigating the impact of e-business on IKT and non-IKT assets, processes and business performance. Using structural equation modelling for investigating the impact of e-business on IKT and non-IKT assets, processes and business performance. Vol. 11. Published online: 29.03.2011.

(227) Loveman, G. [1988]: An Assessment of the Productivity Impact of Information Technologies. Working paper, Management in the 1990s, Sloan School, MIT

(228) Loveman, G. [1994]: An assessment of the productivity impact of information technologies. In: Information Technology and the Corporation of the 1990s: Research Studies, T. J. Allen and M. S. Scott Morton, Eds. Oxford University Press, Cambridge, U.K. pp. 84–110.

(229) Lucas, H. C. [1975]: The Use of an Accounting Information System, Action and Organizational Performance. The Accounting Review. October, 1975. pp. 735-746.

(230) Mahoney, J.T. – Pandian, J.R. [1992]: The Resource-Based View Within the Conversation of Strategic Management. Strategic Management Journal. Vol.15. No. 5. pp. 363–380.

(231) Majlender, P. [2003]: Strategic Investment Planning by Using Dynamic Decision Trees. Proceedings of the 36th Hawaii International Conference on System Sciences. January 06-09, 2003

(232) Majó,Z. – Veres, Z. [2004]: Felhasználói attitűdök tipizálhatósága az információtechnológiai térben. In: Tudástranszfer és információs társadalom. p. 71-83. BGF, Budapest

(233) Makadok R. [2001]: Towards a synthesis of resource-based and dynamic capability views of rent creation. Strategic Management Journal. Vol. 22. No. 5. pp. 387-402.

(234) Mallick, S. – Sharma, A. – Kumar, B. V. – Subrahmanya, S. V. [2005]: Web services in the retail industry. Sadhana. Vol. 30. No. 2-3. pp. 159–177.

(235) Malone, T. – Laubacher, R. [1998]: The dawn of the e.lance economy. Harvard Business Review. Vol. 76. No. 5. pp. 145-152.

(236) Martinez-Caro – Cegarra-Navarro [2010]: The impact of e-business on capital productivity. An analysis of the UK telecommunications sector. International Journal of Operations & Production Management Vol. 30. No. 5. pp. 488-507.

(237) Mata, F. J. – Fuerst, W. L. – Barney, J. B. [1995]: Information technology and sustained competitive advantage: A resource-based analysis. MIS Quarterly. Vol. 19. No. 4. pp. 488-505.

(238) McAfee, A. – Brynjolfsson, E. [2008]: Investing in the IT that makes competitive difference, Harvard Business Review, Vol. 86. No. 7-8. pp. 98-107.

(239) McKnight, D. H. – Choudhury, V. – Kacmar, C. [2002]: Developing and Validating Trust Measures for e-Commerce: An Integrative Typology. Information Systems Research. Vol. 13. No. 3. pp. 334–359.

(240) Melville, N. – Kraemer, K. – Gurbaxani, V. [2004]: Review: Information technology and organizational performance: An integratice model of IT business value. MIS Quarterly. Vol. 28. No. 2. pp. 283-322.

(241) Merono-Cerdan, A. L. – Soto-Acosta, P. [2007]: External Web content and its influence on organizational performance. European Journal of Information Systems. Vol. 16. No. 1. pp. 66–80.
(242) Mészáros, T. [2002]: A stratégia jövője – a jövő stratégiája. Aula Kiadó. Budapest
(243) Mezei, B. [2008]: Kreatív könyvelési motivációk a hazai mikro-, kis- és középvállalatoknál. Citigroup-versenydolgozat. Budapesti Corvinus Egyetem
(244) Miller, R. – Bharat, K. [1998]: SPHINX: A framework for creating personal, site-specific web crawlers. In: Proceedings of the 7th World-Wide Web Conference
(245) Miranda, F.J. – Banegil, T.M. [2004]: Quantitative evaluation of commercial Web sites: an empirical study of Spanish firms. International Journal of Information Management Vol. 24. No. 4. pp. 313–328.
(246) MIT [2012]: Erik Brynjolfsson. Personal webpage ont he MIT Sloan School of Management website. http://ebusiness.mit.edu/erik/bio.html (letöltve: 2012.05.18.)
(247) Mithas, S. – Ramasubbu, N. – Sambamurthy, V. [2011]: How Information Management Capability Influences Firm Performance. MIS Quarterly. Vol. 35. No. 1. pp. 237-256.
(248) Mojzes, I. – Talyigás, J. [2000]: Elektronikus kereskedelem. MTA Információtechnológiai Alapítvány, Budapest
(249) Molla, A. – Licker, P. S. [2005]: Perceived E-Readiness Factors in E-Commerce Adoption: An Empirical Investigation in a Developing Country. International Journal of Electronic Commerce. Vol. 10. No. 1. pp. 83–110.
(250) Molnár Bálint [2002]: Bevezetés a rendszerelemzésbe. A rendszerszervezés alapjai. Műszaki Könyvkiadó. Budapest
(251) Moore. G. C., – Benbasat, I. [1991]: Development of an instrument to measure the perceptions of adopting an information technology innovation. Information Systems Research. Vol. 2. No. 3. pp. 192-222.
(252) Móricz, P. [2004]: Élenjáró magyarországi internetes vállakozások fejlődése az üzleti modell nézőpontjából. Ph.D. értkezés. Budapesti Corvinus Egyetem. Gazdálkodástani Doktori Iskola
(253) MTI [2010]: Nem szakadt meg a kiskereskedelmi csökkenés. Népszava online. 2010.02.24. http://www.nepszava.hu/articles/article.php?id=262909#null (letöltve: 2012.05.10.)
(254) Murphy, K. E. – Simon, S. J. [2002]: Intangible benefits valuation in ERP projects. Information Systems Journal. Vol. 12. No. 4. pp. 301-320.

(255) Murphy, T. [2002]: Achieving Business Value from Technology. John Wiley & Sons. Hoboken

(256) Nagpaul, P. S. [2012]: Guide to Advanced Data Analysis using IDAMS Software. UNESCO http://www.unesco.org/webworld/idams/advguide/TOC.htm (2012.03.19.)

(257) Nardo, M. – Saisana, M. – Saltelli, A. – Tarantola, S. – Hoffman, A. – Giovannini, E. [2005]: Handbook on constructing composite indicators: Methodology and user guide. OECD Statistics Working Paper. STD/DOC(2005)3

(258) Nelson, R. – Winter, S. [1982]: An evolutionary theory of economic change. Cambridge. Belknap Press

(259) Nemeslaki, A. [2007]: E-business diffusion in Hungarian SMEs. Theory, Methodology, Practice Vol. 4. No. 1. pp. 53-60.

(260) Nemeslaki, A. – Aranyossy, M. [2005]: Az információtechnológia vállalati értékteremtésének elméletei, szemléletmódjai és módszerei. Vezetéstudomány. Vol. 36. No. 7-8. pp. 27-38.

(261) Nemeslaki, A. – Duma, L. – Szántai, T. [2004]: e-Business üzleti modellek. Adecom Rt., Budapest

(262) Nemeslaki András – Pocsarovszky Károly [2011]: Web Crawler Research Methodology. 22nd European Regional ITS Conference. 2011. September 18-21, Budapest

(263) Nemeslaki, A. – Pocsarovszky, K. [2012]: Supporting e-business research with web crawler methodology. Society and Economy. Vol. 34. No. 1. pp. 13-28.

(264) Nemeslaki, A. – Füleki, D. – Theiss-Balázs, Zs. [2011]: Modelling value delivery and organizational capability building in the hungarian web agency industry. 24th Bled eConference. June 12 - 15, 2011. Bled. Slovenia

(265) Newman, M. – Sabherwal, R. [1996]: Determinants of commitment to information systems development: longitudinal investigation. MIS Quarterly. Vol. 20. No. 1. pp. 23-54.

(266) Oliner, S. D. – Sichel, D. E. [1994]: Computers and output growth revisited: How big is the puzzle? Brooking Papers on Economic Activity. No. 2. pp. 273-317.

(267) Oliner, S. D. – Sichel, D. E. [2000]: The resurgence of growth in the late 1990s: Is information technology the story? Journal of Economic Perspectives. Journal of Economic Perspectives. pp. 3-22.

(268) Orlikowski, W. J. – Iacono, C. S. [2001]: Desperately Seeking the ’IT’ in IT Research. A Call to Theorizing the IT Artifact. Information Systems Research Vol. 12. No.2. pp. 121-134.

(269) Palepu, K. G. – Healey, P. M. – Peek, Erik [2010]: Business Analysis and Valuation. IFRS edition. Text and Cases. Second Edition. Cengage Learning EMEA. Andover

(270) Palmer, J.W. [2002]: Web Site Usability, Design, and Performance Metrics. Information Systems Research. Vol. 13. No. 2. pp. 151-167.

(271) Panayi, S. – Trigeorgis, L. [1998]: Multi-stage real options: The cases of information technology infrastructure and international bank expansion. The Quarterly Review of Economics and Finance. Vol. 38. Special Issue. pp. 675-692.

(272) Patas, J. – Bartenschlager, J. – Goeken, M. [2012]: Resource-Based View in Empirical IT Business Value Research--An Evidence-Based Literature Review. 2012 45th Hawaii International Conference on System Sciences. hicss. pp. 5062-5071.

(273) Pelikan, P. [1989]: Evolution, economic competence, and the market for corporate control. Journal of Economic Behavior & Organization. Vol. 12, No. 3. pp. 279-303

(274) Penrose, E.T. [1959]: The Theory of the Growth of the Firm. New York. Wiley

(275) Peteraf, M.A. [1993]: The Cornerstones of Competitive Advantage: A Resource-Based View. Strategic Management Journal. Vol. 14. No. 3. pp. 179–191.

(276) Peteraf, M.A. – Barney, J. [2003]: Unraveling The Resource-Based Tangle. Managerial and Decision Economics. Vol. 24. No. 4. Integrating Management and Economic Perspectives on Corporate Strategy. pp. 309-323.

(277) Piccoli, G. – Ives, B. [2005]: Review: IT-Dependent Strategic Initiatives and Sustainable Competitive Advantage: A Review and Synthesis of the Literature. MIS Quarterly. Vol. 29. No. 4. pp. 747-775.

(278) Pintér, R. – Csótó, M. – Holczer, M. – Kis, G. – Molnár, Sz. – Rab, Á. – Székely, L. [2007]: A magyar információs társadalom fejlődése az elmúlt tíz évben: intézményépítés, infrastruktúrafejlesztés és kultúraváltás. Magyar országjelentés 1998-2008. BME Információs Társadalom- és Trendkutató Központ és GKIeNET.

(279) Porter, M. [1985]: Competitive Advantage: Creating and Sustaining Superior Performance. The Free Press. New York

(280) Porter, M. E. [2001]: Strategy and the Internet. Harvard Business Review. March 2001. pp. 63-78.

(281) Potter, K. – Smith, M. – Guevara, J. K. – Hall, L. – Stegman, E. [2010]: IT Metrics: IT Spending and Staffing Report, 2010. 2010. január 22. ID Number: G00173877

(282) Powell, T. C. – Dent-Micallef, A. [1997]: Information Technology as Competitive Advantage: The Role of Human, Business, and Technology Resources. Strategic Management Journal. Vol. 18. No. 5. pp. 375-405.

(283) Prahalad, C.K. – Hamel, G. [1990]: The Core Competence of the Organization. Harvard Business Review. Vol. 68. pp. 79-91.

(284) Pratt, S. P. [1992]: Üzletértékelés – módszertan és gyakorlat. Kossuth Könyvkiadó. Budapest

(285) Priem, R. L. – Butler, J. E. [2001]: Is the resource-based "view" a useful perspective for strategic management research? Academy of Management Review. Vol. 26. No. 1. pp. 22-40.

(286) Quick, P. D. – Goldschmid, M. T. [2002]: FASB Statements 141/142 and the Business Economists – Where, oh where, have my intangibles gone? Business Economics. January 2002. pp. 61-63.

(287) Rappaport, A. [2002]: A tulajdonosi érték. Alinea Kiadó. Budapest

(288) Ray, G. – Muhanna, W. A. – Barney, J. B. [2001]: Information Technology and Competitive Advantage: A Process-Oriented Assessment. Working Paper. University of Texas at Austin

(289) Ravichandran, T. – Lertwongsatien, C. [2002]: Impact of Information Systems Rresources and Capabilities on Firm Performance: A Resource-Based Perspective. In: Applegate, L. – Galliers, R. – DeGross, J. I. [2002]: Proceedings of 23rd International Conference on Information Systems. Barcelona. Spain. pp. 577-582.

(290) Reilly, R. F. [1998]: The valuation of proprietary technology. Management Accounting. Vol. 79. pp.45–49.

(291) Remenyi, D. – Money, A. – Twite, A. [1993]: A Guide to Measuring and Managing IT Benefits. NCC Blackwell. Manchester.

(292) Reszegi L. [2004]: A tulajdonosi érték növelése – a vállalati teljesítménymérés koordináta-rendszerének néhány problémája. Vezetéstudomány. Vol. 35. No. 7-8. pp. 4-15.

(293) Ross, J. W. – Beath, C. M. – Goodhue, D. L. [1996]:"Develop Long-term Competitiveness Through IT Assets. Sloan Management Review. Vol. 38. No.1. pp. 31-42.

(294) Ross, S. A. – Westerfield, R. W. [1988]: Corporate Finance. Times Mirror/Mosby College Publishing. St. Luis

(295) Rumelt, R. P. [1984]: Towards a strategic theory of the firm. In: Lamb, R. [ed.]: Competitive Strategic Management. Prentice-Hall. Englewood Cliffs. pp. 556-570.

(296) Salamonné Huszty Anna [2011]: A pénzügyi-gazdasági válság hatása a magyarországi kis- és középvállalkozások életpályájára, rövidtávú és stratégiai döntéseire. Competitio. Vol. 10. No. 1. pp. 29-43.

(297) Sambamurthy, V. – Bharadvwaj, A. – Grover, V. [2003]: Shaping Agility Through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. MIS Quarterly. Vol. 27. No. 2. pp. 237-263.

(298) Sanchez, R. – Heene, A. – Thomas, H. [1996]: Introduction: Towards the Theory and Practice of Competence-Based Competition. Pergamon Press. Oxford

(299) Santhanam, R. – Hartono, E. [2003]: Issues in linking information technology capability to firm performance. MIS Quarterly. Vol. 27 No. 1. p. 125-153.

(300) SeoQuake [2010]: SeoQuake Guide. http://www.seoquake.com/guide.php?sln=en&browse=2#l_parameters (2010.01.31.)

(301) Shkapenyuk, V. – Suel, T. [2002]: Design and implementation of a high performance distributed web crawler. In: Proceedings of the 18th International Conference on Data Engineering [ICDE], pp. 357-368, San Jose, California. IEEE CS Press

(302) Simon, J. – Pusztai, T. – Jenes, B. – Neumann-Bódi, E. (2008): A mobiltelefon vásárlásával és használatával kapcsolatos magatartás vizsgálata az egyéni mobilvásárlók körében. Kutatási jelentés. BCE MMI. Budapest

(303) Smit, H. T. J. – Trigeorgis, L. [2004]: „Strategic Investment: Real Options and Games", Princeton University Press

(304) Smith, D.J. – Schuff, D. – St. Louis, R. [2002]: Managing your total IT cost of ownership, Communications of the ACM, Vol. 45. No. 1. pp. 101–106.

(305) Soh, C. – Markus, M. L. [1995]: How IT Creates Business Value: A Process Theory Synthesis. Proceedings of the 16th International Conference on Information Systems. Amsterdam. p. 29-41.

(306) Solow, R. M. [1987]: We'd better watch out. New York Times Book Review. 1987.07.12.

(307) Somogyi, M. [2009]: A Vállalati Versenyképesség Modellje (VVM) mint a vállalati versenyképesség mérésének új módszere. Ph.D értekezés. Miskolci Egyetem. Vállalatelmélet és -gyakorlat Doktori Iskola

(308) Soto-Acosta, P. – Loukis, E. – Colomo-Palacios, R. – Lytras, M. [2010]: An empirical research of the effect of internet-based innovation on business value. African Journal of Business Management Vol. 4. No. 18. pp. 4096-4105.

(309) Soto-Acosta, P. – Merono-Cerdan [2008]: Analyzing e-business value creation from a resource-based perspective. International Journal of Information Management Vol. 28. No. 1. pp. 49–60.

(310) Standish Group [2009]: CHAOS Summary 2009. Standish Group Report. http://www1.standishgroup.com/newsroom/chaos_2009.php (2010.08.05.)

(311) Strassmann, P. A. [1985]: Information Payoff: The Transformation of Work in the Electronic Age. Free Press. New York

(312) Strassmann, P.A. [1990]: The Business Value of Computers. The Information Economics Press. New Canaan

(313) Subramani, M. – Walden, E. [2001]: The Impact of E-Commerce Announcements on the Market Value of Firms. Information System Research. Vol. 12. No. 2. pp. 135-154.

(314) Szatmári, F. [2011]: Közgazdasági értékteremtés vizsgálata a hazai vállalkozások infokommunikációs beruházásainál. Doktori (PhD) értekezés. Kaposvári Egyetem. Gazdaságtudományi Kar

(315) Száz, J. [2011]: Valószínűség, esély, relatív súlyok – Opciók és reálopciók. Hitelintézeti Szemle. Vol. 10. No. 4. pp. 336-348.

(316) Szirmai, P. – Nemeslaki, A. – Csapó, K. – Csóri, B. – Pethő, A. I. [2004]: KKV-k digitális tevékenysége és támogatáspolitikai eszközei. Kutatási jelentés. Gazdasági és Közlekedési Minisztérium. GKM 2528/2003, Azonosító VIII.2./2004. Budapest

(317) Tallon, P. P. – Kauffman, R. J. – Lucas, H. C. – Whinston, A. B. – Zhu, K. [2002]: Using real option analysis for evaluating uncertain investments in information technology: Insights from the ICIS 2001 debate. Communications of the Association for Information Systems, Vol. 9. pp.136-167.

(318) Tallon, P. – Kraemer, K. L. – Gurbaxani, V. [2000]: Executives perspectives on the business value of information technology. Journal of Management Information Systems. Vol.16. No. 4. pp. 145–173.

(319) Tambe, P. – Hitt, L. – Brynjolfsson, E. [2011]: The Price and Quantity of IT-Related Intangible Capital. Proceedings of the Thirty Second International Conference on Information Systems, Shanghai 2011. Economics and Value of IS.

(320) Taudes, A. – Feurstein, M. – Mild, A. [2000]: Options Analysis of Software Platform Decisions: A Case Study. MIS Quarterly. Vol. 24. No. 2. pp. 227-243.

(321) Thatcher, M. E. – Pingry, D. E. [2004]: Understanding the business value of information technology investments: Theoretical evidence from alternative market and cost structures. Journal of Management Information Systems. Vol. 21. No. 2. pp. 61-85.

(322) Thomas, R. [2001]: Business value analysis: Coping with unruly uncertainty. Strategy & Leadership. Vol. 29. No. 2. pp. 16-23.

(323) Thompson. R. L. – Higgins. C. A. – Howell, J. M. [1991]: Personal Computing: Toward a Conceptual Model of Utilization. MIS Quarterly. Vol.15 No.1. pp. 124-143.

(324) Tirole, J. [2005]: The Theory of Corporate Finance. Princeton University Press. Princeton

(325) Torkzadeh, G. – Dhillon, G. [2002]: Measuring Factors that Influence the Success of Internet Commerce. Information Systems Research. Vol. 13. No. 2. pp. 187-204.

(326) Triplett, J. E. [1999]: The Solow Productivity Paradox: What Do Computers Do to Productivity? Canadian Journal of Economics. Vol. 32. No. 2. pp. 309-334.

(327) Turban, E. – King, D. – Lee, J. – Viehland, D. [2004]: Electronic commerc: A managerial perspective. Prentice Hall. New Jersey

(328) Turner, A. [2001]: A tulajdonosi érték maximalizálásának lehetőségei Magyarországon. PhD értekezés. Budapesti Közgazdaságtudományi és Államigazgatási Egyetem. Gazdálkodástani PhD program

(329) Turner, J. [1985]: Organizational Performance, Size and The Use of Data Processing Resources. Working Paper No. 58., Center for Research in Information Systems, New York University

(330) Ulbert J. [1994]: A vállalat értéke. Janus Pannonius Tudományegyetem. Pécs

(331) Upton, W. S. Jr. [2001]: Business and financial reporting. Challenges from the New Economy. Financial Accounting Series. No. 219 – A Financial Accounting Standards Board of the Financial Accounting Foundation

(332) Urbán, Zs. – Takács, N. – Nagy P. – Trestyén, A. – Szalay, K. – Nemeslaki, A. [2007]: Az E-business üzleti modellek és a támogató IT infrastruktúra kapcsolata.

A hazai innovatív e-kereskedelmi modellek feltárása, típusainak meghatározása és a hazai kis és közép vállalatok e-business adaptációjának elemzése című Innovációs Kutatás az Inter Európa Bank számára. 1. tanulmánykötet

(333) Vadapalli, A. – Ramamurthy, K. [1997]: Business use of the Internet: An alalyical framework and exploratory case study. International Journal of Electronic Commerce. Vol. 2. No. 2. pp. 71-95.

(334) van Putten, A. B. – MacMillan, I. C. [2004]: Making real options really work. Harvard Business Review. December 2004. pp. 134-141.

(335) Varian, H. [2003]: Does IT Matter? Harvard Business Review, July 2003 , p. 112

(336) Venkatesh, V. – Davis, F. D. [2000]: A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science. Vol. 45. No. 2. pp. 186-204.

(337) Venkatesh, V. – Morris, M. G. – Davis, G. B. – Davis, F. D. [2003]: User acceptance of information technology: Toward a unified view. MIS Quarterly. Vol. 27. No. 3. pp. 425-478.

(338) Venkatesh, V. – Thong, J. – Xu, X. [2012]: Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. MIS Quarterly, Vol. 36. No. 1. pp. 157-178.

(339) Virág, M. [1996]: Pénzügyi elemzés, csődelőrejelzés. Kossuth Könyvkiadó. Budapest

(340) Virág, M. – Fiáth, A. [2010]: Financial Ratio Analysis. AULA Kiadó. Budapest.

(341) Wade, M. – Hulland, J. [2004]: Review: The resource-based view and information system research: Review, extention, and suggestions for future research. MIS Quarterly. Vol. 28. No. 1. pp. 107-142.

(342) Wade, M. – Piccoli, G. – Ives, B. [2011]: IT-dependent strategic initiatives and sustained competitive advantage: a review, synthesis, and an extension of the literature. Chapter 14. in: Galliers, R. D. – Currie, W. [2011]: The Oxford Handbook of Management Information Systems: Critical Perspectives and New Directions. Oxford University Press

(343) Wan, Z. – Fang, Y – Wade, M. [2007]: A Ten-Year Odyssey of the 'IS Productivity Paradox' - A Citation Analysis (1996-2006). Americas Conference on Information Systems. AMCIS 2007 Proceedings. Paper 437. http://aisel.aisnet.org/amcis2007/437 (letöltve 2012.01.29.)

(344) Watjatrakul, B. [2005]: Determinants of IS sourcing decisions: A comparative study of transaction cost theory versus the resource-based view. The Journal of Strategic Information Systems. Vol. 14. No. 4. pp. 389-415.

(345) WebShop-Experts [2012]: Nagy webáruház felmérés 2012. WebShop-Experts Kft. http://www.webshopexperts.hu/downloads/nagy_webaruhaz_felmeres_2012.pdf (letöltve: 2012.05.22.)

(346) Weill, P. [1992]: The Relationship Between Investment in Information Technology and Firm Performance: A Study of the Valve Manufacturing Sector. Information Systems Research. Vol. 3. No. 4. pp. 307-331.

(347) Wernerfelt, B. [1984]: A Resource-Based View of the Firm.Strategic Management Journal, Vol. 5. No. 2. pp. 171-180.

(348) Wernerfelt, B. [1995]: A Resource-Based View of the Firm – Ten Years After. Strategic Management Journal, Vol. 16. No. 3. pp. 171-174.

(349) Wheeler, B.C. [2002]: NEBIC: A Dynamic Capabilities Theory for Assessing Net-Enablement. Information Systems Research. Vol. 13. No. 2. pp.125-146.

(350) Williamson, O. E. [1981]: The economics of organization: The transaction cost approach. American Journal of Sociology. Vol. 87. No. 3. pp. 548.

(351) Wimmer, Á. [2000]: A vállalati teljesítménymérés az értékteremtés szolgálatában. A működési és a pénzügyi teljesítmény kapcsolatának vizsgálata. Doktori (Ph.D.) értekezés.Tézisgyűjtemény. Budapesti Közgazdaságtudományi és Államigazgatási Egyetem. http://phd.okm.gov.hu/disszertaciok/tezisek/2001/tz_eredeti137.htm (2010.08.16.)

(352) Wimmer, Á. [2002]: Üzleti teljesítménymérés. Budapesti Közgazdaságtudományi és Államigazgatási Egyetem. Vállalatgazdaságtan Tanszék. 17. sz. műhelytanulmány. HU ISSN 1786-3031

(353) Wonseok, O. – Pinsonneault, A. [2007]: On the Assessment of the Strategic Value of Information Technologies: Conceptual and Analytical Approaches. MIS Quarterly. Vol. 31. No. 2. pp. 239-265.

(354) Woods, J. [2010]: Gartner Interviews Andrew McAfee on Why Investment in Enterprise Applications and ERP Matters. Garner, Inc. ID Number: G00201488. 3. August

(355) Zahra, S.A. – George,G. [2002]: The Net-Enabled Business Innovation Cycle and the Evolution of Dynamic Capabilities. Information Systems Research. Vol. 13. No. 2. pp. 147-150.

(356) Zhu, K. [2004]: The Complementarity of Information Technology Infrastructure and E-Commerce Capability: A Resource-Based Assessment of Their Business Value. Journal of Management Information Systems. Vol. 21. No. 1. pp. 167-202.

(357) Zhu, K. – Kraemer, K. L. [2002]: e-Commerce Metrics for net-enhanced organisations: Assessing the value of e-commerce to firm performance in the manufacturing sector. Information System Research. Vol. 13. No. 3. pp. 275-295.

(358) Zhu, K. – Kraemer, K. L. – Xu, S. [2003]: Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors. European Journal of Information Systems. No. 12. pp. 251–268.

(359) Zhu, K. – Kraemer, K. L. – Xu, S. – Dedrick, J. [2004]: Information Technology Payoff in E-Business Environments: An International Perspective on Value Creation of E-Business in the Financial Services Industry. Journal of Management information Systems, Vol. 21. No. 1. pp. 17-54.

(360) Zhu, K. – Kraemer, K. L. [2005]: Post-Adoption Variations in Usage and Value of E-Business by Organizations: Cross-Country Evidence from the Retail Industry. Information Systems Research. Vol. 16. No. 1. pp. 61–84.

(361) Zhuang, Y. – Lederer, A.L. [2003]: An Instrument for Measuring the Business Benefits of E-Commerce Retailing. International Journal of Electronic Commerce. Vol. 7. No. 3. pp. 65-99.

(362) Zhuang, Y. – Lederer, A.L. [2006]: A resource-based view of electronic commerce. Information & Management. Vol. 43. No. 2. pp. 251–261.

Related publications of the author

(1) Aranyossy Márta [2006]: Towards Dynamic IS Strategic Map. IT Business Value from Financial, Process and Network Perspectives. CEMS Doctoral Consortium „Innovation through Enterprise Networks and ICT", Piliscsaba, November 2nd-4th 2006.

(2) Aranyossy, M. [2007a]: Információtechnológiai befektetési döntések: A reálopciós megközelítés helye az értékelésben. (Information Technology Investments: The Role of the Real Option Approach) XXVIII. OTDK Doktorandusz Konferencia. 2007. április 25-27., Miskolc.

(3) Aranyossy, M. [2007b]: Business Value of IT Investment: The Case of a Low Cost Airline's Website. 20th Bled eConference, eMergence: Merging and Emerging Technologies. 2007. június 4-6., Bled, Szlovénia. http://domino.fov.uni-mb.si/proceedings

(4) Aranyossy, M. [2010]: Szorzószámos értékelés információtechnológiai iparágakban. (Valuation by Multiples in the ICT Industries) Vezetéstudomány. No. 11. pp. 44-56.

(5) Aranyossy, M. [2010a]: Mapping the business value of information technology investments. Spring Wind 2010. 2010. március 25-27., Pécs

(6) Aranyossy M. [2010b]: Mi az, ami megtérül és hogyan számoljuk ki? Üzleti tervezés és értékelés az e-kereskedelem kapcsán. E-kereskedjünk-e? (How Do We Make Profit and How Do We Calculate It? Business Planning and Valuation for E-Commerce Enterprises) Szövetség az Elektronikus Kereskedelemért Egyesület őszi konferenciája. 2010. november 17. Budapest

(7) Aranyossy, M. [2011]: Resource-based Analysis of E-commerce Business Value. NITIM Doctoral Consortium „Networked Innovation – necessity, challenges and research questions ", Konstanz. Germany. April 12-15. 2011

(8) Aranyossy, M. [2011]: Az információtechnológia üzleti értékének nyomában. (Information Technology Business Value – A Literature Review) Hitelintézeti Szemle. Vol. 10. No. 6. pp. 554-574.

(9) Aranyossy, M. – Csiszár, D. [2004]: ROI Rationale: Measuring ROI for Your Deployment. Plumtree Odyssey 2004. Hollywood. Florida. USA. 11-14. October 2004.

(10) Aranyossy, M. – Juhász, P. [2012]: Értékteremtés e-kereskedelemmel: kitörési lehetőség a recesszió sújtotta magyar kiskereskedelemben? (Value Creation by E-Commerce – An Opportunity in the Hungarian Retail Recession) Kiadás előtt álló kézirat.

(11) Aranyossy, M. – Nemeslaki, A. [2005]: Információtechnológiai beruházások megtérülésének modellezése: Problémák és megoldások egy vállalati portál példáján. (IT Investment ROI Modeling: Problems and Solutions for the Case of Enterprise Portals) Vezetéstudomány. Vol. 36. No. 9. pp. 24-36.

(12) Aranyossy, M. – Szutorisz, G. [2005]: E-payment, E-invoicing, E-contracting – Central and Eastern European Regional Overview. Kutatási jelentés. BCE, E-business Kutatóközpont, Budapest

(13) Aranyossy, M. – Szutorisz, G. – Gólya, Z. [2006]: Business Value of wizzair.com – Website Valuation and Benchmarking. Kutatási jelentés. BCE, E-business Kutatóközpont. Budapest

(14) Nemeslaki, A. – Aranyossy, M. [2005]: Az információtechnológia vállalati értékteremtésének elméletei, szemléletmódjai és módszerei. (Theories, Views and Methodologies of IT Value Creation) Vezetéstudomány. Vol. 36. No. 7-8. pp. 27-38.

Annexes

Annex 1: E-commerce capabilities and crawler keywords

Capability group	Capability (Level 2)	Keywords	Capability (Level 1)	Code
Information	product information	products, services, catalogue, product list, our prices, price list	products, services	I1_1
			prices	I1_2
	search	search, searching, product searcher, product search, detailed search	search	I2_1
	virtual experience	website tour, virtual trial, 360º view, 3d view	virtual experience	I3_1
	shop finder	store finder, our stores, store selection, shop finder, our shops, shop selection, map	stores	I4_1
			map	I4_2
	support	FAQ, frequently asked questions, help, customer service	FAQ	I5_1
			customer service	I5_2
	company information	availability, our availabilities, contact, about us, about our firm, our firm, introduction, company information, company info, map, tax number	contacts	I6_1
			company information	I6_2
			tax ID	I6_3
	language	English, in English	in English	I7_1
	revisit	newsletter, set as homepage, make … my homepage, add to favourites	newsletter	I8_1
			set as homepage	I8_2
			add to favorites	I8_3
Transaction	online shopping	online shopping, e-shop, cart, shopping basket, webstore, webshop, e-shop	webshop	T1_1
	order tracking	tracking, monitoring, order tracking, order tracker, my orders, recent orders, purchases	order tracking	T2_1
	money back	guarantee, warranty, money back	guarantee	T3_1
			warranty	T3_2
			money back	T3_3
	security	disclaimer, legal statement, security, shipping terms, buying conditions, copyright, contract terms, business policy, privacy	legal note	T4_1
			copyrights	T4_2
			terms of contract	T4_3
			privacy	T4_4
	collection	takeover in store, collection in our shop, collection in our store	in-store pickup	T5_1
	shipping	shipping, shipping modes, courier, home delivery, mail order, cash on delivery, collection in person, collection	delivery options	T6_1
			home delivery	T6_2
			cash on delivery	T6_3

Capability group	Capability (Level 2)	Keywords	Capability (Level 1)	Code
		in our shop, collection in our store		
	payment	payment modes, transfer, cash on delivery, payment to bank account, cash, cash payment, bank card, credit card, PayPal, payment by card, payment by instalments, consumer credit	payment options	T7_1
			bank transfer	T7_2
			cash	T7_3
			pay by card	T7_4
			PayPal	T7_5
			commercial credit	T7_6
Interaction	realtime support	online help, instant messaging, skype, msn, helpdesk, contact our staff	online help	N1_1
			instant messaging	N1_2
	after-sale support	product support, servicing, complaints, gurantee, customer service	product support	N2_1
			service	N2_2
			reclamation	N2_3
			customer service	N2_4
	product review	review, reviews, please review, feedback, opinion	review	N3_1
	virtual community	forum, chat, blog, public opinion poll, online users	forum	N4_1
			chat	N4_2
			blog	N4_3
			public opinion poll	N4_4
			online users	N4_5
Customization	registration	register, registration, I register, sign in, password, login	registration	S1_1
	my account	access, profile, modify data	personal data	S2_1
	configuration	settings, customise, favourites, my favourites	favourites	S3_1
			configuration	S3_2
	favorites	favorites	favorites	S4_1
	my pages	personal pages	personal pages	S5_1

Annex 2: Crawler keywords and their types

The keyword in the table are in Hungarian, the language of the crawler-based data collection. For the keyword in English, please check Annex 1.

Keyword	search only in links, menu items and buttons	search everywhere
termékek	+	
szolgáltatások	+	
katalógus	+	
terméklista	+	
áraink	+	
árlista	+	
keres	+	
keresés	+	
kereső	+	
termékkereső	+	
termék keresés	+	
részletes keresés	+	
értékel	+	
értékelés	+	
értékelések	+	
értékeljen	+	
visszajelzés	+	
vélemény	+	
bejárás	+	
virtális kipróbálás	+	
360 nézet	+	
3d nézet	+	
áruházkereső	+	
áruházaink		+
áruház választása	+	
üzletkereső	+	
üzleteink		+
üzlet választása	+	
térkép		+
GYIK	+	
FAQ	+	
gyakran ismételt kérdések		+
segítség	+	
ügyfélszolgálat		+
elérhetőség		
elérhetőségeink		+
kapcsolat	+	
magunkról	+	
rólunk	+	
cégünkről	+	
cégünk	+	
bemutatkozás	+	
céginformáció	+	
céginfó	+	
angolul	+	
angol nyelven	+	
hírlevél	+	
beállítás kezdőlapként	+	
legyen a kezdőlapom	+	
kedvencekhez	+	
online vásárlás	+	
e-bolt	+	
kosár	+	
bevásárlókosár	+	
webáruház	+	
webshop	+	
e-shop	+	
nyomon követés	+	
figyelemmel kísérés	+	
rendeléskövetés	+	
rendeléskövető	+	
rendeléseim	+	
korábbi rendelések	+	
vásárlások	+	
hozzáférés	+	
profil	+	

Keyword	search only in links, menu items and buttons	search everywhere
adatok módosítása	+	
garancia		+
jótállás		+
visszatérítés		
jogi nyilatkozat		+
jogi állásfoglalás		+
biztonság	+	
szállítási feltételek		+
vásárlási feltételek		+
adószám		
szerzői jogok		+
szerződési feltételek		+
üzletszabályzat		+
adatvédelem		+
személyes átvétel		
átvétel boltunkban		
átvétel üzletünkben		
szállítás	+	
szállítási módok		+
futár		
házhozszállítás		
csomagküldő szolgálat		
postai utánvét		
személyes átvétel		
átvétel boltunkban		
átvétel üzletünkben		
bolti átvétel		
átvétel üzletünkben		
fizetési módok		+
átutalás		
utánvét		
banki befizetés		
készpénz		
készpénzes fizetés		
bankkártya		
hitelkártya		
PayPal		
kártyás fizetés		
részletfizetés		+
áruhitel		+
beállítás	+	
testreszabás	+	
kedvencek	+	
kedvenceim	+	
regisztrál	+	
regisztráció	+	
regisztrálás	+	
regisztrálok	+	
bejelentkezés	+	
személyre szabott ajánlatunk		+
saját oldalak	+	
online segítség		+
azonnali üzenetkezelés		+
skype		+
msn		+
helpdesk	+	
kérdezze munkatársunkat	+	
terméktámogatás		+
szerviz		+
reklamáció		+
vevőszolgálat		+
fórum		+
chat		+
blog		+
közvéleménykutatás	+	
online felhasználók		+

Annex 3. Methods of calculating corporate performance indicators

Name of variable	**Calculation method** [based on Virág – Fiáth, 2010; Brealey – Myers, 1999, p. 464 and Turner, 2004, p. 31 but mostly calculated with EBIT to avoid bias]
Sales growth	$\frac{Sales\ revenue_i}{Sales\ revenue_{i-1}} - 1$ where i is the given year
Market share growth	$\frac{Sales\ revenue_i / \sum_{j=1}^{n} Sales\ revenue_{j,i}}{Sales\ revenue_{i-1} / \sum_{j=1}^{n} Sales\ revenue_{j;i-1}} - 1$ where i is the given year and j is the number of the given firm
ROIC (Return on Invested Capital)	$\frac{Operating\ profit}{\frac{Interest-bearing\ liabilities_i + Interest-bearing\ liabilities_{i-1}}{2} + \frac{Equity_i + Equity_{i-1}}{2}}$ where i is the given year
CFROI (Cash Flow Return on Investment)	$\frac{Operating\ profit + Amortization \pm Changes\ in\ Net\ working\ capital \pm Changes\ in\ Non-current\ Assets}{\frac{Interest-bearing\ liabilities_i + Interest-bearing\ liabilities_{i-1}}{2} + \frac{Equity_i + Equity_{i-1}}{2}}$ where i is the given year
ROE (Return on Equity)	$\frac{Operating\ profit}{\frac{Equity_i + Equity_{i-1}}{2}}$ where i is the given year
ROA (Return on Assets)	$\frac{Üzemi\ eredmény}{\frac{Eszközök_i + Eszközök_{i-1}}{2}}$
Sales per employee	$\frac{Sales\ revenue}{Nember\ of\ employees}$
Profit margin	$\frac{Operating\ profit}{Sales}$
Inventory turnover	$\frac{Sales\ revenue}{\frac{Inventories_i + Inventories_{i-1}}{2}}$ where i is the given year

Comments and some additional calculations:

- The denominator, which must be the invested capital, in the ROIC and CFROI indicators can be calculated as follows: “total invested capital can be calculated as the the sum of shareholders’ equity (plus quasi-equity items like deffered taxes) and interest bearing liabalities. [Copeland et al., 1999, p. 192]. Since in this case we do not have information about either investments related to operations or quasi-equity items, the invested capital is defined as the sum of average resource values presented in the table.
- Where there were no data available about supplier obligations for determining the denominator of the ROIC and CFROI indicators, we used the annual industry supplier average / material expenditures ratio (based on 20 firms, in 2009: 0.1596739; in 2010: 0.1555251) to estimate it.
- The size of the entire market in 2008: HUF 42 291 193 000
- The size of the entire market in 2009: HUF 37 906 081 000
- The size of the entire market in 2010: HUF 38 679 360 000

Annex 4. Frequency of e-commerce keywords by method of data collection, 2009

		manual data		crawler-based data collection		total (% of webpages)		total (% of the sample)
		pieces	%	pieces	%	pieces	%	%
Information	Products, services	13	33%	63	48%	76	44%	41%
	Prices	17	43%	17	13%	34	20%	18%
	Search	5	13%	67	51%	72	42%	39%
	Stores	5	13%	1	1%	6	3%	3%
	Map	2	5%	20	15%	22	13%	12%
	FAQ	0	0%	5	4%	5	3%	3%
	Help desk	0	0%	8	6%	8	5%	4%
	Contacts	24	60%	83	63%	107	62%	57%
	Company information	22	55%	54	41%	76	44%	41%
	Tax ID	0	0%	4	3%	4	2%	2%
	Newsletter	5	13%	25	19%	30	17%	16%
	Set as homepage	0	0%	2	2%	2	1%	1%
	Add to favorites	0	0%	13	10%	13	8%	7%
Interaction	Online help	1	3%	2	2%	3	2%	2%
	Instant messaging	1	3%	7	5%	8	5%	4%
	Product support	0	0%	1	1%	1	1%	1%
	Service	10	25%	38	29%	48	28%	26%
	Customer services	0	0%	5	4%	5	3%	3%
	Product review	0	0%	4	3%	4	2%	2%
	Forum	1	3%	3	2%	4	2%	2%
	Chat	0	0%	5	4%	5	3%	3%
	Blog	0	0%	11	8%	11	6%	6%
	Online users	0	0%	1	1%	1	1%	1%
Transaction	Webshop	11	28%	45	34%	56	33%	30%
	Order tracking	0	0%	1	1%	1	1%	1%
	Guarantee	1	3%	20	15%	21	12%	11%
	Warranty	1	3%	2	2%	3	2%	2%
	Legal note	0	0%	9	7%	9	5%	5%
	Copyright	0	0%	2	2%	2	1%	1%
	Terms of contract	1	3%	7	5%	8	5%	4%
	Privacy	0	0%	15	11%	15	9%	8%
	In-store pickup	0	0%	1	1%	1	1%	1%
	Delivery options	0	0%	10	8%	10	6%	5%
	Home delivery	1	3%	6	5%	7	4%	4%
	Commercial credit	7	18%	5	4%	12	7%	6%
Customization	Registration	4	10%	44	33%	48	28%	26%
	My account	0	0%	4	3%	4	2%	2%
	Configuration	0	0%	7	5%	7	4%	4%
	My pages	0	0%	1	1%	1	1%	1%

Annex 5. Frequency of e-commerce keywords by size, 2009

		micro enterprises	small enterprises	total
	N:	138	48	187
Information	Products, services	39%	44%	41%
	Prices	22%	8%	18%
	Search	36%	46%	39%
	Stores	3%	4%	3%
	Map	12%	10%	12%
	FAQ	4%	0%	3%
	Help desk	4%	6%	4%
	Contacts	56%	63%	57%
	Company information	41%	42%	41%
	Tax ID	3%	0%	2%
	Newsletter	14%	23%	16%
	Set as homepage	1%	0%	1%
	Add to favorites	8%	4%	7%
Interaction	Online help	2%	0%	2%
	Instant messaging	4%	4%	4%
	Product support	0%	2%	1%
	Service	25%	27%	26%
	Customer services	3%	2%	3%
	Product review	1%	4%	2%
	Forum	1%	4%	2%
	Chat	2%	4%	3%
	Blog	4%	13%	6%
	Online users	1%	0%	1%
Transaction	Webshop	31%	27%	30%
	Order tracking	1%	0%	1%
	Guarantee	11%	13%	11%
	Warranty	1%	2%	2%
	Legal note	6%	2%	5%
	Copyright	1%	2%	1%
	Terms of contract	4%	4%	4%
	Privacy	8%	8%	8%
	In-store pickup	1%	0%	1%
	Delivery options	6%	4%	5%
	Home delivery	4%	4%	4%
	Commercial credit	8%	2%	6%
Customization	Registration	25%	29%	26%
	My account	3%	0%	2%
	Configuration	4%	4%	4%
	My pages	1%	0%	1%

Annex 6. Frequency of e-commerce keywords by business model, 2009

(significant differences with bold, α<5%)

		traditional retailers	mixed sales model	total
	N:	118	69	187
Information	**Products, services**	**35%**	**51%**	41%
	Prices	15%	23%	18%
	Search	**31%**	**52%**	39%
	Stores	**1%**	**7%**	3%
	Map	**17%**	**3%**	12%
	FAQ	3%	1%	3%
	Help desk	3%	7%	4%
	Contacts	54%	62%	57%
	Company information	36%	49%	41%
	Tax ID	3%	0%	2%
	Newsletter	**8%**	**30%**	16%
	Set as homepage	1%	1%	1%
	Add to favorites	8%	6%	7%
Interaction	Online help	2%	1%	2%
	Instant messaging	3%	6%	4%
	Product support	1%	0%	1%
	Service	**18%**	**39%**	26%
	Customer services	2%	4%	3%
	Product review	2%	3%	2%
	Forum	2%	3%	2%
	Chat	0%	7%	3%
	Blog	7%	4%	6%
	Online users	1%	0%	1%
Transaction	**Webshop**	**5%**	**72%**	30%
	Order tracking	0%	1%	1%
	Guarantee	10%	13%	11%
	Warranty	1%	3%	2%
	Legal note	4%	6%	5%
	Copyright	2%	0%	1%
	Terms of contract	3%	7%	4%
	Privacy	9%	6%	8%
	In-store pickup	0%	1%	1%
	Delivery options	**2%**	**12%**	5%
	Home delivery	**1%**	**9%**	4%
	Commercial credit	4%	10%	6%
Customization	**Registration**	**10%**	**52%**	26%
	My account	3%	1%	2%
	Configuration	5%	1%	4%
	My pages	0%	1%	1%

Annex 7. Comments on errors in data collection

The following statements can be made in respect of potential problems related to the quality of initial data collected:

- I checked the extent to which the method of data collection influenced the values of e-commerce capabilities calculated in 2009, i.e. whether there was a significant difference between the frequencies of crawler-based and manually collected keywords (see Annex 4). With the majority of keywords, there was no difference at a 5% significance level, with the exception of these few keywords (and their synonyms): prices, seach, our shops, registration, guarantee and consumer credit.
- Since only manual data collection was performed on the entire sample in 2010, it was worth looking at whether changes from 2009 to 2010 reflected an actual tendency or whether they were caused by a change in the method of data collection. For this exercise I compared the data of 40 companies surveyed in 2009 and came somewhat closer to actual trends, albeit on a smaller sample. More significant increases in penetration were also found on this sample, except the doubling of the proliferation of the commercial credit function, which did not show on the subsample at all. Similarly, nor was the subsample justified by the search, "add to favourites" and guarantee functions. These distortions probably stemmed from the inaccuracies of manual data collection in 2010, except maybe for the consumer credit function, which often featured sites in a picture format and therefore it must have been the crawler that underestimated reality. Overall, however, the change in the method of data collection did not cause any considerable distortions in the data structure: The most frequent 10 functions, for instance, are identical, with one exception, in both years.
- Webstore as a keyword (group) emerged to the fore in relation to clustering by business model. Related to this, in the manual revision of business models it was found that although crawler-based data collection was accurate, in roughly 5% of cases the occurrence of the keyword was not concurrent with the existence of the e-commerce function associated with it. I believe that this 5% error can be an estimate of errors arising from the crawler data collection method and its extent still falls into the acceptable range.

- The data of ranking databases are quite deficient for the sample; moreover, ranking data inherently become rather volatile over time below a certain level of website popularity.
- Data collection was primarily focused on main page e-commerce capabilities and so the study did not cover subpages and functions accessible only through registration. Their inclusion could have of course increased the reliability of the picture formed about e-commerce capabilities to some extent but would have made data collection and analysis far more complicated. Moreover, from an e-commerce perspective, the main page is critically important in making a first impression on the visitor and building customer confidence [see e.g. Korper – Ellis, 2001, or Egger, 2000]

Annex 8. Correlation between usage as principal component and other variables in the model

Correlation between usage and e-commerce factors/corporate performance indicators

(Spearman's rho; correlations marked with * and ** are significant at the level of 0.01 and 0.05, respectively, based on a 2-tailed significance test)

E-commerce factors, 2009			Corporate performace ratios, 2009			Corporate performace ratios, 2010		
webshop	Correlation	,316**	Sales growth	Correlation	,076	Sales growth	Correlation	,192*
	Sig.	,000		Sig.	,301		Sig.	,011
	N	187		N	187		N	173
special functions	Correlation	-,117	ROIC	Correlation	-,093	ROIC	Correlation	,012
	Sig.	,110		Sig.	,203		Sig.	,871
	N	187		N	187		N	175
interactivity	Correlation	-,108	CFROI	Correlation	,124	CFROI	Correlation	-,005
	Sig.	,142		Sig.	,092		Sig.	,950
	N	187		N	187		N	175
customer value	Correlation	,279**	ROA	Correlation	-,146*	ROA	Correlation	-,010
	Sig.	,000		Sig.	,047		Sig.	,895
	N	187		N	187		N	175
reliable comapany info	Correlation	,200**	Sales per employee	Correlation	,021	Sales per employee	Correlation	,063
	Sig.	,006		Sig.	,771		Sig.	,411
	N	187		N	187		N	172
terms of service 1	Correlation	-,041	Profit margin	Correlation	-,047	Profit margin	Correlation	-,041
	Sig.	,578		Sig.	,523		Sig.	,596
	N	187		N	185		N	172
products, services	Correlation	,126	Inventory turnover	Correlation	,006	Inventory turnover	Correlation	,020
	Sig.	,086		Sig.	,935		Sig.	,792
	N	187		N	184		N	172
online communication	Correlation	,090						
	Sig.	,220						
	N	187						
terms of service 2	Correlation	,098						
	Sig.	,184						
	N	187						