Impact of IT Investments on a Company – Towards an Approach for Managing the IT Business Value

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Ich danke allen von Herzen,
die mich auf dem Weg zur Promotion
motiviert, begleitet und unterstützt haben.

Contents

List of Abbreviations

AI	Artificial Intelligence
BI	Business Intelligence
BISE	Business and Information Systems Engineering
BM	Benefits Management
BMM	Business Motivation Model
BPMN	Business Process Model and Notation
CCI	Chamber of Commerce and Industry
CDO	Chief Digital Officer
CIO	Chief Information Officer
COA	Cross-Organizational-Activities
COO	Chief Operating Officer
CRediT	Contributor Roles Taxonomy
CRM	Customer Relationship Management
CSF	Critical Success Factor
CSR	Corporate Social Responsibility
DSDM	Dynamic Systems Development Method
DSR	Design Science Research
ERP	Enterprise Resource Planning
ES	Enterprise Systems
FDD	Feature Driven Development
GDP	Gross Domestic Product
HR	Human Resource Management
IS	Information Systems
IT	Information Technology / Informationstechnologie
i*	Distributed Intentionality
KAOS	Knowledge Acquisition in Automated Systems

KMS Knowledge Management Systems

KPI Key Performance Indicator

Log Logistics

M&S Marketing and Sales

NuRIT Nutzenrealisierungsmodell für Informationstechnologie

Ops Operations

Proc Procurement

RAD Rapid Application Development

RBV Resource-based View

RE Requirements Engineering

REF Requirements Engineering Framework

ROA Return on Assets

ROE Return on Equity

ROI Return on Investment

RUP Rational Unified Process

R&D Research and Development

SCM Supply Chain Management

SE Software Engineering

Ser Services

TD Technological Development

VCC Value Contribution Controlling

VUCA Volatility, Uncertainty, Complexity, and Ambiguity

WBC Wertbeitragscontrolling

WI Wirtschaftsinformatik

XP Extreme Programming

List of Figures

List of Tables

List of Publications

The thesis consists of four accepted or to-be-submitted research papers. Earlier versions of the papers II, III and IV have been published in conference proceedings. Paper I is intended for another conference publication. The rankings of the publications are based on VHB JQ3[1] and Core2018[2]. The description of the author roles to capture the own contribution are based on the Contributor Roles Taxonomy (CRediT)[3]. In addition, the co-authors are named for each paper. Paper I was written with sole authorship.

Paper I

- **Title:** Impact of IT on Dynamic Capabilities and Vice Versa - Measurement and Management Through the Design of Dynamic Capability Profiles
- **To-be-submitted at:** 32nd European Conference on Information Systems (ECIS 2024), Paphos, Cyprus (VHB JQ3: B ranked)
- **Co-authors:** -
- **Own contribution:** Conceptualization, data curation, formal analysis, investigation, methodology, project administration, supervision, writing – original draft

Paper II

- **Title:** A Literature-based Derivation of a Meta-framework for IT Business Value
- **Accepted at:** 23rd International Conference on Enterprise Information Systems (ICEIS 2021), Virtual Conference (Core2018: C ranked)
- **Co-authors:** Tobias Wulfert, Jan Eric Wernsdörfer, and Reinhard Schütte
- **Own contribution:** Conceptualization (equal), data curation (lead), formal analysis (equal), investigation (lead), methodology (equal), project administration (lead), supervision (lead), validation (equal), writing – original draft (equal), writing – review & editing (equal)

1 VHB JQ3 ranking: https://vhbonline.org/vhb4you/vhb-jourqual/vhb-jourqual-3/gesamtliste.
2 Core2018 ranking: http://portal.core.edu.au/conf-ranks.
3 CRediT: https://credit.niso.org/.

Paper III

- **Title:** Towards a Reference Value Catalogue for a Company-Specific Assessment of the IT Business Value - Proposing a Taxonomy to select IT Impacts from Existing Catalogues
- **Accepted at:** European Conference on Information Systems (ECIS 2021), Virtual Conference (VHB JQ3: B ranked)
- **Co-authors:** Tobias Wulfert and Jan Eric Wernsdörfer
- **Own contribution:** Conceptualization (equal), data curation (lead), formal analysis (equal), investigation (lead), methodology (equal), project administration (lead), supervision (lead), validation (equal), writing – original draft (equal), writing – review & editing (equal)

Paper IV

- **Title:** Das Wertbeitragscontrolling als Anreicherung bestehender Vorgehensmodelle des Software Engineering
- **Accepted at:** Tagung der Fachgruppen Vorgehensmodelle und Projektmanagement im Fachgebiet der Wirtschaftsinformatik der Gesellschaft für Informatik e.V. (PVM-2019), Lörrach, Deutschland (not ranked)
- **Co-authors:** Reinhard Schütte and Tobias Wulfert
- **Own contribution:** Conceptualization (supporting), data curation (equal), investigation (supporting), project administration (lead), supervision (lead), writing – original draft (equal), writing – review & editing (lead)

Part I

Introduction

1 Motivation

This introductory chapter presents the motivation for identifying and assessing the impacts of information technology (IT) investments. Based on the various phenomena of digitalization, we emphasize why considering the value of an IT investment for companies is important. In addition, the practical relevance of determining IT business value in IT project management is highlighted as an area of application.

1.1 Considering the Business Value of an IT Investment

Due to digitalization driven by globalization[4] companies[5] in general and their value chains in particular are becoming increasingly permeated with IT. While companies in the IT sector have already made relatively good progress in digitalizing their companies (BMWK 2022a) - according to a study by the German Chamber of Commerce and Industry (CCI) (2021), 75 % of companies in the IT sector are almost completely digitalized[6] - companies in other industries are not yet as advanced in Germany. For example, only one in two companies in the financial services sector and only around one in three companies in the industrial and retail sector would describe themselves

4 Globalization describes the worldwide interconnection of individuals, companies, regions, and countries in diverse areas such as politics and the economy (Koch 2017). In the economy, globalization increases the competitive pressure on companies, which are then forced to cut costs (Petersen 2015). These cost savings can be realized, among other things, through increased digitalization, i.e., greater use of IT, and thus lower costs. The reduction in transport and communication costs will in turn strengthen globalization (Petersen 2015). The two phenomena of globalization and digitalization are therefore mutually dependent and reinforcing (Petersen 2015). In 2021, goods and services in the amount of US$ 27 trillion were traded worldwide, which is an increase of 24 % compared to 2020 (WTO 2022) and also exceeds pre-pandemic levels. International cooperation is improving the use of the world's resources ever more effectively (Koch 2017). However, this also leads to higher complexity in the supply chain. The covid 19 pandemic highlighted how vulnerable existing supply chains can be (WTO 2021), so market dynamics may also occur in the future. While companies can benefit from global trade, it also poses challenges for established companies and opportunities for new innovative companies. The barriers to entry have been lowered by the progress of information technology (IT), allowing new innovative firms to enter a market. This intensifies international competition (Koch 2017). All in all, globalization is a dynamic process which companies are facing (Koch 2017).

5 A company is an economic, financial, and legal entity that pursues a specific goal (Schäfer 1974). The specific goal of companies is usually to maximize their profits (Schäfer-Kunz and Vahs 2021) through the combination of production factors (Gutenberg 1951). Production factors are tangible or intangible goods that are necessary for the production of higher value goods or services (Gutenberg 1951). Through the combination of the productions factors, the human demand for goods and services can be covered (Schöne 1988). The terms company, firm, and enterprise are used synonymously in this thesis.

6 However, the CCI study did not define what can be understood by digitalization. In addition, the study is a self-assessment by the participating companies (BMWK 2022a). Bley et al. (2016) were able to prove that companies overestimate their own level of digitalization. For this reason, the mentioned figures should only serve as an orientation and, above all, to highlight the differences between the industries. It should be noted that Bley et al. (2016) themselves use the term digitization, but use it in the sense of digitalization. At this point, the terms digitization and digitalization should be differentiated, as they are sometimes used synonymously as in the case of Bley et al. (2016) and thus cause confusion (Legner et al. 2017). Digitization means the technical transfer of analog signals into digital ones (Hess 2019). Digitalization relates to a broader perspective in which technology is used in a corporate context (e.g., to support a business process) and thus describes a sociotechnical phenomenon (Legner et al. 2017). This thesis focuses on digitalization.

as almost fully digitalized (DIHK 2021). All the other industries studied are even less digitalized. There are therefore major differences depending on the industry, which is also confirmed by the study of BMWK (2022a). BMWK (2022a) have developed a digitalization index[7]. In addition to the differences between the industries, the index also shows that companies are digitalized differently depending on their size, with larger companies[8] being more digitalized[9]. Although there is still a need to catch up on digitalization, especially in a european (European Commission 2021) and global (IMD 2021) comparison, digitalization in Germany appears to be stagnating in 2022 after a large increase in 2021 (BMWK 2022b). The reason for this is that in 2021, it was primarily the external drivers that provided the impetus for digitalization (e.g., availability of broadband and human capital), but these did not recur at the same level in 2022 (BMWK 2022a). Companies must now drive digitalization internally if they want to make progress.

In addition to competitive pressures from globalization, employees and customers are also contributing to the increasing pressure on companies to digitalize. This can be explained by the way the individuals deal with digitalization in their private lives. One aspect is the access to the internet, which has been rising steadily for years. In 2021, over 90 % of the german population already had access to the internet (Initiative D21 e. V. 2022). Access to the internet is provided by (mobile) devices. The number of devices experienced an upswing in the first covid 19 pandemic year, but stagnated again or continued only slowly in 2021 (Initiative D21 e. V. 2022). On average, 3.5 devices per net income are used in a household (Initiative D21 e. V. 2022), and the smartphone has become a constant companion. The use of social media is also a contributing factor, with 97 % of Generation Z[10], 95 % of Generation Y, 91 % of Generation X and

7 The digitalization index is made up of five internal indicators (processes, products, business models, qualification, and research and innovation activities) and five external indicators (technical infrastructure, administrative and legal framework conditions, society, human capital, and innovation landscape). More detailed information on the individual indicators and the method can be found under BMWK (2020).

8 The study of BMWK (2022a) distinguishes between three company size classes: 1-49 employees (small companies), 50-249 employees (medium-sized companies) and 250 and more employees (large companies). The differentiation is based on the definition of the European Commission (2022).

9 99.4 % of companies in Germany in 2020 were small and medium-sized enterprises (SMEs) (Statistisches Bundesamt 2020). This study is also based on the European Commission (2022), but also includes sales figures. Accordingly, it classifies microenterprises (up to 9 employees and up to 2 million euros in sales), small enterprises (up to 49 employees and up to 10 million euros in sales and not a microenterprise), medium-sized enterprises (up to 249 employees and up to 50 million euros in sales and not a small enterprise) and large enterprises with more than 249 employees or more than 50 million euros in sales. The division thus means that companies in Germany still have a lot of potential for digitalization.

10 In the study of Initiative D21 e. V. (2022), Generation Z was defined for the 1996-2009 birth cohorts. They represent the digital natives. Digital natives "have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age" (Prensky 2001). Generation Y is also referred to as digital natives (Bennett et al. 2008). However, they still grew up with the ongoing development of the internet, computers and mobile devices and are still aware of a world without the ubiquity of the internet (Initiative D21 e. V. 2022). Generation Y are also called net-generation (Oblinger and Oblinger 2005; Tapscott 1999) or Millennials (Howe and Strauss 2000). Generation Y comprises the birth cohorts 1981-1995, Generation X the birth cohorts 1966-1980, and the baby boomers the birth cohorts

81 % of baby boomers using it (Initiative D21 e. V. 2022), representing the current or future workforce. Digitalization is thus an integral part of everyday life (Cijan et al. 2019). The benefits of digitalization are also expected in the workplace (Colbert et al. 2016), which is something companies have to deal with. Otherwise, the company may not be attractive enough for employees in the future.

Due to external (competitive environment) and internal pressure (employees expectations), companies have to deal with digitalization. All in all, it is apparent that digitalization is a relevant topic for companies in all industries in order to keep up with the competition and position themselves better. There is no end in sight for digitalization, which is a process that changes the company and creates something new. There are many ways in which companies can become more digitalized.

Digitalization is leading to companies not only to convert analog signals into digital ones, but also to use them to support their processes (BMWK 2022a; Hess et al. 2016), products (BMWK 2022a; Hess et al. 2016), business models (BMWK 2022a; Hess 2019; Kohli and Melville 2019), qualification (BMWK 2022a), and research and innovation activities (BMWK 2022a; Hess et al. 2016; Melville 2015). When looking at Porter (1985b)'s value chain , it is clear that IT can have an impact on all activities, whether primary or support[11] activities.[12] This penetration of the value chain can be observed across all industries. In the context of the digitalization of value chains, an increasingly strong interlocking of object and information is initially recognizable, so that there is also a stronger need for integration of domain and application system. Traditional products (e.g., books) can now also be offered purely digitally because of digitization (e.g., e-books). For companies, it has the advantage that the marginal costs for reproducing a digital product are almost zero (Luxem 2000). Digital offerings are increasingly displacing traditional products and can be understood as a substitute (Grömling 2016). A study by Bitkom e.V. (2022a) shows that digitalization efforts have gained in importance as a result of the covid 19 pandemic. 44 % of the companies surveyed in Germany in 2022 stated that the digitalization of their business processes had accelerated as a result of the covid 19 pandemic, while 49 % also noted an accel-

1956-1965 (Initiative D21 e. V. 2022). The latter two generations did not grow up with digitization, but they have witnessed its emergence and are confronted with it at the latest in their professional lives, for example with the development from the first cell phone to the smartphone (Initiative D21 e. V. 2022).

11 Primary activities refer to those activities "involved in the physical creation of the product and its sale and transfer to the buyer as well as after-sale assistance" (Porter 2001b, p. 53). These activities thus contribute to the competitive advantage. The support activities "support the primary activities" (Porter 2001b, p. 53) and can relate to individual primary activities or the entire chain. Due to the production orientation of the value chain according to Porter (1985b), there is criticism when transferring this to services (Nooteboom 2007; Stabell and Fjeldstad 1998). Nevertheless, the division of activities into primary and support is retained even in the modified value chains (Popp et al. 2016).

12 As an example, external logistics in a production company, which is a primary activity, can be mentioned. Through an intelligent route planning system, the optimal utilization of transport vehicles can be achieved. In addition, goods can be tracked in real time through sensors and GPS location (Buchholz et al. 2017). In corporate infrastructure, a secondary activity, machines can, for example, take dangerous work away from humans (Buchholz et al. 2017).

eration in the digitalization of their business models. The digital transformation[13] has enabled companies to transform their business models (Legner et al. 2017) in ways that were unthinkable without IT. Vial (2019) even describes the changes in business models as significant. IT thus plays a leading role and is no longer merely supportive. A typical example is AirBnB, which was founded in 2008 and offers overnight accommodation without owning apartments (Sainger 2018). AirBnB offers an online platform[14] where providers and customers of private accommodation can network (Täuscher and Laudien 2018). Rheinboldt (2014) describes platforms as the most successful online business models. Further successful examples are Uber, Delivery Hero, Amazon, and Netflix. On the other hand, they show that traditional business models also need to change in order to compete with the new digital innovations. Employees in Germany already perceive that companies are actively adapting their own product and service portfolios to current market developments (Hinz and Heinen 2021). One in five companies, for example, introduced the position of chief digital officer (CDO) and a further 18 % of the companies are planning such a position (Bitkom e.V. 2022b), which can be perceived directly by employees. The CDO[15] is a central position (Horlacher and Hess 2016) responsible for accelerating and coordinating (Firk et al. 2021) the digital transformation of the company (Singh and Hess 2020). Innovation departments are also frequently established in companies. These explore new opportunities or technologies to ensure the company's competitiveness (Göbeler et al. 2020). At the same time, however, traditional IT departments continue to optimize existing systems (Duwe 2018). This capability of companies is called organizational ambidexterity (Kimbrough 2011) and refers to the fact that two opposing goals are being pursued at the same time (Tushman and O'Reilly III 1996). A structural separation into two departments is not necessarily required. It is also possible to switch between exploitation and exploration over a fixed period of time, to complement either exploitation or exploration with the help of a merger, acquisition, or outsourcing, or to create a corporate culture in which employees switch independently between exploitation and exploration (Soto-Acosta et al. 2018). These innovative activities then drive digitization in companies further, whereby a balance must be created between exploitation (traditional IT) and exploration (innovative IT) (Tushman and O'Reilly III 1996).

13 The digital transformation is the process by which a company's products or processes are significantly changed by IT. This digitalization process represents a radical change between the current state and the target state of a company (Schütte et al. 2022b).

14 A platform is operated by a platform owner (Tiwana 2014), who brings together suppliers and customers by providing the technical infrastructure (Parker et al. 2016). Since two sides are brought together, it is also referred to as two-sided markets (Wulfert et al. 2021). These digital marketplaces are controlled by the platform owner, for example by setting standards and defining interfaces and can thus significantly influence his ecosystem (Wulfert et al. 2022).

15 In 2005, the first CDO position was established at MTV Networks (Horlacher and Hess 2016). Many companies followed this trend and established CDO positions, for example at McDonald's in 2013, Nike in 2016 and Novartis in 2018 (Firk et al. 2021). The introduction of a CDO is a global phenomenon (Horlacher and Hess 2016) and continues to this day.

All in all, it also became clear with which digitalization initiatives (internal driver of digitalization) companies can meet digitalization in order to continue to survive in the competitive pressure (Figure 1.1). The digitalization initiatives then require IT investments to be implemented.

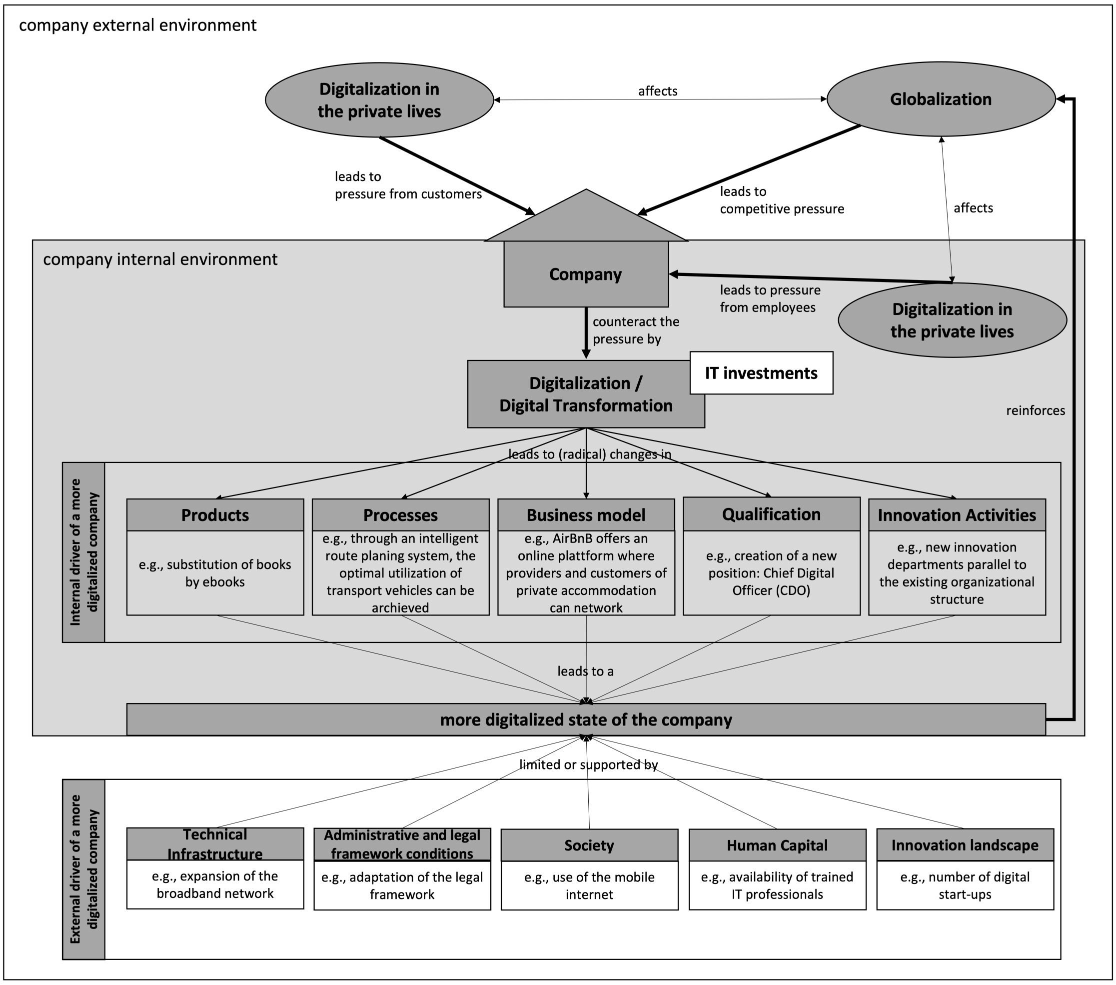

Figure 1.1: Digitalization according to BMWK (2022a) and Petersen (2015)

In line with the increasing digitalization, investment in IT has been on the rise for years (Figure 1.2). Gartner (2022) forecasts total global IT spending of $4.4 trillion in 2022 for the first time ever. IT spending is also forecast to increase in 2023, with the assumption that current events in the world such as Russia's war of aggression against the Ukraine, the ongoing covid 19 countermeasures, and rising inflation will have no impact on corporate IT spending (Gartner 2022). Figure 1.2 shows that in 2020, despite the onset of the covid 19 pandemic, IT spending stagnated but did not decline. The decline in IT spending in 2015 can be attributed to the rising U.S. dollar.[16] In a constant currency calculation, the result is also an increase of 3.1 % in IT spending worldwide (Gartner 2015), which should be taken into account here. All in all, it can be

16 Listed in the following is the average exchange rate of the U.S. dollar against the euro from 2013-2021. 2013: 0.7532; 2014: 0.7539; 2015: 0.9019; 2016: 0.9039; 2017: 0.8870; 2018: 0.8476; 2019: 0.8934; 2020: 0.8768; 2021: 0.8460 (Bank European Central 2022).

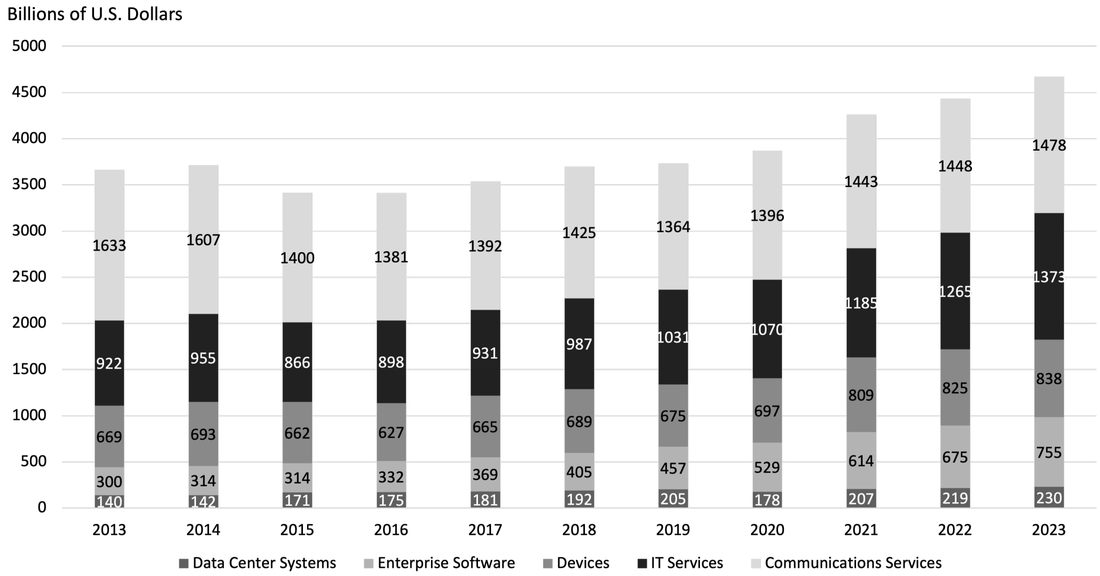

Figure 1.2: Worldwide IT Spending Forecast according to Gartner (2014; 2015; 2016; 2017; 2018; 2019; 2020; 2021; 2022)

stated that IT investments are increasing more and more. In a german study by Bitkom e.V. (2022a), too, companies state that 29 % want to invest more in digitalization, 53 % expect to use the same level of investment as in 2021, and only 14 % want to invest less in 2022, which confirms all in all Gartner’s forecast. Baker et al. (2017) was able to confirm that productivity gains from an earlier IT investment lead to subsequent investments in IT in the future. So it seems that productive companies are "reinvesting their returns in IT, creating a virtuous cycle of IT investments" (Baker et al. 2017, p. 157).

Behind the investment effort is the assumption that more IT is better. This assumption has already been discussed in the context of the IT productivity paradox. The IT productivity paradox describes the fact that empirical studies show no significant positive or even negative correlation between firm productivity and the level of IT investment (Schütte et al. 2022b). The discussion began in 1987 with Solow’s statement: "You can see the computer age everywhere but in the productivity statistics" (Solow 1987, p. 36). Since then, there has been much discussion in the literature. Brynjolfsson (1993) believes that these results should not be overinterpreted and identifies four explanations: mismeasurement of outputs and inputs, lags due to learning and adjustment, redistribution and dissipation of profits, and mismanagement of information and technology. To date, further explanatory approaches have been identified and existing ones confirmed. For this thesis, we assume the understanding that IT offers a positive added value if it is used properly in the company, so the IT productivity paradox can be overcome. Nevertheless, the discussion keeps coming up (Krishnan et al. 2018), especially when new technologies appear. Following Solow (1987), Brynjolfsson et al. (2019, p. 24) formulates the statement, "We see transformative new technologies everywhere but in productivity statistics" and call it the modern productivity paradox. The main reason for this is that the new technologies do not translate directly into productivity, but only through further innovations, which may not be developed and implemented for several years (Brynjolfsson et al. 2019). This can be demonstrated by the example of artificial intelligence (AI), which is the most prominent example currently of a technology that promises to increase productivity and economic welfare (Brynjolfsson et al. 2019). The promises range, for example, from better early detection of cancer and better treatment at an earlier stage, which increases the chance of survival (healthcare) and a reduction in fatal traffic accidents, which are detected by cars in good time and countermeasures are initiated (road traffic), to self-driving cars that deliver our groceries independently to several customers, and are used efficiently so that the space for parking spaces can be used elsewhere (retail). According to Stanford University's Artificial Intelligence Index Report 2023, $91.9 billion was spent on global AI private investments in 2022 (Maslej et al. 2023). Compared to the previous year, this represents a reduction of 26.7 %.[17] Despite this high level of investment, there is a significant decrease compared to 2021. This could be due to the fact that, despite the high level of investment in previous years, there was no discernible increase in productivity (Brynjolfsson et al. 2019). Reasons for no noticeable productivity are the false expectations of AI[18], mismeasurement[19], and a concentrated distribution[20] (Brynjolfsson et al. 2019). While these reasons also indicate incorrect or inadequate management, there are also implementation and restructuring lags that are time-dependent. Brynjolfsson et al. (2019) consider AI to be

17 In another study of Mittal et al. (2022), respondents state that the biggest challenge to launching AI projects is proving business value. This was stated by 37 % of all business leaders surveyed. However, respondents also indicated that 76% would like to invest significantly more in the next fiscal year (Mittal et al. 2022).

18 The false expectations of IT investments are also reflected in the explanations of the original productivity paradox by Brynjolfsson (1993). This is the case when AI is hyped but is not at all as tranformative as everyone expects (Brynjolfsson et al. 2019). In AI application scenarios, a lot is promised (see the previous examples) that cannot be fulfilled at an early stage. In order to achieve efficient delivery from the grocery store, self-driving cars must first be developed, which in themselves do not increase productivity. Several technologies must therefore be combined with AI (Brynjolfsson et al. 2019) in order to then be able to meet the expectations.

19 The mismeasurement of inputs and outputs are also reflected in the explanations of the original productivity paradox by Brynjolfsson (1993). The special characteristic of AI is that it deals with intangible inputs (e.g., data sets and firm-specific human capital) and intangible outputs (Brynjolfsson et al. 2019). The output of AI in turn leads to further actions, which are usually also intangible (e.g., new types of software) (Brynjolfsson et al. 2019). Brynjolfsson et al. (2019, p. 45) propose to think of AI "as a type of capital, specifically a type of intangible capital. [...] Treating AI as a type of capital clarifies how its development and installation as a productive factor will affect productivity". Nevertheless, the benefits of current technologies are not reflected in traditional metrics such as gross domestic product (GDP) and productivity. Brynjolfsson et al. (2019) call for a modification of economic measurements, as traditional metrics are reaching their limits. In addition to improving measurement metrics at the economy-wide level, Lynn et al. (2020) are also advocating more robust measurement methods at the enterprise level, especially for cloud computing, as this is also a technology where most impacts are intangible.

20 This explanation approach can also be found in parts in the original explanation approach by Brynjolfsson (1993). The benefit of AI has so far only been concentrated on a small part of the economy. Furthermore, many advantages are destroyed by a competing relationship of those who benefit from it and those who do not benefit so far but want to (Brynjolfsson et al. 2019).

a generally purposeful technology that must first improve over time. About 45 % of the activities in a company could be taken over by AI (Brynjolfsson et al. 2019). However, the speed of automation depends on other factors such as the costs of automation, the regulations and also the acceptance of AI (Brynjolfsson et al. 2019). Investing in AI and complementary changes in the company or society may initially affect productivity (Brynjolfsson et al. 2019). According to Brynjolfsson et al. (2019), we are currently in this phase, which is why the discussion about the productivity paradox is coming up again.

The discussion about the productivity paradox leads to the recognition that there does not have to be a causality between an IT investment and the impacts that lead to a higher productivity of the company. An expectation that IT will always make a positive contribution to a company is naïve. Causality is the relationship of a cause and an effect and concerns the influence of a change in the expression of a causally acting variable X (cause) on a change in the expression of the causally influenced variable Y (effect) (Kühnel and Dingelstedt 2019). In this thesis, we want to know to what extent IT (X) leads to impacts (Y)[21] and whether causality can be recognized at all or it is only an apparent causality. An IT system initially has no impact on the company. The IT[22] system only becomes effective when it is implemented in a company and used by the employees (Mandrella et al. 2016a; McAfee and Brynjolfsson 2017; Mikalef et al. 2017). We are again considering the sociotechnical system. If an IT system is implemented in a company but is not used by the employees, it only causes costs, but does not bring any positive impact (Schütte et al. 2022b). This means that there are assumptions that have to be met in order to achieve the impacts, and the degree of fulfillment then affects the amount of the impacts. In addition, the organization of the company is usually also adapted when an IT system is implemented. This adaptation of the organization, which is basically independent of IT, can already lead to performance improvements (Leiting 2012). It is possible that an impact is achieved that is triggered by the IT investment project, but is not directly attributable to IT. This leads to the problem that the identification and assessment of IT investments is complex, as it can be influenced by many other factors. The mapping of impacts to IT investments is a

21 It can also be discussed whether impacts (Y) in turn lead to more IT (X). Aral et al. (2006) have found that successful ERP investments have led to further investments in extended enterprise systems (e.g., CRM and SCM), which in turn have positively improved productivity and firm performance. They call it "virtuous cycle". Here one can refer to follow-up investments. These follow-up investments should also be taken into account when evaluating an IT investment. Otherwise, the impact of an IT system could be underestimated. One method that takes follow-up investments into account is the real options approach, which was developed in analogy to the financial options (Danylyshyn et al. 2019). In the real options approach, follow-up investments are regarded as options (Ullrich 2013) that may or may not be exercised at a later date (Schulze 2009).

22 The terms information technology (IT) and information systems (IS) are often used synonymously. That is why it is relevant to differentiate between these terms. Information Systems can be considered as sociotechnical systems (Heinrich et al. 2011), which consist on the one hand of the organizational system, which have not been automated, and on the other hand of the technical systems, which are automated (Becker and Schütte 2004). These technical systems represent the IT systems (Schütte 2019). IT systems comprise hardware and software (Schütte et al. 2022b).

challenge. In the literature, this challenge is discussed under the term IT business value.

All in all, it became clear that not every IT investment always makes sense and brings the company closer to its business goals. In order to be able to assess this, the determination of the IT business value of an IT investment could be a solution.

IT business value can be broadly defined as extent of the contribution of IT on firm performance[23] (Devaraj and Kohli 2003; Melville et al. 2004; Mooney et al. 1996), which is widely established in the literature (Pathak et al. 2019). Figure 1.3 shows that an IT investment consists of IT assets and non-IT assets, which then have an impact on the process performance of a company, which then has an impact on the firm performance (Schryen 2013). Performance is influenced by company factors, industry factors or country factors (Schryen 2013). The results of the assessment can then be used by management as a basis for decision-making. Decision support can be helpful before a project (e.g., for project prioritization), during a project (e.g., for countermeasures if performance does not develop as expected) and after a project (e.g., to check whether all expectations have been met). Nevertheless, a correct determination of the values of an IT investment is necessary, otherwise wrong or critical decisions will be made (see productivity paradox). Incorrect determination can result, for example, from the forgetting of impacts, the double recording of impacts because they cannot be clearly assigned, or from recording them in too isolated a manner, so that possible consequential impacts are not taken into account.

Determining an IT business value seems appropriate, but also requires thorough consideration to ensure that the result is not subject to error. This is currently a challenge for companies and requires further research. For this reason, the focus of this thesis is on IT business value.

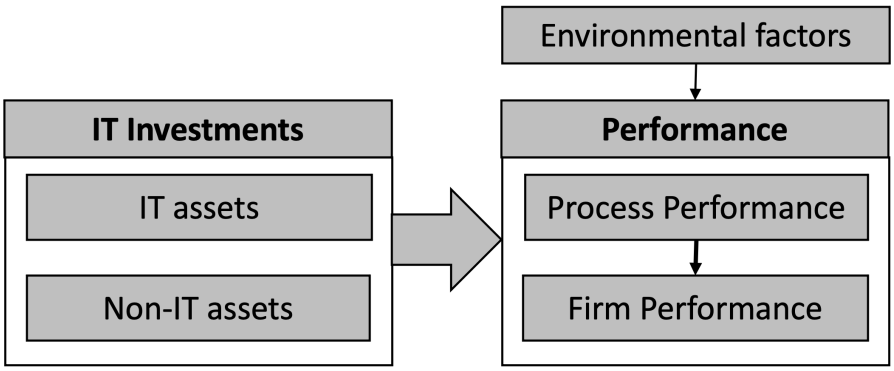

Figure 1.3: IT Business Value according to Schryen (2013)

23 Also found in the literature under organizational performance (Melville et al. 2004), business performance (Pye and Rai 2014), and firm profitability (Lee et al. 2014).

1.2 IT Project Management as a Benefiting Application Area

In order to highlight the relevance of determining IT business value in the area of application as well, the following section considers IT projects through which IT investments are implemented in companies. In doing so, we want to show what the current challenges in IT projects are and to what extent they can be overcome by identifying and assessing the IT business value.

A project has a defined start and completion date and is typically divided into phases (DIN Deutsches Institut für Normung e.V. 2016). The phases follow a logical sequence and are collectively described as the project life cycle (DIN Deutsches Institut für Normung e.V. 2016). IT projects[24] in particular focus on the hardware and software in companies (Pietsch 2019; Wallace 2015; Wieczorrek and Mertens 2011). Compared to "traditional" projects, IT projects are influenced by additional characteristics (Wirth 1996) that are given due to the fact that they are affiliated with the IT domain. The IT domain is shaped by the VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) world. Volatility describes "the amount of uncertainty about size of changes" (Mack and Khare 2015) that is evident in IT projects as requirements change regularly and the scope of the project expands (Alami 2016). In addition, volatility increases proportionally with the amount of information being processed, making large transformation projects more susceptible to volatile conditions (Alami 2016). The volatility of projects also gives rise to uncertainties. The uncertainties exist because the future is difficult to predict due to fast-paced changes (Mack and Khare 2015), which means that challenges and opportunities are not obvious (Kail 2010). In IT projects it is difficult because during a project there are environmental factors (known and unknown) that are difficult to assess in advance (Alami 2016; Andersen 2016). According to a study by Wirth (1996), it is made clear that IT projects have a higher uncertainty level compared to traditional projects. Complexity describes "a situation, where interconnectedness of parts and variables is so high, that the same external conditions and inputs can lead to very different outputs or reactions of the system" (Mack and Khare 2015). IT projects can be classified as complex because they usually involve several departments, if not the entire company (Bourdeau and Shuraida 2022). A wide variety of stakeholders are affected (Bourdeau and Shuraida 2022), which leads to a further increase in complexity. While in complexity it is not always clear what is cause and effect, in ambiguity the causal relationship is completely unclear (Bennett and Lemoine 2014). The meaning or interpretation of a decision option cannot be resolved through an analytical process (Mack and Khare 2015). In IT projects, there is usually more than one option available to solve an existing problem, but these options cannot be evaluated. These special characteristics of IT projects require targeted management. IT project management is a subtype of project management that includes the application of methods, tools,

24 IT projects can be assigned to different types such as development projects, maintenance projects, reorganization projects, pilot projects, and evolution projects (Wieczorrek and Mertens 2011).

techniques, and competencies in a project (DIN Deutsches Institut für Normung e.V. 2016) throughout the entire project life cycle. IT project management is typically dedicated to the following phases: Initiating, planning, executing, and closing IT projects.[25] Determining the IT business value can help to support IT project management tasks in every phase. As an example, a task that can benefit from an IT business value identification is now given for each phase.

One task of IT project management in the *initiating phase* is to estimate the rough budget required (Project Management Institute 2017). Although the costs of an IT project are relatively easy to calculate, the benefits are more difficult or almost impossible to determine[26] (Beer et al. 2013). In some cases, these estimates can only be made very roughly, as the parties involved are unable to describe the interrelationships of impacts. The reason for this is insufficient knowledge and the potentially unrestricted number or unknown alternative courses of action (Schütte et al. 2022b). An IT project should only be carried out if it provides a benefit for the company's goals, otherwise it should be questioned (Gunasekaran et al. 2006). An objective statement of the IT business value that is comprehensible and also reveals assumptions made can serve as a basis for justification to IT management or top management of budgets for IT projects. Especially in times of crisis, when more and more budgets are being cut, this can be helpful in demonstrating the relevance of IT projects for the company. *The identification and assessment of IT business value can help justify the IT budget for a specific IT investment in a company.*

The expected impacts of IT investments are sometimes difficult to identify in the *planing phase*. Since the discussion of the productivity paradox, an expectation that IT will always make a positive contribution to a company is naïve. Since IT systems in companies are no longer viewed in isolation (Tanriverdi 2005), but are networked with each other, this must also be taken into account when identifying impacts. Due to globalization, there are also many links between IT systems from external partners. These dependencies increase the complexity and make it more difficult to determine the detailed impacts and may also lead to false expectations of the IT investment.

25 The level of detail of the phases may differ, so a different number of phases are mentioned in the literature and especially in project management standards. The Project Management Body of Knowledge (PMBoK), which is a collection of standardized terms and guidelines for project management, uses the process groups initiating, planning, execution, monitoring & controlling, and closing (Project Management Institute 2017). Prince2, on the other hand, defines seven main activities, which are directing a project, starting up a project, initiating a project, managing a stage boundary, controlling a stage, managing product delivery, and closing a project (Prince2 2017). HERMES, which is used as a standard primarily in the administrative environment in Switzerland, reduces the number to four essential phases, which are initialization, concept, realization and implementation (Schweizerische Eidgenossenschaft 2014). Nevertheless, all phases found in the literature can be assigned to the four phases initiating, planning, executing, and closing.

26 This applies in particular to intangible benefits of an IT project (Murphy and Simon 2002; Oliver et al. 2009). These benefits are difficult to translate into monetary values (Beer et al. 2013). In contrast, established methods can be used for costs, are still insufficiently available for the benefits (Beer et al. 2013; Lindo 2017). However, the assumption that the benefits are known presupposes that they have been identified in advance.

In addition to the positive impacts, the negative impacts must also be taken into account, which do not always have to be obvious. For example, training is necessary to familiarize employees with the new IT system. This training is in turn associated with costs, since the training must be provided and the employees must be able to carry out their daily tasks during the training period. Other costs may also be overlooked. Benchmarks can provide an indication of which impacts to consider (Schütte et al. 2022b), but from other companies will only help to a limited extent with a detailed analysis, even from companies in the same industry and of similar size. The impacts may differ depending on the IT infrastructure already in place in the company or even the corporate culture. The assessment of the impacts of an IT investment are company-specific. *The identification and assessment of IT business value helps with a realistic profitability calculation and avoids false expectations of the IT project.*

IT projects are then ultimately implemented in the *executing phase* through process models.[27] Process models typically included project phases with milestones, roles and responsibilities, tasks, deliverables, and a toolbox (tools, methods, techniques, guidelines, standards). The use of a process model has the goal of making the project more likely to succeed than without (PwC 2007). For IT implementation projects, the process models from software engineering are suitable. These can be divided into traditional, sequential process models and agile process models (Sameen Mirza and Datta 2019). However, these process models do not take the impacts of IT systems into account, or only to a very limited extent. In the traditional approach models, a requirements analysis takes place at the beginning of the project (e.g., in the waterfall model, the first phase is requirements analysis (Alshamrani and Bahattab 2015)), which can serve as a starting point for identifying impacts. However, this is not explicitly provided for and may require an extension of the models. Moreover, a one-time analysis before a project is not helpful, at least one more analysis after the project is needed to give a statement about the achievement of the project objectives. But even this is not sufficient, because internal or external changes can occur during the project, which also have an influence on the expected impacts. With the help of an IT business value analysis over the entire project lifecycle, this could be taken into account and, if necessary, countermeasures could be taken to steer the project back on the right path. A failure of the project could thus be avoided. *The identification and assessment of IT business value helps to ensure that countermeasures are taken in good time in response to project changes and that projects do not fail as a result.*

27 Companies that use a process model appear to be more successful than companies that do not use a process model, as measured by the failure rate of a project (PwC 2007). In the context of software engineering, process models can also be found in the literature under the terms procedure models (Tantscher and Mayer 2022), software methodologies (Leau et al. 2012) and software development methodologies (Gechman 2019).

In the *closing phase*, the question also arises as to when IT projects can be considered successful. The iron triangle[28] has become established in the literature to measure project success. The iron triangle consists of three dimensions that are determined before the project: OnTime, OnBudget, and OnTarget. A change in one dimension during the course of the project will affect the other dimensions, which will then have to be adjusted (Pollack et al. 2018). If, for example, more functions are to be implemented, the costs may rise and the project duration may increase. But even if all dimensions are met in a project and the project can be evaluated successful according to the iron triangle, this does not have to be accurate (The Standish Group 2015). A successfully completed IT investment that is not used by employees, for example, is not cost-effective for the company. Some authors therefore say that there must be something beyond time, costs, and quality. For example, Van Wyngaard et al. (2014), Mokoena et al. (2013) and Badewi (2016) would replace quality with scope. Lock (2007) and Pinto (2010) would use performance as a term and Jugdev and Müller (2005) tends to use the term requirements. We would agree that the previous iron triangle is not sufficient, because it lacks a dimension that shows the benefits of the IT investment for the company's goals. A project should only be judged successful when the expected effects have actually occurred. According to The Standish Group (2015), 29 % of IT projects are successful, 52 % are challenged, and 19 % completely fail. The Standish Group (2015) adjusted the valuation of projects in 2015. Instead of using the traditional resolution of OnTime, OnBudget, and OnTarget, they now use OnTime, OnBudget, with a satisfactory result. This is intended to take into account the success of the project management as well as the success of the project. As a result of the new consideration, the success rate decreased by 7 % and the challenged rate increased by the 7 %, supporting the statement that projects supporting the iron triangle consider the success of the project management, but not the benefit of the project to the company. *The identification and assessment of IT business value helps to assess whether the IT project has been successfully completed in relation to the company's objectives.*

While time and budget are straightforward to control, achieving satisfactory result that represents IT business value is a challenge for many organizations in general and for IT project managers in particular. On the one hand, the areas of application in IT project management have once again made it clear to what extent an IT business value determination can be helpful. On the other hand, methodological problems in the determination have already been discussed. To overcome this practical problems, it is essential to be aware of the current state of IT business value research in order to be able to continue with this research, which can then enable managers in general and IT project managers in particular.

28 In the literature, this can also be found under the terms magic triangle (Schopp et al. 2019), project management triangle (Pollack et al. 2018), or the triple constraint (Pollack et al. 2018).

2 State-of-the-Art of Current IT Business Value Research

The research on IT business value is very broad. To obtain a better overview of the current state of the IT business value research, this chapter derives the various research areas on the basis of the existing literature. Current papers that has been identified through a literature review are assigned to the research areas. This allows us to identify the focus of research areas, show progress in the research areas, and highlight research findings and gaps that are relevant for further research on IT business value.

2.1 Derivation and Overview of the Research Areas

To address parts of the research problem, a number of papers have already been discussed in the IS community[29] under the heading of IT business value[30]. At the beginning of the research effort, there was intense debate about whether IT has a positive impact on business success. In order to illustrate the interrelationships, a number of studies were conducted, some of which produced different results. The studies investigated whether there was a correlation between productivity and the level of IT investment, as the expectation was that IT would correlate positively with productivity (Zelewski 1999). A neutral or negative correlation represents the productivity paradox of IT (Schütte et al. 2022b). The analysis was done at different levels: company level, industry level, and macroeconomic level. At the company level, positive correlations were identified in studies by Devaraj and Kohli (2000), Dewan and Min (1997), and Menon et al. (2000), while studies from Barua et al. (1995) and Strassmann (1990) only produced neutral results. Similarly, in studies at the industry level, positive correlations could be identified on the one hand (Kelley 1994; Siegel and Griliches 1991), but also neutral correlations, on the other (Berndt and Morrison 1995; Koski 1999; Loveman 1994). On a macroeconomic level, even negative correlations were confirmed (Bailey 1986; Berndt and Morrison 1991; Roach 1988). Solow (1987)'s statement that IT is not reflected in productivity statistics then triggered a variety of explanations for the inconsistent results.[31] As a result, it has become widely accepted in the literature that the IT productivity paradox can be considered solved by the firm-level explanatory approaches (Dedrick et al. 2003; Wan et al. 2007). Since the firm level is the focus of this work, the productivity paradox can be considered solved and the statement can be made that IT adds business value (Kohli and Grover 2008). Despite

29 Kohli and Grover (2008) identify IT business value as a key issue in information systems. Likewise Agarwal and Lucas Jr (2005) also point to the powerful transformative impact of information technology and its potential for the future as fundamental to the contribution of the IS discipline.

30 In addition to "IT business value", the topic is also discussed under "IT values", "IT benefits", "IT business value benefits", and "business value of IT" (Gellweiler and Krishnamurthi 2021).

31 Among others: Capturing the input and output of the IT deployment is error-prone, see Rowe (1994); Delays between use and impacts, see Aral et al. (2006) and Piller (1998); Redistribution of profits between companies, see Brynjolfsson (1993); Management errors and insufficient use of technology potentials, see Stratopoulos and Dehning (2000); Negative effects of the increase in information, see Stickel (1997).

this agreement, the mechanism of the impacts of IT investments on business value remains unclear (Baker et al. 2008; Fink 2011; Hajli et al. 2015; Masli et al. 2011; Pathak et al. 2019; Schryen 2013) turns the discussion from whether IT has a positive effect on business to how IT business value can be created. The new focus is thus the creation process of IT business value. Schryen (2013, p. 159) describes this research area as "Creation Process as a Grey Box". In addition to this research area, Schryen (2013, p. 159) also identifies in a meta-study "Ambiguity and Fuzziness of the IS Business Value Construct" and "Neglected Disaggregation of IS investments" as other research areas. The research area "Ambiguity and Fuzziness of the IS Business Value Construct" is primarily concerned with the intangible impacts of an IT investment, which, if neglected when calculating performance, lead to incorrect or rather underestimation of the IT business value (Schryen 2013) and thus concern the output of an IT investment. The research area "Neglected Disaggregation of IS investments", on the other hand, deals with the input of an IT investment, which is concerned with the breakdown of an IT investment in IT assets, which then leads to better insight into the derived performance (Schryen 2013).

Since the 2013 meta-study, further papers have been published in the various research areas. This chapter now identifies the current research work through a literature review. Building on Schryen (2013)'s review of current IT business value research, a literature review according to Webster and Watson (2002) was conducted using the search string "IT Business Value" in leading journals (Litbasket M)[32] and the leading conferences[33] in the IS discipline from 2014 to the present. The initial search resulted in 85 papers. Excluded were papers that were teaching cases, duplicates, withdrawn, inaccessible, and did not have IT business value as the focus of the paper. The results of 78 papers

32 ACM Transactions on Information Systems, Australasian Journal of Information Systems, Business and Information Systems Engineering, Communications of the ACM, Communications of the Association for Information Systems, Computer Supported Cooperative Work, Computers in Human Behavior, Data Base for Advances in Information Systems, Decision Sciences Journal, Decision Support Systems, European Journal of Information Systems, European Journal of Operational Research, Expert Systems with Applications, IEEE Transactions on Knowledge and Data Engineering, Information and Management, Information and Organization, Information Processing and Management, Information Society, Information Systems and e-Business Management, Information Systems Frontiers, Information Systems Journal, Information Systems Management, Information Systems Research, Information Technology and People, INFORMS Journal on Computing, International Journal of Business Information Systems, International Journal of Enterprise Information Systems, International Journal of Human-Computer Studies, International Journal of Information Management, International Journal of Information Security, International Journal of Information Systems in the Service Sector, Journal of Computer Information Systems, Journal of Database Management, Journal of Enterprise Information Management, Journal of Global Information Management, Journal of Global Information Technology Management, Journal of Information Systems, Journal of Information Technology, Journal of Management Information Systems, Journal of Organizational Computing and Electronic Commerce, Journal of Strategic Information Systems, Journal of Systems and Software, Journal of the Association for Information Science and Technology, Journal of the Association for Information Systems, Knowledge-Based Systems, Management Science, MIS Quarterly, OMEGA - International Journal of Management Science, Online Information Review, Organization Science, Scandinavian Journal of Information Systems.

33 Americas' Conference on Information Systems (AMCIS), European Conference on Information Systems (ECIS), International Conference on Information Systems (ICIS), Hawaii International Conference on System Sciences (HICSS), Pacific Asia Conference on Information Systems (PACIS).

were assigned to the different research areas. An overview is shown below in table 2.1. the results are presented in the chapters 2.2.1-2.2.4. The author is aware that papers which are not written under the heading of "IT Business Value", but which relate to it, may not be taken into account. Nevertheless the goal of the search was to identify the focus areas of current research in the research stream "IT Business Value". The research areas are not strictly separated from each other, but serve as an orientation and classification of the existing literature. The goal of the literature review is to identify the focal points of current research in the "IT Business Value" research stream and to highlight the progress and identify research findings that are relevant for further research on IT business value.

Authors	Titel	Publication type	Publication name	Publication year	Assigned to Research Area
Ayabakan et al.	A data envelopment analysis approach to estimate IT-enabled production capability	Journal Article	MIS Quarterly	2017	Creation Process
Baker et al.	Closing the loop: Empirical evidence for a positive feedback model of IT business value creation	Journal Article	Journal of Strategic Information Systems	2017	Creation Process
Bi et al.	IT and fast growth small-to-medium enterprise performance: An empirical study in Australia	Journal Article	Australasian Journal of Information Systems	2015	Creation Process
Brajawidagda and Chatfield	The impact of social media policy and use on value creation: A survey research	Conference Paper	PACIS 2016 Proceedings	2016	Creation Process
Cao et al.	Systemic capabilities: the source of IT business value	Journal Article	Information Technology and People	2016	Creation Process
Ceric	Analysis of interactions between IT and organisational resources in a manufacturing organisation using cross-impact analysis	Journal Article	Journal of Enterprise Information Management	2016	Creation Process
Chae et al.	Information technology capability and firm performance: Role of industry	Journal Article	Information and Management	2018	Creation Process
Chae et al.	Information technology capability and firm performance: Contradictory findings and their possible causes	Journal Article	MIS Quarterly	2014	Creation Process
Chatfield et al.	Creating value through virtual teams: A current literature review	Journal Article	Australasian Journal of Information Systems	2014	Creation Process
Chen et al.	Effects of shared financial services on firm performance	Conference Paper	AMCIS 2020 Proceedings	2020	Creation Process
Chen et al.	IT capabilities and product innovation performance: The roles of corporate entrepreneurship and competitive intensity	Journal Article	Information and Management	2015	Creation Process

Table 2.1 continued from previous page

Authors	Titel	Publication type	Publication name	Publication year	Assigned to Research Area
Choi et al.	Does IT Capability and Competitive Actions Shape Firm Profitability?	Conference Paper	ICIS 2017 Proceedings	2017	Creation Process
Dahlberg and Kivijärvi	Role of IT management and the dynamics behind IT Business value creation – A longitudinal assessment	Conference Paper	HICSS 2018 Proceedings	2018	Creation Process
Dahlberg et al.	Longitudinal study on the expectations of cloud computing benefits and an integrative multilevel model for understanding cloud computing performance	Conference Paper	HICSS 2017 Proceedings	2017	Creation Process
Dutta et al.	Digital systems and competitive responsiveness: The dynamics of IT business value	Journal Article	Information and Management	2014	Fuzziness
Elazhary et al.	How Information Technology Governance Influences Organizational Agility: The Role of Market Turbulence	Journal Article	Information Systems Management	2022	Creation Process
Fay and Kazantsev	When smart gets smarter: How big data analytics creates business value in smart manufacturing	Conference Paper	ICIS 2018 Proceedings	2018	Creation Process
Fichman and Melville	How posture-profile misalignment in IT innovation diminishes returns: Conceptual development and empirical demonstration	Journal Article	Journal of Management Information Systems	2014	Creation Process
Gellweiler and Krishnamurthi	IT Business Value and Competitive Advantage: Integrating a Customer-Based View	Journal Article	Information Systems Management	2021	Creation Process
Hackenberg et al.	Business strategy, IT management and business value - A tripartite interaction?	Conference Paper	AMCIS 2015 Proceedings	2015	Creation Process
Huang et al.	Initial Evidence on the Impact of Big Data Implementation on Firm Performance	Journal Article	Information Systems Frontiers	2020	Creation Process
Huygh and de Haes	Towards a viable system model-based organizing logic for IT governance	Conference Paper	ICIS 2020 Proceedings	2020	Creation Process
Huygh and De Haes	Investigating IT Governance through the Viable System Model	Journal Article	Information Systems Management	2019	Creation Process
Jafarijoo and Joshi	How do firms derive value from cloud computing investment? Examining the role of information technology governance	Conference Paper	AMCIS 2020 Proceedings	2020	Creation Process
Jia et al.	Digital link and return predictability	Conference Paper	ICIS 2020 Proceedings	2020	Creation Process

Table 2.1 continued from previous page

Authors	**Titel**	**Publication type**	**Publication name**	**Publication year**	**Assigned to Research Area**
Jia et al.	Reducing capital market anomaly: The role of information technology using an information uncertainty lens	Journal Article	Management Science	2020	Creation Process
Kathuria et al.	Extent versus range of service digitization: Implications for firm performance	Conference Paper	AMCIS 2014 Proceedings	2014	Disaggregation
Khuntia et al.	How foreign and domestic firms differ in leveraging it-enabled supply chain information integration in bop markets: The role of supplier and client business collaboration	Journal Article	Journal of the Association for Information Systems	2021	Creation Process
Kim et al.	When does repository KMS use lift performance? the role of alternative knowledge sources and task environments	Journal Article	MIS Quarterly	2016	Creation Process
Klaus et al.	Prioritizing IT Management Issues and Business Performance	Journal Article	Journal of Information Systems	2022	Creation Process
Köffer et al.	It consumerization and its effects on it business value, it capabilities, and the it function	Conference Paper	PACIS 2015 Proceedings	2015	Creation Process
Kung et al.	Exploring configurations for business value from event-driven architecture in healthcare	Conference Paper	ICIS 2016 Proceedings	2016	Creation Process
Lee et al.	Examining Complementary Effects of IT Investment on Firm Profitability: Are Complementarities the Missing Link?	Journal Article	Information Systems Management	2014	Creation Process
Liu et al.	How IT wisdom affects firm performance: An empirical investigation of 15-year US panel data	Journal Article	Decision Support Systems	2020	Creation Process
Luo et al.	Information technology, cross-channel capabilities, and managerial actions: Evidence from the apparel industry	Journal Article	Journal of the Association for Information Systems	2016	Creation Process
Mandrella et al.	Synthesizing and integrating research on it-based value cocreation: A meta-analysis	Journal Article	Journal of the Association for Information Systems	2020	Disaggregation
Mandrella et al.	Creating value through IT-enabled resource efficient production: A dynamic capability perspective	Conference Paper	PACIS 2017 Proceedings	2017	Creation Process
Mandrella et al.	IT-based value co-creation: A literature review and directions for future research	Conference Paper	HICSS 2016 Proceedings	2016	Disaggregation

Table 2.1 continued from previous page

Authors	Titel	Publication type	Publication name	Publication year	Assigned to Research Area
Mandrella et al.	How different types of is assets account for synergy-enabled value in multi-unit firms: Mapping of critical success factors and key performance indicators	Conference Paper	AMCIS 2016 Proceedings	2016	Creation Process
Markus and Rowe	Knowing what we know about it and business value: Cause for concern about endogeneity problems and potential solutions	Conference Paper	HICSS 2020 Proceedings	2020	Creation Process
Melville	Digital fitness: Four principles for successful development of digital initiatives	Conference Paper	HICSS 2015 Proceedings	2015	Disaggregation
Mikalef et al.	Big data analytics capability: Antecedents and business value	Conference Paper	PACIS 2017 Proceedings	2017	Creation Process
Mikalef et al.	Big data analytics capabilities: a systematic literature review and research agenda	Journal Article	Information Systems and e-Business Management	2018	Creation Process
Oesterreich et al.	What translates big data into business value? A meta-analysis of the impacts of business analytics on firm performance	Journal Article	Information and Management	2022	Creation Process
Pang	IT governance and business value in the public sector organizations - The role of elected representatives in IT governance and its impact on IT value in U.S. state governments	Journal Article	Decision Support Systems	2014	Fuzziness
Pang et al.	Information technology and administrative efficiency in U.S. state governments: A stochastic frontier approach	Journal Article	MIS Quarterly	2014	Fuzziness
Peters et al.	The role of mobile bi capabilities in mobile bi success	Conference Paper	ECIS 2014 Proceedings	2014	Creation Process
Polykarpou et al.	Justifying health IT investments: A process model of framing practices and reputational value	Journal Article	Information and Organization	2018	Creation Process
Popovic et al.	The impact of big data analytics on firms' high value business performance	Journal Article	Information Systems Frontiers	2018	Creation Process
Pye and Rai	How can it enable the simultaneous pursuit of green and business outcomes?: An investigation of smart grid innovations	Conference Paper	AMCIS 2014 Proceedings	2014	Creation Process

Table 2.1 continued from previous page

Authors	Titel	Publication type	Publication name	Publication year	Assigned to Research Area
Queiroz et al.	The effects of IT application orchestration capability on performance	Conference Paper	ICIS 2015 Proceedings	2015	Creation Process
Rai et al.	Fit and misfit of plural sourcing strategies and it-enabled process integration capabilities: Consequences of firm performance in the U.S. electric utility industry	Journal Article	MIS Quarterly	2015	Creation Process
Reichstein	Strategic IT management: how companies can benefit from an increasing IT influence	Journal Article	Journal of Enterprise Information Management	2019	Creation Process
Richards et al.	Business Intelligence Effectiveness and Corporate Performance Management: An Empirical Analysis	Journal Article	Journal of Computer Information Systems	2019	Creation Process
Rojas and Kathuria	Competitive brokerage, information technology and internal resources	Conference Paper	ICIS 2014 Proceedings	2014	Creation Process
Saldanha et al.	Do CEO's long-term performance incentives induce IT investments? Theory, evidence, and industry contingencies	Conference Paper	AMCIS 2015 Proceedings	2015	Disaggregation
Sambhara et al.	Why increased use of it can be beneficial or damaging? Insights from the puzzle of IT use and managerial expertise for internal controls	Conference Paper	ICIS 2018 Proceedings	2018	Creation Process
Semmann and Böhmann	Post-project benefits management in large organizations - Insights of a qualitative study	Conference Paper	ICIS 2015 Proceedings	2015	Creation Process
Tallon	Do you see what i see? the search for consensus among executives' perceptions of IT business value	Journal Article	European Journal of Information Systems	2014	Creation Process
Tallon et al.	Business process and information technology alignment: Construct conceptualization, empirical Illustration, and directions for future research	Journal Article	Journal of the Association for Information Systems	2016	Creation Process
Turedi and Zhu	How to generate more value from IT: The interplay of it investment, decision making structure, and senior management involvement in IT governance	Journal Article	Communications of the Association for Information Systems	2019	Creation Process
Van Der Pas and Furneaux	Improving the predictability of it investment Business value	Conference Paper	ECIS 2015 Proceedings	2015	Disaggregation

Table 2.1 continued from previous page

Authors	**Titel**	**Publication type**	**Publication name**	**Publication year**	**Assigned to Research Area**
vom Brocke et al.	How in-memory technology can create business value: Insights from the hilti case	Journal Article	Communications of the Association for Information Systems	2014	Creation Process
Wagner et al.	How social capital among information technology and business units drives operational alignment and it business value	Journal Article	Journal of Management Information Systems	2014	Creation Process
Wagner and Moshtaf	Individual IT roles in business - IT alignment and IT governance	Conference Paper	HICSS 2016 Proceedings	2016	Creation Process
Wang et al.	The interaction effect of IT assets and IT management on firm performance: A systems perspective	Journal Article	International Journal of Information Management	2015	Creation Process
Weeger et al.	Operational alignment in hospitals -the role of social capital between it and medical departments	Conference Paper	ECIS 2015 Proceedings	2015	Creation Process
Wei et al.	Supply Chain Information Integration and Firm Performance: Are Explorative and Exploitative IT Capabilities Complementary or Substitutive?	Journal Article	Decision Sciences	2020	Creation Process
Wiedemann et al.	How IT management profile and IT business value correlate - Exploring cross-domain alignment	Conference Paper	HICSS 2017 Proceedings	2017	Creation Process
Wiesböck et al.	The dual role of IT capabilities in the development of digital products and services	Journal Article	Information and Management	2020	Creation Process
Xu et al.	Leveraging CSR-related knowledge for firm value: The role of IT-enabled absorptive capacities	Conference Paper	ICIS 2020 Proceedings	2020	Fuzziness
Zand et al.	A Role-based Typology of Information Technology: Model Development and Assessment	Journal Article	Information Systems Management	2015	Disaggregation
Zhang and Gable	Automatic post-adoptive information technology use: The role of innovativeness goal	Conference Paper	PACIS 2016 Proceedings	2016	Creation Process
Zhang et al.	The impact of IT governance on IT capability and firm performance	Conference Paper	ICIS 2014 Proceedings	2014	Creation Process
Zhang and Rai	Complementarities for IT business value of firms: Synthesis for future empirical work	Conference Paper	AMCIS 2021 Proceedings	2021	Disaggregation

Table 2.1 continued from previous page

Authors	Titel	Publication type	Publication name	Publication year	Assigned to Research Area
Zhu et al.	The effects of e-business processes in supply chain operations: Process component and value creation mechanisms	Journal Article	International Journal of Information Management	2020	Creation Process
Zolper et al.	The effect of social network structures at the business/IT interface on IT application change effectiveness	Journal Article	Journal of Information Technology	2014	Creation Process

Table 2.1: Results of the Structured Literature Review with Assignment to Research Areas in Alphabetical Order by Author(s)

As a result, to Schryen (2013)'s three identified research areas, a fourth, called the "Holistic Procedure to Identify and Evaluate the IT Business Value" research area, is added based on the results of the literature review and the motivation of the thesis (Chapter 1.1). This research area deals with a more holistic view across the input, the creation process, and the output. When assigning the identified papers to the research areas, it becomes clear that 78 % of all papers are dedicated to the creation process. This clearly shows that the research question of whether IT offers business value has shifted to the extent to which IT can offer business value. 12 % of the papers deal with the disaggregation of IT investments, while 4 % each are assigned to the research areas of the IT business value construct and the holistic procedure (Figure 2.1). The focus of current IT business value research is on the extent to which specific technological capabilities, human actors, IT department or the tasks subsumed under it, IT-supported business processes, or environmental factors have an impact on firm performance. While the current research aims to get clarity on the creation process, as Schryen (2013) have it on their agenda for IS business value research, the other research areas are neglected. An unexplored research path is still the "identification of value items with which the respective value can be measured" (Schryen 2013, p. 159) and the "identification and development of methods that allow the measurement of value items" (Schryen 2013, p. 159).

In figure 2.1, the IT business value definition according to Schryen (2013) from chapter 1.1 has been expanded. On the one hand, the creation process between IT investment and firm performance has been explicitly added, since many identified papers deal with this grey box. On the other hand, internal and external environmental factors seem to affect not only performance, but also IT investments and the creation process. Figure 2.1 shows the four identified research areas as well as an assignment of overarching questions in the respective research areas and the published papers since 2014.

Figure 2.1: Research Areas of the IT Business Value adapted from Schryen (2013) as well as Assignment of IT Business Value Research Work to the Research Questions of the Research Areas since 2014.

2.2 IT Business Value Research Areas

After the research areas of IT business values have been derived, the current focus for each research area are presented below. We first look at the research content on ambiguity and fuzziness of the IT business value construct to follow the continuing development of the original discussion (see the discussion about the productivity paradox in chapter 2.1). After focusing on the output of the IT business value, we look at the input and thus the research area neglected disaggregation of IT investments. This is followed by the research content of the creation process. Finally, the newly added research area, which aims at a holistic procedure, is presented. The papers identified in the literature review are supplemented in the following by further literature on the subject of IT business value in order to explain the topics under consideration in more concrete terms. For each research area, the findings are summarized that should be considered in a future IT business value identification and assessment, and existing gaps are highlighted to identify potential future research. The presented research areas illustrate the current status of IT business value research and forms the basis for the research papers in part II, III, and IV of this thesis.

2.2.1 Ambiguity and Fuzziness of the IT Business Value Construct

Although the literature agrees on what can be understood by IT business value, the construct IT business value is not well defined (Schryen 2013). IT business value can be broadly defined as extent of the contribution of IT on firm performance[34] (Melville et al. 2004; Mooney et al. 1996; Devaraj and Kohli 2003), which is widely established in the literature (Pathak et al. 2019). Melville et al. (2004) complements this general definition with the intermediate process level and the firm level, which means that impacts can be expected at different levels. Many previous papers have dealt with the productivity of a company at the firm level (see productivity paradox). Firm level can be further subdivided into market performance and accounting performance. In the more recent literature, Pye and Rai (2014) investigate how IT can lead to firm performance as well as green performance. Sustainability aspects are used to identify the extent to which IT can contribute to sustainability in the company. Xu et al. (2020) would also like to find out to what extent IT plays a role in corporate social responsibility (CSR) initiatives. This contributions expand IT business value research in the direction of sustainability, that is, a specific type of impacts.

Melville et al. (2004) also distinguish between internal impacts (efficiency impacts) and external impacts (competitive impacts). As internal impacts can be mentioned e.g., productivity enhancement (Tallon and Kraemer 2003) and product quality (Barua et al. 1995) and as external impacts e.g., competitive advantage (Parsons 1983) and product differentiation (Belleflamme 2001). In addition, impacts can also be

34 Also found in the literature under organizational performance (Melville et al. 2004), business performance (Pye and Rai 2014), and firm profitability (Lee et al. 2014).

classified as tangible and intangible. As intangible impacts can be mentioned e.g., better supplier selection (Anselstetter 1984) and satisfied employees (Shang and Seddon 2002) and as tangible impacts e.g., better inventory management (Shang and Seddon 2002) and faster delivery of services (Andresen et al. 2002). In addition to these distinctions, further characteristics of impacts are conceivable. For example, the positive impacts of an IT investment are often considered, but negative impacts are also neglected. Impacts of an IT investment can also be mutually conditional and thus have an influence on the direction and amount of an impact. Nevertheless, it remains unclear what can ultimately be subsumed under IT business value, especially since current research does not focus on this.

In this thesis, a distinction is made between impacts, an observable effect of an IT investment, and its monetary valuation. All identified impacts valued in monetary terms then constitute the IT business value. This results in two research foci: the identification of impacts and the assessment of the identified impacts (Schütte et al. 2019). This distinction comes from the fact that many papers do not even describe what they mean by IT business value. The assumption here is that the impacts have already been determined and only need to be evaluated economically to determine the IT business value. However, this poses a problem, as it does not make it clear what is being assessed in the company at all and whether a reliable statement can be made as a result. The aim should be to capture the key impacts of an IT investment as comprehensively as possible, so that they can also be followed by IT decision-makers. For the identification of impacts some value catalogs have already been developed in the literature[35], which determine the type of impacts, e.g. for certain types of IT systems. A value catalog is a reference list of values and pre-economic impacts that can be associated with the use of IT systems. Since there is also no unified name for searching, the selection of appropriate catalogs in practice is difficult. Additionally, the value catalogs vary in the number, definitions, and granularity of categories. There is no overview of individual impacts or no selection guide for a suitable value catalog. Previous research has not dealt with it.

For the assessment of the identified impacts established procedures from investment accounting can be applied. In this context, key accounting figures such as return on assets (ROA) (Bharadwaj 2000; Dehning and Stratopoulos 2002; Hitt and Brynjolfsson 1996; Kim et al. 2009; Peslak 2003; Rai et al. 1997; Santhanam and Hartono 2003; Stratopoulos and Dehning 2000; Tam 1998), return on investment (ROI) (Hayes et al. 2001; Mahmood and Mann 2005; Peslak 2003; Stratopoulos and Dehning 2000), return on equity (ROE) (Alpar and Kim 1990; Beccalli 2007; Dehning et al. 2008; Peslak 2003; Rai et al. 1997; Shin 2006; Stratopoulos and Dehning 2000; Tam 1998) are used. The applicability of typical measurement methods are questioned in some recent papers.

35 See among others Anselstetter (1984); Schumann (1992); Petrovic (1994); Mirani and Lederer (1998); Lucas (1999); Shang and Seddon (2000); Schubert and Williams (2009a); Kütz (2013); Schulze (2009); Kesten et al. (2007); Riggins (1999); Erickson and Hughes (2005).

Lynn et al. (2020) address at the measurement methods for cloud computing and emphasizes the specific impacts (resilience, speed of deployment, scalability, and organizational agility), which can be classified as more non-financial than for other IT systems. As a result, they are calling for robust methods of measuring business value. Also besides the type of IT investment, the type of company seems to require a different measurement method. Pang (2014) assume that measurement methods already used for firms cannot be appropriate for the non-profit organizations[36]. The difference is in the nature of the impacts, as in non-profit organizations these are social outcomes due to the company's objectives and not financial outcomes as in for-profit organizations[37] (Oakley and Iyer 2014). However, the appropriate assessment of intangible impacts appears to be relevant, as otherwise the IT business value is distorted - and this also applies to for-profit organizations.

In addition to the impact of an IT investment, the environment also has an influence on the realization of the IT business value. Dutta et al. (2014) have investigated what to look for when determining the IT business value of an IT investment in a competitive environment. IT systems contribute to a company's ability to more quickly detect and respond to competitive actions. In doing so, they emphasize that not only the magnitude of the impacts, but also their duration should be taken into account when determining IT business value, as well as the on-going actions of competitors (Dutta et al. 2014). Choi et al. (2017) have found that IT capability in a company has an impact on competitive action, which in turn results in improved firm performance. In addition to the industry-specific factors, the company itself (e.g., degree of digitization) and country-specific factors (e.g., regulations of the state) can also have an influence. However, the influence of contextual factors are mainly discussed in the creation process.

In summary, the following research findings should be considered for further IT business value research:

- The determination of the IT business value can be divided into 1) the identification of impacts and 2) the assessment of impacts. To better identify the impacts of an IT investment an overview about potential key impacts is needed.

- Impacts of IT investments can be further classified (e.g., into internal and external impacts as well as tangible and intangible impacts). To better understand the

36 While a firm aims to make a profit and thus focuses on profitable areas, non-profit organizations have a focus on social, cultural, sporting, societal, educational, general interest, or environmental protection objectives (Helmig 2018). Public organizations can thus be understood as a subgroup of non-profit organizations (Helmig 2018).

37 The focus of this paper is on firms, so the particularities of non-profit organizations are not considered further. For more information regarding IT business value in non-profit organizations see among others Arenas (2020); Gregory et al. (2020); Oakley and Iyer (2014); Oakley (2014); Pang et al. (2014); Pang (2014); Schlichter et al. (2014).

concept of IT business value, the characteristics of the impact and its effect on the overarching IT business value should be understandable.

- To better assess the identified impacts of an IT investment, suitable evaluation methods should be available that also make intangible impacts measurable. The IT business value measurement methods should also fit the type of company.
- The environment (e.g., on-going actions of competitors) can have an impact on the realization of the IT business value. In order to better understand the IT business value construct, the internal and external influencing factors and their impact on the IT business value should be considered.

In the research area "Ambiguity and Fuzziness of the IT Business Value Construct", it remains unclear what impacts can generally occur with an IT investment. It should become clear which characteristics can be used to describe an impact, so that an appropriate measurement method can then be applied. Tangible and intangible impacts are system-specific and company-specific, so that determining the impact of the same IT investment in different companies can lead to different results. All identified impacts evaluated in monetary terms should then be able to be aggregated hierarchically into an IT business value of an IT investment to make this comparable to other IT investments, for example. To date, there is a lack of a structured procedure for determining the impacts of an IT investment to guide practitioners. Compared to the research area "Creation Process as a Grey Box", the research area "Ambiguity and Fuzziness of the IT Business Value Construct" has been rather neglected in current research, in particular the identification of impacts.

2.2.2 Neglected Disaggregation of IT Investments

In contrast to the previous research area, which deals with the output problem of an IT investment, this research area deals with the input problem (Schryen 2013). This stream of research looks at the types of IT investments, as different types lead to different impacts on a firm’s performance, e.g., the same amount of investment in substituting employee PCs or in a Customer Relationship Management (CRM) system is expected to have different impacts (Schryen 2013). Therefore, the focus here is on the IT artifact. There are different approaches in the literature as to how the types of IT investments can be differentiated. Schryen (2013) see a differentiation based on the support of the business goals as useful, Aral and Weill (2007) suggest a differentiation based on opposites (innovative vs. non-innovative, strategic vs. non-strategic, and internally vs. externally), and Weill and Broadbent (1998) want to sort diaggregated IT assets into a portfolio of infrastructure, transactional, informational, and strategic assets. Zand et al. (2015) distinguishes between different types of IT roles (Information, Communication, Automation, Coordination, Integration, Transformation, and Innovation), which have different implications for performance and thus act as intermediate mechanisms regarding the business objectives. Zand et al. (2015) emphasize that IT investments only make sense if they are also used to achieve the overall business goals. Despite the different types of differentiation, it becomes clear that IT investments should be identified and evaluated on a system-specific basis.

However, studies conducted on specific IT investments come to different impacts, so Schryen (2013) assumes that the combination of different IT assets of an implementation also has an influence. If the idea is taken further, then the current IT landscape can also have an impact on the new IT investment, especially if IT systems build on each other (Aral et al. 2006). Kathuria et al. (2014) examine the extent of digitization and the range of digitization as underlying dimensions. In addition to IT assets, non-IT assets can also have an impact (Figure 1.3), so that complementarities and synergies should generally be taken into account. This is important, because only IT systems embedded in a firm lead to impacts (socio-technical systems). The IT business value is therefore not only dependent on the type of IT system but also company-specific. Complementarities[38] therefore need to be explored further. This area has been little analyzed in the literature (Schryen 2013). Schryen (2013) suggests using the critical success factor (CSR) approach, as IT assets can be mapped to the appropriate business objectives and synergies of IT assets that support the same objective can become transparent. Mandrella et al. (2016b) take up this suggestion and examined the relationship of IT assets, cross-unit synergies, CSFs, and key performance indicators (KPIs). Zhang and Rai (2021) have developed a classification of different types of complementarities[39] and highlighted research gaps to drive further research. Beyond the company perspective, the topic was also considered under the term co-creation on a cross-company level. Mandrella et al. (2016a) deal with collaborations in inter-organizational networks to create value that would not be possible alone. Mandrella et al. (2020), however, have identified inconsistencies in the recent co-creation literature and attribute this to different conceptualizations of IT as well as methodological and environmental factors.[40]

Saldanha et al. (2015) join the research stream that examines the antecedents of IT investment decisions. They found that "the associations between long-term performance plans and IT investments are stronger in high tech industries and weaker in industries where IT plays a transformative strategic role" (Saldanha et al. 2015, p. 8). Van Der Pas and Furneaux (2015) are concerned with IT investment decisions and want

38 Synergies can be considered synonym in this context (Brynjolfsson and Milgrom 2013).

39 First, it is analyzed whether the complementarity is supermodular or submodular. Supermodular means that the value of two complements is greater than the individual values. Submodular means that the common cost of complements is less than the individual cost. Second, a distinction is made in the specification of complementarity based on the number of complements. The fewer the complements, the higher the specificity. Third, a distinction is made as to whether the relationship between a complement pair is unidirectional or bidirectional/mutually. For implications for further research in this area see Zhang and Rai (2021).

40 See the aspects discussed in the previous chapter 2.2.1.

to improve them by closing the gap between the expected value of IT and the actual value that IT delivers. "Results of our analysis indicate that cost reduction initiatives deliver more of their expected business value than revenue generating investments. Further to this, the accuracy of forecasts for initiatives that extend existing revenue streams are better than for initiatives that seek to establish entirely new revenue streams" (Van Der Pas and Furneaux 2015, p. 1).

Melville (2015) sets out four principles for successful implementation of digital initiatives, the first of which is "generate business value". By considering five dimensions of business value (enabling or enhancing products and services, process enhancement and transformation, intangible values, environmental sustainability performance, and mobilizing options)[41], the risk of the initiatives can be reduced and project efficiency can be achieved.

In summary, the following research findings should be considered for further IT business value research:

- Different types of IT systems seem to produce different impacts. For this reason, the impacts of an IT investment should be determined and evaluated on an individual and system-specific basis.
- IT investments can be broken down into IT assets and non-IT assets. In order to better understand how the business goals can be achieved, the combination of assets should be considered.
- There also seems to be a difference between whether companies already have a high level of IT and the extent to which IT is a focus in the company. It should be noted that IT investments are always linked to an existing IT landscape.
- IT investments are implemented through projects. In order to better evaluate the success of a project, it seems helpful to analyze the IT business value. Moreover, it is possible that the analysis will contribute to the project being executed more successfully.

In the research area "Neglected Disaggregation of IS Investments", it remains unclear to what extent IT investments can be broken down into specific IT system types and these can then be further broken down into IT assets and non-IT assets and how these then in combination lead to IT business value. The process of IT business value creation will be discussed in more detail in the next research area.

41 See the aspects discussed in the previous chapter 2.2.1.

2.2.3 Creation Process as a Grey Box

Current research focuses primarily on this area of research (Figure 2.1). Since research has been concerned with how the IT Business Value can be created, research has focused on the relationship between IT assets, IT capabilities and sociotechnical capabilities, their interrelationships and their impact on performance.

Part of the research is concerned with relationships from a technology-related perspective. The effects of e.g., Big Data Analytics / Business Intelligence (BI) (Fay and Kazantsev 2018; Huang et al. 2020; Mikalef et al. 2017; 2018; Popovic et al. 2018; Oesterreich et al. 2022; Richards et al. 2019), Cloud Computing (Dahlberg et al. 2017; Jafarijoo and Joshi 2020), In-Memory Technology (vom Brocke et al. 2014) and Social Media (Brajawidagda and Chatfield 2016) on the firm's performance are examined in studies. Nevertheless, it is difficult to compare the different results, as they analyze the value creation process differently depending on the focus of their paper. Typically, the value creation process consists of an IT capability or a combination of IT capabilities, other organizational capabilities, which are then related to each other and directly and indirectly to a type of performance, usually firm performance. This examines whether IT has a moderating or mediating effect on performance. The results of the studies were obtained through interviews, so subjective opinions may be included at this point.[42] The scope of empirical analysis is cited as a weakness in many studies, and long-term studies are also lacking. This is especially important here because relationships can also change over time. The time aspect, however, is often neglected.

Oesterreich et al. (2022) have found that the social factors of Big Data Analytics have a greater impact than the technological factors on business value. Here, too, it becomes clear that IT systems should be viewed as sociotechnical systems. In this context, other papers focus on the influence of individuals/groups on IT business value. This is done via senior management (Turedi and Zhu 2019), IT management (Dahlberg and Kivijärvi 2018; Wiedemann et al. 2017), teams (Chatfield et al. 2014) to individual positions (Wagner and Moshtaf 2016).

Since IT itself does not lead to a competitive advantage, it is necessary to combine it with organizational resources (Liang et al. 2010). Ceric (2016) conceptualize the IT creation process as a system "in which IT and organizational resources interact with one another" (Ceric 2016, p. 603). The system consists of elements that influence each other positively or negatively at different levels or influence the entire system. The elements are divided into 5 categories: levers, indicators, identities, buffer, or trends (Ceric 2016). The system is referred to as IT capability (Ceric 2016). The influence of complementarities is the focus of further research. The IT business value discussion is

42 To our knowledge, only Ayabakan et al. (2017) has attempted an objective investigation.

largely based on the resource-based view. The aim of the resource-based view (RBV)[43] is to make the best possible use of the resources available in the company in order to create unique resources and competencies and thereby gain a competitive advantage (Ambrosini et al. 2009; Barney 1991). Gellweiler and Krishnamurthi (2021) extend the IT business value discussion based on the resource-based view to include the customer-based view and sees customer value and organizational value as complements that can have a direct or indirect impact on firm performance. Steininger et al. (2021) considers dynamic capabilities to be a complement to the current IT business value discussion in order to better reflect the dynamic environment and thus the rapid changes over time. The original definition of dynamic capabilities was provided from Teece et al. (1997) and they define a dynamic capability as a "firms' ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. 1997, p. 516). This raises the question of the extent to which IT affects dynamic capabilities, or whether dynamic capabilities affect IT, and how dynamic capabilities can be operationalized in order to take them into account in an value management. Lee et al. (2014) examines the relationship between IT investments and corporate performance with a focus on complementarities of IT components. They found that complementarities between IT components are significantly related to firm performance. The effect, whether positive or negative, depends on the level of the complementary components. Neglecting them when determining firm performance would lead to different results. Sambhara et al. (2018) found evidence that the increased use of a complementary IT system suppresses the efficiency of the leading IT system, as this introduces further complexity into the process under consideration. Sambhara et al. (2018) also consider the extent to which the use of IT is linked to competencies in the business domain, with a focus on process performance, and conclude that increased use of IT can also be counter-productive for companies that lack IT managerial competencies. They identify three impacts that lead to improvement or deterioration through increased Enterprise System (ES) use: "(1) technology enablement effect, (2) suppressive effect of the supporting technology, and (3) countervailing knowledge effect" (Sambhara et al. 2018, p. 1). They identify competencies as a key factor in driving improvement in a company's internal processes. Other papers deal with cross-company effects (Mandrella et al. 2020; Jia et al. 2020b). Rojas and Kathuria (2014) examine the extent to which the combination of resources beyond firm performance influences the position in competitive networks. While previous papers write about capabilities and dynamic capabilities, Liu et al. (2020) introduce IT wisdom as a meta-capability. IT wisdom is a "holistic meta-IT capability of a firm which can strategically enable and exercise any suitable IT capabilities and organizational capabilities for improving firm performance" (Liu et al. 2020, p. 1). An empirical study confirmed that IT wisdom is positively and also directly related to firm

43 The RBV can also be found in the literature under resource-based theory (RBT) (Ceric 2016; Kozlenkova et al. 2014; Alvarez and Busenitz 2001). The RBV was developed in strategic management (Barney 1991; Wernerfelt 1984) and was then transferred to IS research (Wade and Hulland 2004).

performance (accounting and market-based metrics).

While most papers examine the value creation process in terms of how IT affects performance, examines Baker et al. (2017) the value creation process in both directions, namely whether IT investments lead to more productivity and whether more productivity leads to more IT investments. They have found that it is neither a unidirectional nor a bidirectional relationship, but that it exists through intermediate variables and over multiple time periods. "IT investment in a given time period builds the stock of IT inputs, those IT inputs then impact productivity, and that productivity then leads to IT investment in a future time period, completing the loop and beginning the cycle anew" (Baker et al. 2017, p. 142).

Other works approach the topic more via tasks from the IT management such as IT business alignment, IT governance, and service digitization, or from the specialist departments such as supply chain management (SCM) and financial services. IT business value is mainly discussed in the context of IT management and the associated task areas. Wang et al. (2015) state that IT assets do not have a direct influence on firm performance, but in combination with IT management they influence firm performance dynamically, taking into account environmental parameters. Köffer et al. (2015) investigate the implication for IT management through IT consumerization. IT consumerization describes the use of consumer technology such as smartphones, tablets, or cloud applications in companies. In terms of IT business value, IT consumerization can lead to greater operational agility and also to digital options through individualization. Reichstein (2019) focused on the IT department and was able to determine that the investment in the size of the IT department as well as in experienced top managers in IT and a high degree of digitalization of the company positively influenced the role of the IT department. The influence of the IT department has a positive impact on firm performance (Reichstein 2019). Hackenberg et al. (2015) would like to investigate how IT management profiles and business strategy affect IT business value domains.

Some papers focus on specific task areas of IT management. In context of IT business alignment Tallon et al. (2016, p. 563) were able to determine that IT shortfall, defined as "a lack of IT support for business activities" correlates negatively with IT business value, while IT slack, defined as "having more IT than needed to support current business activities" correlates positively. Whether a company had an IT shortfall or an IT slack depended on the business strategy and whether the process was critical to the success of the chosen business strategy (Tallon et al. 2016). Klaus et al. (2022) were able to provide empirical evidence that IT business alignment, which is considered particularly important in IT management, has a positive impact on the company's financial performance. Also Dahlberg and Kivijärvi (2018) confirm that the IT business alignment is positively related to IT business value. Wagner et al. (2014), Wagner and Moshtaf (2016), Weeger et al. (2015), and Zolper et al. (2014) have considered the IT business alignment on a more operational level, focusing on the social aspect. Wagner et al. (2014) use the social capital-based alignment model as the basis of alignment to explain how alignment affects IT business value. They recommend that managers focus on knowledge, trust, and respect in addition to communication (Wagner et al. 2014), as operational alignment is just as important as strategic IT business alignment (Wagner et al. 2014; Weeger et al. 2015). In complement to Wagner et al. (2014), who examined social capital on business understanding of IT, Weeger et al. (2015, p. 2) propose that "social capital drives cross-functional cooperation between business and IT at operational levels and, in turn, creates IT business value". Wagner and Moshtaf (2016) emphasize the importance of the human component between the business and the IT. Accordingly, they examined the required competencies of an IT architect that have an impact on the interface between business and IT. In particular, openness, trust, relationship management, and communication are relevant (Wagner and Moshtaf 2016). Nevertheless, according to Wagner and Moshtaf (2016)'s study, the broad work experience is the most important. Zolper et al. (2014) also named frequent interaction, cross-domain knowledge, and a trusted partnership as key social aspects. In addition, a main contact person is needed between IT and the business. The contact person from IT and the business, in turn, must be well connected in their departments. Related to IT business alignment, the literature also examines IT governance in terms of IT business value. Zhang et al. (2014) investigate the impact of IT governance on IT capabilities and firm performance and Elazhary et al. (2022) also analyze the impact of IT governance on organizational agility under market turbulence, which show a strong impact. Turedi and Zhu (2019) found a positive moderating effect of the IT decision-making structure in IT governance on firm performance. However, it also showed that senior management involvement had no influence on this relationship. Huygh and De Haes (2019, p. 16) confirm that a "viable IT governance system continues to achieve its purpose of creating and preserving IT business value". Specific capabilities and their influence are also examined: IT application orchestration capability (Queiroz et al. 2015), IT-enabled process integration capability (Rai et al. 2015), and mobile BI capabilities (Peters et al. 2014).

In addition to the focus on the IT department, other business areas of a firm are also considered. Khuntia et al. (2021) analyzes to what extent it enabled supply chain information integration has an impact on business collaboration with clients as well as suppliers and how this then affects firm performance. In the context of supply chain information integration, Wei et al. (2020) examine in more detail whether exploratory and exploitative IT capabilities are complementary or substitutive. Zhu et al. (2020) consider the value creation mechanism of e-business processes in the supply chain. Chen et al. (2020) investigate in the finance area of a company to what extent shared financial services improve the firm's performance. Chen et al. (2015b) and Fichman and Melville (2014) investigate the influence of IT on innovation. Wiesböck et al. (2020) extends previous research on product innovation performance through the influence of digital products.

Other papers focus on the creation process of IT business value in different industries: Healthcare (Kung et al. 2016; Polykarpou et al. 2018; Weeger et al. 2015), Retail (Luo et al. 2012), Manufacturing (Mandrella et al. 2017; Popovic et al. 2018; Ceric 2016), and Electric Utility Industry (Rai et al. 2015). Chae et al. (2014) did a study to check whether the link between IT capability and firm performance is still positive, despite the many developments in IT. To their surprise, their results showed that no significant link could be demonstrated, so IT leaders could not demonstrate better financial performance compared to the control firms either. In a subsequent study, Chae et al. (2018) have found that firms where IT has a transformative role demonstrated higher performance than IT leaders. Jia et al. (2020a) examine to what extent IT implementations reduces information uncertainty induced underreaction anomaly in capital markets. Underreaction is understood as public information that is underestimated by investors (Jia et al. 2020a). It has been shown that ES can reduce the ambiguity of new information and thus better determine the company’s value. In addition to the industry, the size of the company is also taken into account as a differentiation. Bi et al. (2015) analyze the impact of IT on firm performance in small and medium enterprise (SME). Kim et al. (2016) investigates under which conditions the use of a knowledge management systems (KMS) leads to a higher performance. On the one hand, for managers who also use other physical or computer-based knowledge sources, the usefulness of the KMS decreases, while social knowledge sources complement the KMS. On the other hand, the KMS leads to a higher benefit for managers who need large amounts of data due to their environment, while the benefit of the KMS decreases for managers who need rapidly changing data due to their environment.

Apart from content-related papers on IT business value, methodological problems of current IT business value research are also mentioned. Markus and Rowe (2020) discuss the problem of theoretical endogeneity, which can be caused by data scarcity and measurement errors. The problem can be tackled by four alternatives/additions: social norms, better theory, deep description, and causal case study methods (Markus and Rowe 2020). Kennedy et al. (2021) point out that the classification of the industry and the level of aggregation can have an influence on the investigated impact of IT on firm performance and appeal to perform robustness checks.

In summary, the following research findings should be considered for further IT business value research:

- The IT business value can change over time due to various environmental factors. For this reason, IT business value should be identified and assessed not just once, but repeatedly before, during, and after the IT investment project. In addition, the environmental factors should be included in the analyses of the IT business value.

- The impact of IT investments depends not only on technology but also on human actors. To better understand the creation process, the IT systems and the firm must be viewed as a sociotechnical system.
- Within the sociotechnical system, IT and non-IT resources interact with each other. To better understand the creation process, it is important to understand how and which complementarities affect IT business value.
- IT investments can lead to more productivity, which in turn can lead to more IT investments. To better understand the creation process, it is necessary to examine what is cause and what is effect.
- The reliability of the results of the various studies must be ensured in order to avoid methodological problems in research.

Although the research area "Creation Process as a Grey Box" receives the most attention in the IS discipline, further research is needed on the creation process of an IT investment for firm performance. In this research area, it is still unclear, for example, what role IT plays in the context of dynamic capabilities and how these can be operationalized to complement current research on IT business value.

2.2.4 Holistic Procedure to Identify and Evaluate the IT Business Value

Overall, the IT business value literature deals with many different topics, which is due to the ambiguity and complexity of the subject area, which also became clear above all in the considerations of the creation process in chapter 2.2.3. Each paper thus contributes a small part to the research areas, which is important to make the topic handleable. Nevertheless, the literature lacks a holistic procedure for identifying, realizing, measuring, and controlling IT business value. For this reason, the "Holistic Procedure to Identify and Evaluate the IT Business Value" is considered as another research area. In benefits management[44] research, a procedure is proposed that monitors the realization of benefits in a project. Semmann and Böhmann (2015) focus on the post-project phase of benefits management. However, benefits management is about the realization of the technical artifact and not about actions for its realization, which is the main issue to be considered in this thesis. Nevertheless, Zhang and Gable (2016) also see the post-project phase, in which the IT system is actually used, as useful and important for realizing the potential of an IT investment.

While in the literature mainly pairwise the relationship of IT investments on firm performance is analyzed, Cao et al. (2016) emphasize that a focus on the whole

44 Bradley (2010) refers to the process from analysis to benefits realization as benefits management. The approach can also be found in the literature under benefits realization management (Bradley 2010). The focus is on benefit planning, change management, and benefit realization (Ward and Daniel 2012). In this approach, the measurability of benefits is assumed and IT is viewed as an enabler (Ward and Daniel 2012).

system[45] should be considered. They investigate systemic capabilities that can be developed through synergistic interrelationships among IT and other organizational factors at a system level that positively impact IT business value[46]. In this context, the human actors as a system element have a considerable influence on the configuration of the organizational factors.

Tallon (2014) emphasizes that agreement among executives in a company on the business value of IT investments can be important, as it allows for joint assessment of future investments or countermeasures to be taken if IT projects threaten to fail. "Consensus around IT is especially important considering the enormous amounts spent on IT by firms worldwide and the associated risk of failing to halt or reverse losses from a failing IT investment" (Tallon 2014, p. 321). Chief Information Officers (CIOs) can help communicate the purpose behind IT investments to non-IT employees (Tallon 2014).

In summary, the following research findings should be considered for further IT business value research:

- Not only during the IT investment project the IT business value should be considered, but also a post-project phase should be considered to capture the realization of the potential of the IT investment.
- IT business value should be considered in different IT investment project phases. For a holistic process, the individual steps of the controlling process of IT business values should become clear. In addition, responsibility must be clarified as to which persons are responsible for the realization and communication of the IT business value.
- IT business value should be analyzed on a holistic level for the entire company and not just considered in isolation for individual IT investment projects.

On the one hand, in this research area "Holistic Procedure to Identify and Evaluate the IT Business Value" a procedure is needed to identify, evaluate, agree and control the IT business value of an IT investment, and on the other hand, this procedure must then be integrated into a project procedure, which is the implementation of an IT investment. The implementation of IT investments is carried out on the basis of IT projects. Process models from software engineering are used to implement the IT projects in a structured manner. However, these do not take into account the IT business value considerations at all or only insufficiently (Schütte et al. 2022b). In

45 Cao et al. (2016) view a company as a system, which can be defined as "a system composed of interrelated subsystems or systems elements such as organisational members, strategy, structure, process, culture, and IT, separated by a boundary from its environment".

46 Cao et al. (2016) understand an firm’s IT business value as "the behaviour of the whole system rather than that of systems elements, such as the pairwise relationship between IT and another organisational factor".

order to take IT business value into account in IT projects, the question arises as to how controlling can be integrated into project process models.

3 Problem Statement and Research Questions

After reviewing the current status on IT business value research and identifying the related research gaps in chapter 2, the research problem of this thesis can be derived.

It can be summarized that the identification and the assessment of the business value of IT would be helpful for the management of a company to make more targeted decisions. However, the identification continues to be a major challenge for companies, which is further reinforced by the phenomenon of increasing IT investments due to digitalization. Information Systems (IS) as a scientific discipline[47] has the claim to deal with information systems in companies, public sector, and private households which are constituted by phenomena of reality (WKWI 1994). This thesis deals with the identification of the IT business value of IT systems, which are considered embedded in organizations and thus is assigned to the IS discipline.[48] According to Schütte et al. (2022a, p. 530), a research problem in the IS discipline consists of three perspectives that need to be considered: "technology, organization, and economic efficiency". In the following, the three perspectives that make up the research problem of this thesis will be explained in detail in order to further specify the problem.

In the context of this thesis, technology represents the IT systems to be introduced or modified, meaning the IT investments. The focus here is primarily on larger company-wide IT systems such as Enterprise Resource Planing (ERP), Supply Chain Management (SCM), Business Intelligence (BI), and Customer Relationship Management (CRM) systems. Determining the IT business value of a workstation, for example, does not seem to do justice to an IT business value analysis, as it does not have a major impact on the company’s objectives and is therefore not the focus of this thesis. Moreover, the effort outweighs the benefit. For larger IT investments, however, it seems helpful

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47 A distinction is often made between the international IS discipline and the German "Wirtschaftsinformatik" (WI) discipline. WI can also be found in the literature under the terms business informatics (Schütte et al. 2022a), business and information systems engineering (BISE) (Steininger et al. 2009), and business information systems (Patig 2001). According to Chen and Hirschheim (2004) and Frank (1997), "Wirtschaftsinformatik" primarily follows the design science paradigm. For a more detailed distinction between the two disciplines, please refer to Heinrich et al. (2011), Herzwurm and Stelzer (2014), and Schauer and Frank (2007). In this thesis, the separation of disciplines is not relevant and for this reason only the term information systems is used.

48 Recently, IS researchers (Schütte et al. 2022a) have been discussing the extent to which differentiation from other disciplines is necessary and possible. The reason for this is that neighboring disciplines such as computer science or business administration are increasingly dealing with issues that were previously assigned to the IS discipline (Schütte et al. 2022a). Ahlemann et al. (2021) assume in IS research an (1) understanding of an IT artifact that emerges in a (2) system with social elements, while the system is (3) resource-constrained and must be managed and used accordingly. It is about an "software’s successful use in organizations, as reflected in an organization’s success" (Schütte et al. 2022a, p. 531). The other disciplines each have weaknesses in one of the three perspectives or do not consider them at all (Schütte et al. 2022a). Figure 3.1 shows how the three perspectives are considered in this thesis, so that it becomes clear why this thesis can be assigned to IS.

to determine the IT business value. ERP systems have the task of planning and organizing the available resources in a company (Gronau 2019). This includes, for example, the areas of finance, human resources, and procurement (Winkelmann 2019). CRM systems focus on customer relationship processes (Hilbert 2019). BI systems help managers make informed decisions by analyzing and presenting data (Hummeltenberg 2019). Thus it becomes clear that IT systems differ in their tasks, so the impacts of IT systems are also system-specific, because a BI system will deliver more strategic impacts (intangible) (Tripathi et al. 2020) than an ERP system[49] (Martin et al. 2002). Nonetheless, even among those who plan to invest in Big Data, 43 % do not know what impacts can be expected and likewise those who have already invested in Big Data, 38 % do not know the impacts either (Mason and Weigend 2015). So there is a lack of an overview of possible impacts in general, but checklists to identify the impact of IT systems cannot be used generally. Impacts must therefore be identified on a system-specific basis. This requires knowledge of the IT system to be introduced. Some authors have addressed the problem by formulating value catalogs for specific IT system types. Schubert and Williams (2009a) and Shang and Seddon (2000) have developed value catalogs for ERP systems, DeLone and McLean (2003) and Riggins (1999) for e-commerce systems. However, there is no overview of the possible value catalogs in the literature so far, which then also makes the selection of the practitioners more difficult. Especially since there are still no dedicated value catalogs for all system types. In addition to the different IT systems, there are also the number of systems that exist in a company. IT business value depends on the existing IT landscape in the company, which can support but also limit the realization of impacts (Lee et al. 2014). The more systems there are in a company, the more complexity exists. This complexity makes it difficult to separate cause and effect from IT investments. Schubert and Williams (2013) use cause and effect chains for a better overview. However, these can quickly become incomprehensible for large IT investments. Nevertheless, a holistic perspective is needed to assess the impacts of IT investments. In addition to the technological perspective of the research problem, the organizational perspective must also be taken into account.

The impact of the technology is to be determined on the whole organization as a system (Cao et al. 2016), which is context dependent. If you introduce the same IT system into two different companies, the impact will still be different (Schütte et al. 2022b). The occurrence of impacts and also the level of impacts are therefore dependent on the specific companies. The organizational system contains a variety of factors that are affected by the introduction of a new IT system. The IT system can adapt to the

49 But integrating the two systems, ERP and BI, can also "enhance and improve the ability of companies to decision-making by leveraging the ability to manage data from the ERP system and the analytical capabilities of the BI system" (Nofal and Yusof 2013). The following benefits, among others, can be achieved: "Allowing to control the recognition of corporate cash flow in real time", "improving profitability by transaction data analysis" and "forecasting business trends, and enable the management of the sales force" (Agostine 2004; Nofal and Yusof 2013).

organization, or the organization must adapt to the IT system, so that organizational changes are also necessary (Brynjolfsson and Hitt 2000). This makes it difficult to say what caused an effect and whether it was due to IT. The organizational perspective is taken into account in this thesis, but the focus is particularly on examining the economic impact of IT systems. The organizational perspective determines whether the impacts occur and to what extent. It thus sets requirements for impact realization. This must then be considered for individual cases and requires a case study, which, however, is not part of this thesis.

Economic efficiency is expressed in "economic design, implementation, use and management of information technology artifacts" (Schütte et al. 2022a, p. 530-531) and economic success. It therefore concerns the management of the introduction of an IT system. To the best of our knowledge, current approaches are either not concrete enough to be directly applied in practice or cover only a small part of the IT business value identification and assessment process. Benefits management (BM), which is primarily concerned with organizational change in the course of change management (Bradley 2010), focuses on the realization of the value of the technical artifact, but not on the actions needed to realize the artifact. From our perspective, this is not sufficient. In the IS literature, a number of value catalogs have been developed to date (eg., Kesten et al. (2007); Lucas (1999); Mirani and Lederer (1998); Riggins (1999); Schubert and Williams (2009a); Shang and Seddon (2000)). These contain a list of impacts that can occur with an IT investment. Nevertheless, it remains unclear to what extent the value catalogs can be taken into account in the project lifecylce and how they can be complemented by other methods to obtain a holistic view of the IT Business Value. Here is missing an integrated view to address the complexity. In practice, process models are adapted in organizations in order to consider economic efficiency (e.g., the enterprise value-oriented controlling at BMW Group (Krause and Schmidbauer 2003)). However, the problem of impacts is ignored[50] and only the problem of economic efficiency, which in companies originates from controlling, is transferred to the process models. From our perspective, this is not sufficient.

With the assumption that digitalization will still be relevant for companies in the future, the following relevant research problems can be derived in regard to the three perspec-

50 In Scrum, the product owner prioritizes the features in the product backlog (Schwaber and Sutherland 2020). Thus, an evaluation is implicitly made as to which feature is important for him. In 2020, the product goal was also introduced to align the Scrum team with a larger, more valuable goal (Schwaber and Sutherland 2020). However, the approaches do not aim to enable a comprehensive and continuous IT business value consideration. In XP, the product manager also helps the team to set priorities (Beck 1999). In addition, he writes stories that present the customer's requirements from a business perspective. Although profitability is one of 14 principles (Beck 1999), there is no structured IT business value controlling. In RUP, a business case and a cost-benefit analysis are prepared in the invention phase (Péraire et al. 2007). However, this is not considered further in the subsequent phases or monitoring of the benefits is not included. This list can be continued with the other process models such as FDD, Crystal, DSDM, V-Model, RAD-model, waterfall model, spiral model, and V-model-XT, but should suffice as an example here. Since the models originate from software engineering, it is not surprising that the development of software is the focus.

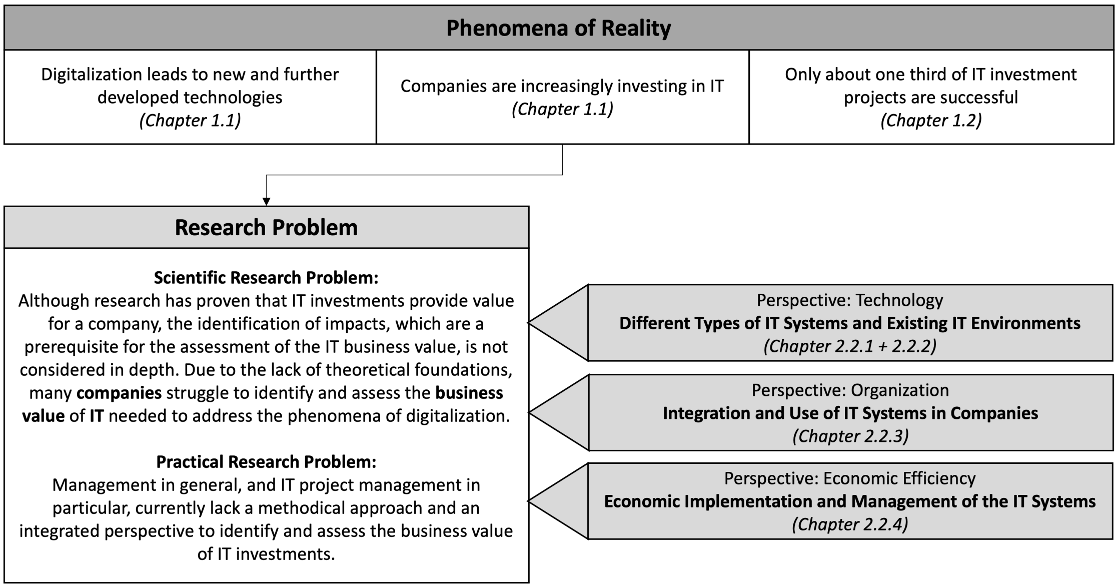

Figure 3.1: Adapted Perspectives of the Research Problem according to Schütte et al. (2022a)

tives technology, organization, and economic efficiency (Figure 3.1):

> **Scientific Research Problem:** *Although research has proven that IT investments provide value for a company, the identification of impacts, which are a prerequisite for the assessment of the IT business value, is not considered in depth. Due to the lack of theoretical foundations, many companies struggle to identify and assess the business value of IT needed to address the phenomena of digitalization.*

In addition, from the scientific research problem, the practical problem can be derived. In practice, it is still the case that many IT projects add little or no value to the company's success, even though there is a fundamental awareness of the relevance of IT business value (Chapter 1.1). This can be attributed to the fact that previous methods are too complicated or too resource-intensive, or do not yet exist to support management in a company. Thus, the following practical research problem can be derived:

> **Practical Research Problem:** *Management in general, and IT project management in particular, currently lack a methodical approach and an integrated perspective to identify and assess the business value of IT investments.*

The identified problem area – identification of impacts of IT investments – seems to be very broad (many research areas with in turn many research streams), complex (many influencing factors determine the IT business value), and high social-technical (consideration only possible in combination of IT with the organization). Schütte et al. (2022a) advocate addressing precisely such real-world research problems and thereby avoiding model platonism[51]. In order to address the research problems, the problems were divided into three research questions.

First, the scientific research problem focuses on the identification of impacts, which is the prerequisite for assessing IT business value. In this thesis, impact identification will be differentiated into two research streams: the identification of impacts on a strategic level and on an operational level of a company. At the strategic level, the focus is often on the potential of IT investments. For example, "automation" (Petrovic 1994), "reduction of local and time barriers" (Petrovic 1994), and "increased information" (Petrovic 1994) can be named as potential of IT investments. Potentials can therefore be considered as intangible impacts (Prasad 2008). Sussland (2001) emphasize that the largest part of a company's business value is achieved through intangibles. Executives also find that intangible assets are crucial to the future success of the company (Molnar 2004). The operationalization of intangibles, however, is a challenge (Bavdaž et al. 2023; Marr 2007). This also applies to intangible impacts of IT investments (Gunasekaran et al. 2006; Khallaf 2012). IT investments can unlock capabilities, for example. Failure to take intangible impacts into account leads to the risk that the potential of investments is neglected when calculating the IT business value and that the value of the IT investment is therefore not correctly captured. Companies can therefore make the wrong decisions on the basis of these incorrect values (Lev 2001). To prevent this, foundations must be created to nevertheless take the strategic impacts into account. This requires an approach to the extent to which potentials can be conceptualized and made accessible for an IT business value assessment. This approach should also be usable in practice, so that practical research problem are also addressed. Thus, we pose the first research question:

> **Research Question 1:** *How can strategic impacts of IT investments be made accessible for the IT business value identification?*

Second, once it has been clarified how impacts can be captured on a strategic level of a company and taken into account in the IT business value assessment, we can move on to the operational level of impact identification. There are still challenges for companies. Although there are already approaches to help identify impacts of IT investments, they are difficult to find in the literature. An example are the value catalogs (see Chapter 2). In this thesis, we use the term "value catalogs", but there is still no uniform term in the literature. This makes the search for a suitable value catalog difficult, especially since it should be designed for the type of IT system under consideration (see Chapter 2). As with value catalogs, this applies to other terms in the context of IT business values. The definitions of values are "nebulous" (Gellweiler and Krishnamurthi 2021). The term IT business value can also be found in the literature

51 Model platonism is, for example, when the object of investigation is simplified for reasons of complexity reduction to such an extent that the results have only little significance for practice (Schütte et al. 2022a).

under synonyms such as "IT value", "business value of IT", "Benefits", "IT Business Value Benefits" (Gellweiler and Krishnamurthi 2021), or "economic impact" (Chae et al. 2014). The same applies to how IT business value can be manifested. The literature mentions among others profitability, productivity, and process improvements (Gellweiler and Krishnamurthi 2021). Synonyms for firm performance are performance, organizational performance (Gellweiler and Krishnamurthi 2021), manufacturing performance (Popovic et al. 2018), and business performance (Reichstein 2019). Thus, there is no overview of what the impacts of a specific IT investment can be, how they can be characterized and to what extent they can be identified. In this research stream, theoretical foundations are to be provided for the identification of impacts. Thus, we pose the second research question:

> **Research Question 2:** *How can impacts of an IT investment be identified on an operational level in a company?*

Finally, in order to determine the IT business value, it is not sufficient to deal only with the impact identification. For this reason, the designed IT artifacts of the previous research questions are to be integrated into an overarching procedure. The impact identification should be only the first step in a procedure for management in general and IT project management in particular. The question arises here as to what all has to be taken into account in such a procedure. It is already clear from the state-of-the-art analyst that values must be agreed (Tallon 2014), that values must first be realized, that an ex-post consideration is necessary (Zhang and Gable 2016). For example, the agreement on IT business value seems to be important, as executives' perception of IT business value should be viewed with caution, as it may also be subject to "bias, error, and distortion" (Tallon 2014) because IT business value is such a complex area (Mezias and Starbuck 2003). The overarching procedure cannot run incidentally to an IT project, but requires dedicated management. Thus, we pose the final research question:

> **Research Question 3:** *How can companies achieve targeted management of the IT business value, which includes the identification of impacts?*

The research of this thesis is thus intended to advance research on impact identification while supporting practitioners. To solve the real-world research problem, new IT artifacts are needed to help identify and assess IT business value. This requires a design science paradigm[52] [53] from the IS discipline. With the help of the design science paradigm, the objectives of this thesis can be achieved. Therefore, the methodological approach of this thesis is presented next.

52 In the information systems discipline, a distinction can be made between behavioral science and design science (Hevner et al. 2004). While behavioral science has a theory as a research result through theory building and theory testing, design science focuses on the construction and evaluation of IT artifacts (Hevner et al. 2004). The two researches thus differ in their goal. Behavioral science tries to find the truth through empirical adequacy, whereas design science aims at usefulness (Hevner et al. 2004). Becker and Pfeiffer (2006) also see the clear separation of research goals, but the research results and research activities are not clearly separable. This is because the two paradigms are interdependent approaches, each needing the other approach to progress (Becker and Pfeiffer 2006). This linkage is also evident in Hevner et al. (2004)'s information systems research framework, where the knowledge base is applied to the development of artifacts. In turn, IT artifact development then complements the knowledge base (Hevner et al. 2004). However, the focus of this thesis is more on design science, as solutions to a problem should be created that are then useful in practice.

53 A theory, which is the goal of the behavioral science, can be defined as regularity through a spatiotemporally independent cause-effect relationship (nomological hypotheses). In the field of economics, however, usually only a spatio-temporal cause-effect relationship can be uncovered (Prim and Tilmann 2000). Through theories, the cause-effect relationship can be recognized for explanations (through causes and effects) and predictions (based on causes and effects). Part of a theory are the boundary components (cause) and the situational givens (cause), a regularity (cause-effect relationship) and an action (effect). According to Carrier (2011), Kuhn (1997), and Töpfer (2012), good scientific theories should fulfill the following criteria: conformity to facts, freedom from contradiction, scope, simplicity, and fruitfulness. For further details, please refer to the above-mentioned publications.

4 Methodological Approach

In this chapter, the methodological approach to answer the research questions is explained. First of all, the design science research on which the thesis is based and the philosophical grounding that is relevant for a better understanding of the contributions are presented. Then, a selected design science research methodology is adapted to the thesis in order to show the overarching methodological approach. Finally, the papers of this cumulative dissertation are placed in the thesis structure and the further remainder of the thesis is described.

4.1 Design Science Research and the Philosophical Grounding

This thesis is based on the design science research (DSR), which was particularly described and driven by Hevner (2007). DSR describes the creation of an artifact to solve a problem and the subsequent analysis of its performance. An artifact represents a (technological) solution: constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), or implementations (implemented and prototype systems) (Hevner et al. 2004; March and Smith 1995).[54] Some literature, such as Baskerville et al. (2018), Vaishnavi and Kuechler (2004) and van der Merwe et al. (2020), has added design theory[55] to this list. Besides the artifact as design, the process of creating the artifact is also the design. This is because design can be considered a noun as well as a verb, so design can be discussed as a dual construct.[56] All in all, DSR as design-oriented research focuses on problem-solving (Hevner et al. 2004) and is thus suitable for research disciplines with a strong application orientation. This includes, for example, the information systems (IS) discipline (Frank 1997), as IS research is "directly related to its applicability in design" (Hevner et al. 2004, p. 76). In the IS discipline, DSR is established as a research method, which also finds a growing application (Becker 2008; Deng and Ji 2018). The application orientation of this thesis became already clear in the motivation and the research problem (Chapters 1 and 3), so that DSR was chosen as the appropriate research approach for this thesis.

54 Other IT artifacts such as meta-models of modeling tools, process models, project models (Winter 2008), software, systems (Purao 2002), algorithms, human/computer interfaces, languages, system design methodologies (Hevner and Chatterjee 2010; Vaishnavi and Kuechler 2004), frameworks, architectures (Vaishnavi and Kuechler 2004), (better) theories (Rossi and Sein 2003; Winter 2008), and design theories (Baskerville et al. 2018) also exist in the literature. According to van der Merwe et al. (2020), five types of artifacts can be distinguished, into which all the artifacts mentioned can be classified: constructs, models, methods, implementations, and design theory.

55 Not all authors agree to consider theories as artifacts in the context of design science research. At the beginning of DSR, theories were explicitly excluded. „Design science products are of four types, constructs, models, methods, and implementations. [...] Notably absent from this list are theories, the ultimate products of natural science research“ (March and Smith 1995). Natural science aims to understand reality (Baskerville and Pries-Heje 2010), where design science "produce and apply knowledge of tasks or situations in order to create effective artifacts“ (March and Smith 1995, p. 253). See Baskerville and Pries-Heje (2010) and Venable (2006) for an in-depth discussion.

56 Authors who consider and discuss the dual concept are among others Gregor and Jones (2007), Hevner et al. (2004), Simon (1996), and Walls et al. (1992).

To conduct our research, we need a method that shows which activities are necessary to address the research problem in a structured way. In the design science literature, one of the most frequently cited methods, the Design Science Research Methodology[57] (DSRM), is from Peffers et al. (2007), which is also used in highly ranked[58] papers (e.g., Grenha Teixeira et al. (2017); De Leoz and Petter (2018); Gregor and Hevner (2013); Chanson et al. (2019); Silic and Lowry (2020); Pee et al. (2021)). The DSRM process model[59] consists of six activities. In the first activity, the problem is identified and motivated. Then, by inference from the motivation, the goals of the solution are defined in the second activity. Through the enrichment of theory, the artifact is then designed and developed in the third activity. The fourth activity involves the demonstration of the artifact, which can be done with the help of how-to knowledge. It is important to note that the entry point or research for Peffers et al. (2007) does not always have to be at activity 1, but can take place at activities 1-4 (e.g., a design & development centered solution starts in activity 3). Metrics, analyses, and knowledge are then used to evaluate the artifact in the fifth activity. In the sixth activity, disciplinary knowledge is typically communicated to the research community. The fifth and sixth activities can then trigger an iteration in which the objectives of the artifact or the design & development are modified.

Before the adapted DSRM according to Peffers et al. (2007) for this thesis can be described, the philosophical grounding of this thesis must be explained. In IS research, the underlying ontological and epistemological views are typically described in order to better understand the interpretation of the contributions. Ontology refers to the nature of reality (Wahyuni 2012). The question of whether reality can be considered objective or whether reality depends on social actors and their actions is discussed (Orlikowski and Baroudi 1991).[60] Epistemology refers to the nature of knowledge (Becker and Niehaves 2007; Burrell and Morgan 1979; Hirschheim 1992).

57 The terms methodology and method are often used synonymously in the literature. A method is generally described as a procedure that uses specific tools to ultimately achieve a goal (Chmielewicz 1994). In the IS discipline, the goal can be to gain knowledge or to create an artifact (Wilde and Hess 2006). DSRM is the latter and represents a method to create an artifact. A methodology, on the other hand, is the theoretical study of different methods (Schilling 2008). However, this differentiation is not used in the english-language literature. For this reason, the terms are used synoymously in the thesis, with the terms used in the sense of method.

58 According to the VHB JQ3 ranking: https://vhbonline.org/vhb4you/vhb-jourqual/vhb-jourqual-3/gesamtliste.

59 For completeness, we would also like to refer to other DSRM process models by Takeda et al. (1990) (920x cited on google scholar), Eekels and Roozenburg (1991) (250x cited on google scholar), Nunamaker Jr et al. (1991) (2120x cited on google scholar), March and Smith (1995) (5789x cited on google scholar), Cole et al. (2005) (481x cited on google scholar), Offermann et al. (2009) (362x cited on google scholar), Gleasure et al. (2012) (21x cited on google scholar), Alter (2013) (576x cited on google scholar), Vaishnavi and Kuechler (2015) (1322x cited on google scholar), which, however, do not have the status as Peffers et al. (2007) (9166x cited on google scholar) in the literature.

60 Historically, IS research distinguishes between the two extremes of subjective and objective assumptions (Wahyuni 2012). The subjective assumption describes reality from the perception of a human being (Wahyuni 2012). The objectives assumption, on the other hand, describes a reality that exists even without a human being (Burrell and Morgan 1979). This means that an objective reality exists, which can thus be observed.

The question of how "true" knowledge can be constructed and evaluated is discussed (Orlikowski and Baroudi 1991; Niehaves 2007).[61] The answer to this question is limited by the previously ontological point of view taken (Guba and Lincoln 1994; Niehaves 2007).

As already mentioned, this thesis follows the DSR. The underlying philosophy of DSR differs in the literature. Van der Merwe (2020) have identified papers that see DSR as its own paradigm (Vaishnavi and Kuechler 2004; Cross 2001), that favor traditional paradigms such as positivism and interpretivism (Gregory 2010; Venable et al. 2012; Carlsson 2006), and that adopt pragmatism as appropriate paradigm (March and Smith 1995; Hevner 2007; Goldkuhl 2012; Deng and Ji 2018). Besides positivism and interpretivism, pragmatism represents an alternative to the traditional perspectives. In pragmatism, utilitarianism plays the decisive role, because something is true if it is useful, and truth is that which leads to meaningful action (Dürr 1999). March and Smith (1995) defines truth as what works in practice, and Goldkuhl (2012) confirms that the pragmatic perspective fits for DSR. Hevner (2007) sees pragmatism as the nature of DSR "due to its emphasis on relevance; making a clear contribution into the application environment" (Hevner 2007, p. 91), and Deng and Ji (2018) sees DSR as underpinning philosophy. In accordance with the arguments, this thesis also follows a pragmatic philosophy.

Having now clarified the philosophical grounding, the activities of the DSRM process according to Peffers et al. (2007) need to be adapted to the specific research project of this thesis.

4.2 Adopted Design Science Research Methodology

The individual activities according to Peffers et al. (2007) are adopted for this thesis (Figure 4.1).

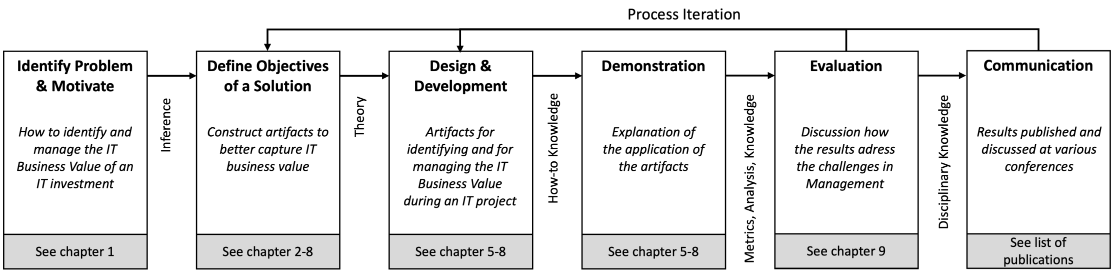

Figure 4.1: Adopted DSRM Process Model according to Peffers et al. (2007)

61 Historically, IS research distinguishes between the two extremes of positivism and interpretivism (Niehaves 2007). Positivists believe that reality and researchers are independent of each other, that is, reality can be observed by any researcher in exactly the same way (Becker and Niehaves 2007). Interpretivists, on the other hand, believe that reality and its perception are directly related to the researcher and that no objective knowledge can exist (Niehaves et al. 2006). Knowledge may differ among researchers because of subjective experiences (Weber 2004).

This research process begins with the first activity, as we use a problem-centered approach. In the first activity, the specific research problem is explained and the relevance of the solution for the researchers as well as for the target audience of the research is highlighted (Peffers et al. 2007). This thesis deals with the problem of how to identify and control the IT business value of an IT investment. The detailed motivation to solve the problem can be found in chapter 1.

Once the problem has been identified, it can be translated into objectives for the artifact to be developed (Peffers et al. 2007). This is done in the second activity. The objective of this thesis is to construct artifacts to better capture IT business value, because management in general, and IT project management in particular, currently lack a methodical approach and an integrated perspective to identify and assess the business value of IT investments. The detailed derivation of the objectives of the artifacts to be developed can be found in chapters 2-8.

In the design & development activity, the third activity of the DSRM process model, the artifacts are created (Peffers et al. 2007). Since this is a cumulative work, different artifacts are developed in the respective research papers. The research papers are mapped into the thesis and briefly summarized in chapter 4.3. In paper I we create a meta-model of dynamic capability profiles (construct), a dynamic capability profiles template (model), and a procedure to derive and to use dynamic capability profiles (method), in paper II we develop an IT value framework (model), in paper III we create a taxonomy of value catalogs (model) and an procedure for developing a company-specific value catalog (method), and in paper IV we derive a procedure for value contribution controlling (method) and an approach for the integration in Software Engineering (SE) process models (model). The detailed artifacts and their derivation can be found in the chapters 5-8.

In the fourth activity, the artifacts are demonstrated. This requires knowing how the artifact can be used to solve a part of the problem from activity 1 (Peffers et al. 2007). For this reason, we have paid particular attention to the applicability of the artifacts in practice and have therefore developed appropriate procedures that can be used to increase the applicability of the artifacts (e.g., the procedure to derive and to use dynamic capability profiles (Paper I) and the procedure for developing a company-specific value catalog (Paper III)). This is important to us because otherwise the artifacts are useless for practice. The application of the artifacts is explained in the chapters 5-8.

Once the artifact has been demonstrated, evaluation can then take place. This is done in activity 5, where the goals of a solution are compared to the actual solution (Peffers et al. 2007). In this thesis, the logical proof is provided based on the criteria of Hevner et al. (2004) in chapter 9, the overarching discussion chapter of this thesis.

Finally, it is relevant to communicate the problem, the artifacts, and the contribution to other researchers and practitioners (Peffers et al. 2007). This is done in the sixth and final activity in the DSRM process model. Most of the research papers of the cumulative thesis have already been published and discussed in renowned conferences. Research paper II is published in the proceedings of the International Conference on Enterprise Information Systems (2021), research paper III is published in the proceedings of the European Conference on Information Systems (2021) and research paper IV is published in the proceedings of the Tagung der Fachgruppen Vorgehensmodelle und Projektmanagement im Fachgebiet der Wirtschaftsinformatik der Gesellschaft für Informatik (2019). Research paper I will also be submitted to another IS conference. In addition, the dissertation is also published, which also communicates the results of the thesis to the IS community.

Since this thesis is a cumulative work in which the research problem is to be addressed by four papers, each with a specific focus, the research papers are now mapped and summarized into the structure of the thesis.

4.3 Mapping of the Research Papers to the Thesis Structure

The thesis is divided into five parts. Figure 4.2 provides an overview of the structure of the overall thesis.

The first part introduces the topic "IT business value" and describes in particular the motivation of this thesis, the research areas, the problem statements and research questions, and the research method. The second, third and fourth part contains the research paper as is usual in cumulative IS research. The four research papers each address a specific research question derived from the overarching research problem. The papers are explained below, also with particular reference to method selection.

In the second part, the impact of IT investments on the strategic level of the company is considered. As a complement to the current IT business value discussion, dynamic capabilities are mentioned in the literature. The IT business value can be extended by the dynamic capabilities approach to "help explain how organizations can develop and renew their value-generating mechanisms by the means of IT" (Steininger et al. 2021, p. 4). Côrte-Real et al. (2017) emphasizes that the previous IT business value research still needs a more dynamic perspective. Dynamic capabilities, like the IT business value, is an abstract concept that focuses on the ability of an organization (Helfat et al. 2007) to change competences in a dynamic environment (Teece et al. 1997) to remain competitive (Dong and Wu 2015) or become better (Rehm et al. 2017). Both concepts in the end focus on organizational performance (Schilke et al. 2018; Mooney et al. 1996; Devaraj and Kohli 2003; Melville et al. 2004). It currently remains unclear to what extent IT is mapped in dynamic capabilities. In particular, IT investments raise the

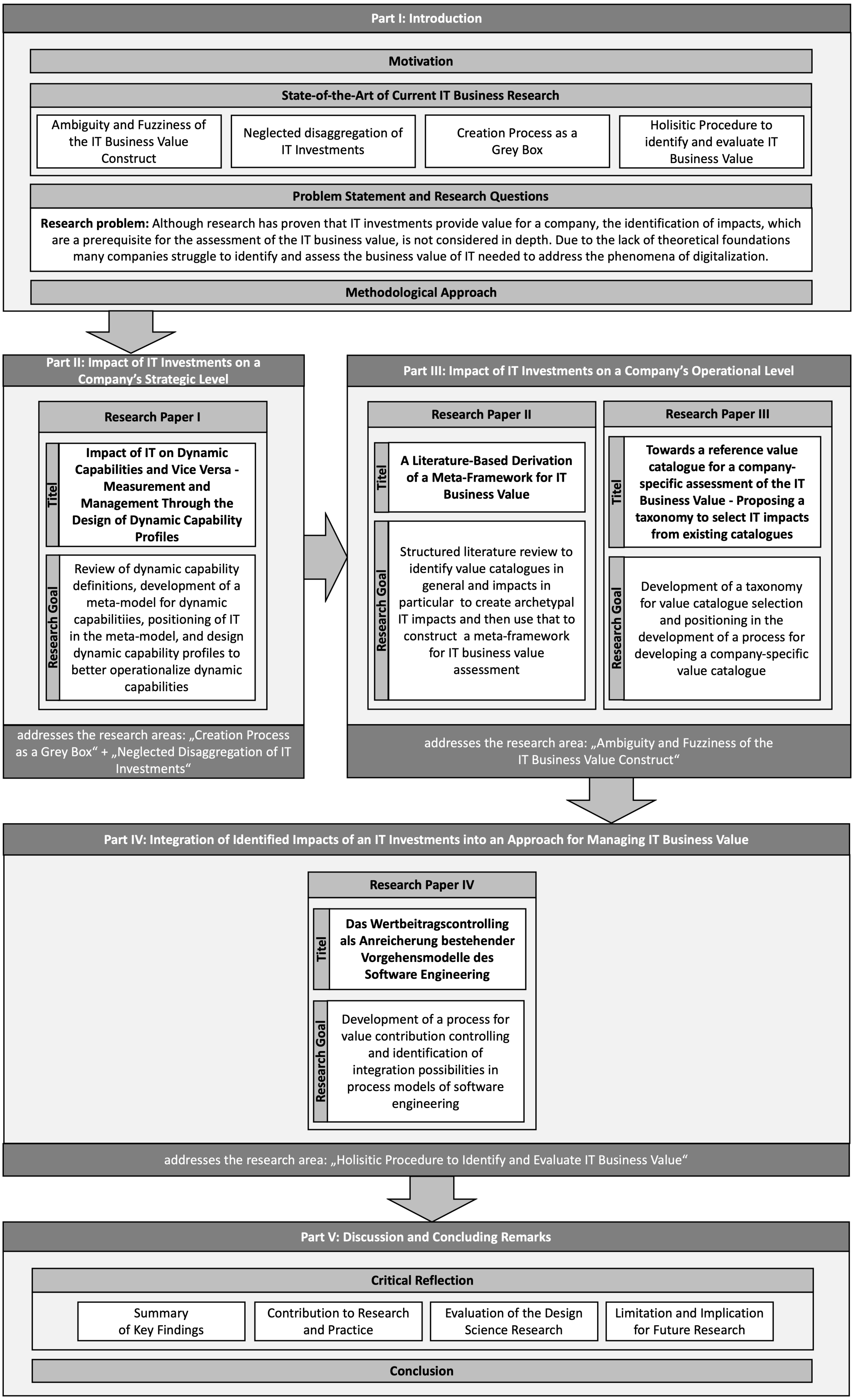

Figure 4.2: Positioning of the Research Papers in the Structure of the Thesis

question of the extent to which the new or changed IT systems change the (dynamic) capabilities of an organization. Answering the question could create transparency about the impact of an IT investment on a strategic level and areas can be identified that have not yet been adequately supported with IT in order to then make them competitive for the future. To achieve this goal, we take up the idea of dynamic capability profiles from the literature, with the help of which the multidimensional construct of dynamic capabilities is to be operationalized more effectively than before. To gain a clearer understanding of dynamic capabilities and dynamic capability profiles, 30 definitions of dynamic capabilities from strategic management and IS literature are systematically analyzed. Key findings show that several definitions neglect the "dynamic" in dynamic capability, and that the differentiation between a dynamic capability and related concepts is often not clear. We therefore deliberate a clearer understanding of dynamic capabilities and related concepts, as well as their interplay with IT. In the paper, a meta-model of dynamic capability profiles in the form of an entity-relationship model according to Chen (1976) was created on the basis of the literature review. To answer the question of the extent to which IT influences dynamic capabilities or vice versa, design guidelines for dynamic capability profiles were derived as a complement to the meta-model at a more operational level, which can be used to better operationalize dynamic capabilities. For a better application in practice, the paper also shows a procedure how to proceed in order to create and use dynamic capability profiles. *In paper I, the goal is to design and to apply dynamic capabilities profiles to make the relationship between dynamic capability and IT visible. A common understanding of dynamic capabilities should be the basis. Research paper I can be assigned to research area "Neglected disaggregation of IT Investments" and "Creation Process as a Grey Box". Paper I thus addresses the existing research gaps that on the one hand it remains unclear to what extent IT investments can be broke down into specific IT system types and these can then be further broken down into IT assets and Non-IT assets and how these in combination lead to IT business value (see Chapter 2.2.2) and on the other hand which role IT plays in the context of dynamic capabilities and how these can be operationalized to complement current research on IT business value (see Chapter 2.2.3). Overall, paper I focuses on the first research question.*

In addition to the strategic perspective, the third part examines the impact of IT investments at the operational level of a company. The IT business value is a highly discussed topic in information systems research (Melville et al. 2004; Brynjolfsson and Hitt 2003; Mirani and Lederer 1998; Müller et al. 2018; Pathak et al. 2019). However the decomposition and assessment on a more detailed level is ambiguous in literature and practice. As a result, IT investment decisions are often still made on the basis of the decision-maker's rule of thumb (Schniederjans et al. 2010). This makes it clear that assessing the IT business value is pivotal for goal-oriented IT management. To overcome this research gap, researchers have already presented approaches such as value catalogs. A value catalog is a reference list of positive and negative impacts (Schulze 2009) that can be attributed to the launch or productive operation of an IT system (Schütte et al. 2019). In order to gain an understanding of IT business values, a *structured literature review*[62] was conducted in paper II according to Webster and Watson (2002). The focus was to identify individual impacts from existing value catalogs enable the identification of overarching archetypical IT impacts of IT investments. To get an overview of the subject area, we conducted a broad search through the search strings. By limiting the search (Urbach et al. 2009) to leading journals (AIS Senior Scholars' Basket), the quality of the results should be ensured (Webster and Watson 2002). Due to the lack of a common generic term of value catalogs, we place particular emphasis on the subsequent forward and backward search. After applying our exclusion criteria, we were able to identify 33 sources as relevant. These identified papers were also the basis for paper III, which deals with the value catalogs in more detail. In paper II, a *qualitative content analysis*[63] follows. We suggest a hierarchical decomposition of the IT business value along aggregated impacts and atomic impacts. For a better understanding, we introduced a taxonomy of what types of atomic impacts may be caused by IT investments. We used the data-set of 682 atomic IT impacts from the 33 sources and codified each IT impact regarding the presented dimensions and characteristics from the taxonomy. After an initial test coding we have adjusted the dimension and characteristics. In the further systematic coding process, 5 trained (Nili et al. 2017) and independent coders analyzed the further impacts. To assess the coding quality, we calculated Fleiss' Kappa as suggested indicator (Landis and Koch 1977) for the intercoder reliability (Fleiss 1971) for each dimension. In the next step, we then *clustered* the archetypical IT impacts. For deriving the number of clusters, we visually examined the dendrogram (Ketchen and Shook 1996) resulting in a number of 29 clusters. With the help of these clusters, the IT value framework could then be developed as a result of the paper. The IT value framework consists of 29 distinct archetypal IT impacts and for each archetypal IT impact exemplary impacts and associated further references were named. *All in all, in paper II, a structured literature review is conducted to identify value catalogs in general and impacts in particular to create archetypical IT impacts and then use that to construct a framework for the IT business value identification. Research paper II can be assigned to research area "Ambiguity and Fuzziness of the IT Business Value*

62 A literature review is particularly useful at the beginning of a research project (Rowe 2014; Okoli and Schabram 2010) to identify and understand the current state of the research and to drive further research forward by compiling the current body of knowledge (Schryen 2014) (e.g., by identifying research gaps (Schryen 2014)). In the second paper of the thesis the literature review was used to get an overview about the existing value catalogs and the detailed impacts of an IT investment, which are also the basis of the further papers.

63 Qualitative content analysis helps in the rule-guided analysis of material (Mayring 2015). The aim of the analysis can be a summary, an explication, or a structuring. In the case of structuring, previously defined criteria are applied to the material in order to be able to evaluate them (Mayring 2015). The aim of the second paper is to structure the impacts so that the application of content analysis seems reasonable.

Construct". Paper II thus addresses the existing research gap that it is currently unclear what impacts generally occur with an IT investment (see Chapter 2.2.1). Overall, paper II focuses on the second research question.

Once the understanding of IT business value is clearer, it is necessary to consider how companies can now make IT business value more concrete. Impacts of IT investments can have many interdependencies with each other and also with the current IT landscape. To keep the overview, a systematic procedure are necessary to not only get a limited view of the topic. Procedures are necessary to guide practitioners. With the help of a reference value catalog, IT investment decisions can be reflected in a structured way and are comparable to each other, for example, whether a project prioritization is necessary (Becker 2011). In addition, the company-specific reference value catalog can then be used for any new IT investment in a particular company. An applicable reference value catalog should meet the following requirements: (1) It is important for the evaluation of IT investment to first know the possible impacts so that the impacts can be observed in reality, (2) To account for an individual context of the IT investment, the creation of a customized catalog is necessary, (3) A company-specific value catalog must consist of those observable impacts on the bottom, which can be hierarchically aggregated based on their value contribution to create a quantifiable hierarchy tree of impacts, and (4) impacts should be quantifiable. Applying a design science research method, we identified four steps to develop a reference value catalog: catalog selection, impact selection, hierarchy establishment, and quantification determination. In paper III we focus on the first step, which resembles the rigor cycle and form the basis for the next three steps. At the operational level, value catalogs[64] were developed for the identification of impacts. Value catalogs can be defined as a reference list of values and pre-economic impacts that can be associated with the use of IT systems. Schubert and Williams (2013) have developed a Nutzenrealisierungsmodell für Informationstechnologie (NuRIT) to look at the impact of an ERP implementation on a company's organization and processes. Hammer and Mangurian (1987) developed the impact/value framework, in which the impacts time, geography, relationships are applied to the values efficiency, effectiveness, and innovation. Riggins (1999) expands this catalog and explicitly focuses on e-commerce. In contrast, the value catalog of Andresen et al. (2002) focuses on the construction industry. The value catalog of Weill and Broadbent (1998) is based on management objectives. It becomes clear that the value catalogs[65] differ in their focus, number of impacts, definitions, and granularity of categories. The selection and adaptation of catalogs to the specific IT investment project is difficult, especially for practitioners. The identification should be complete, because anything that has not been identified cannot later be included afterwards. Overall, there is a lack of a procedure to identify the impacts in particular, a company-specific approach. As a first step, research paper III focus on the development of a

64 There is no clear term for value catalogs in the literature.
65 There are further catalogs in the literature that will be discussed in chapter 7.

taxonomy of value catalogs to structure the existing literature. For this purpose, we used the literature research results from paper II. This enabled us to analyze 32 value catalogs. The *taxonomy*[66] following Nickerson et al. (2013) was developed using a hybrid approach to obtain conceptual and empirical dimensions and characteristics. The meta-characteristics is to support the IT business value assessment by proposing appropriate IT business value catalogs. In the first three iterations, which follow the empirical-to-conceptual approach, eight value catalogs were examined per iteration and the dimensions and characteristics were derived from them by three independent researchers who are familiar with IT business value. In the fourth iteration, the conceptual-to-empirical approach was chosen. The fifth and last iteration with the empirical approach did not lead to any new dimensions and characteristics. The ending conditions were checked after each iteration. To interrupt the iterative process in developing the taxonomy, we established ten objective[67] and five subjective[68] ending conditions. Our development process stops after the fifth iteration. The developed taxonomy for value catalogs has 10 dimensions, with a total of 33 characteristics. The taxonomy developed serves as the basis for step 1 "Catalog selection" of the overall process to develop a reference value catalog. *Paper III creates a taxonomy for a value catalog selection and positions the created taxonomy in the procedure of developing a company-specific value catalog. The second contribution of the third part also targets the research area "Ambiguity and Fuzziness of the IT Business Value Construct". Paper III thus addresses the existing research gap that there is a lack of a structured procedure for determining the impacts of an IT investment (see Chapter 2.2.1). Overall, paper III focuses on the second research question.*

After the results from the strategic and operational level have been presented, the next step in the fourth part is to look at them from a process perspective, which shows how to proceed with IT business value identification and assessment. Although the developed constructs, models, and methods contribute to the identification of IT business value, the question remains open as to what extent the identification of impact should not be considered in isolation, but rather across the company. The literature agrees that IT business value must always be assessed in context (Lee et al. 2014). Due to the phenomena of IT penetration in companies, an overly isolated

66 A taxonomy serves the description objective from a research perspective by providing transparency about one important aspect of IS research (Gregor 2006).

67 The objective ending conditions are adapted from Nickerson et al. (2013) and are: "All relevant objects were analyzed", "No merge or split of object", "Each characteristic was assigned at least once", "No new dimension or characteristic was added", "No dimension or characteristics was merged or split", "Every dimension is unique", "Every characteristic per dimension is unique", "No duplicate combinations of characteristics", "Mutually exclusive: All objects have no more than one characteristic per dimension", and "Collectively exhaustive: For all objects, a characteristic can be assigned to each dimension".

68 The subjective ending conditions are adapted from Nickerson et al. (2013) and are: "Concise: Dimensions and characteristics are limited", "Robust: Sufficient number of dimensions and characteristics", "Comprehensive: Identification of all (relevant) dimensions of an object", "Extendable: Possibility to easily add dimensions and characteristics in the future", and "Explanatory: Dimensions and characteristics sufficiently explain the object".

view is not sufficient, as relevant impacts, for example, are not captured and thus an unhelpful IT business value is calculated. For this reason, it must be clear how a holistic approach to determining and evaluating IT business value must be structured. So far in this thesis we have focused mainly on impact identification, now the following steps for a holistic value management in an IT project need to become clear. Paper IV uses an *argumentative-deductive analysis*[69] to draw conclusions from a given set of circumstances (Wilde and Hess 2006). The starting point is that software engineering and, in particular, existing process models do not, or not sufficiently, take into account the IT business value. Process models of software engineering frequently used in practice focus on the fulfillment of time, budget, and content requirements, but neglect the intended value contributions of the IT investment (Termer et al. 2014; Atkinson 1999). Thus, the actual impacts of the information systems are often neither taken into account for the investment decision to be made ex ante, where they are methodologically difficult to identify and quantify, nor consistently monitored over the entire course of the project. In view of the manifold methodological problems facing the economic analysis of IT systems, a holistic approach is presented that encompasses the identification of impacts in a specific IT investment project, the evaluation of the impacts, the coordination within an organization on this evaluation, and the realization of the impacts. This process is referred to as value contribution controlling and should not be established in a company in isolation as a subarea of corporate controlling, but is of particular importance in the context of IT projects. This is because enriching process models with value contribution realization considerations is a prerequisite for implementing IT projects successfully in economic terms. The integration of value contribution controlling is then shown once as an example for a traditional software engineering procedure model. We identified ways in which value contribution controlling can be integrated into software engineering process models, because IT projects are carried out with the help of various process models. In the case of implementations, the process models of software engineering are the most suitable. A closer look at the traditional and agile process models reveals that these do not explicitly or not sufficiently consider IT business value. In traditional process models, a requirements analysis takes place at the beginning. Usually, the requirements are also prioritized, which could be accompanied by an evaluation of the impact of IT, but is not made explicit there. In agile process models, IT business value is almost not considered at all. In a further step, the value contribution controlling is described in detail and an exemplary procedure model is compared in order to unfold the integration problem. *The research goal of the fourth paper is the development and specification of a procedure for value contribution controlling and the identification of integration possibilities in process models of software engineering. The research paper can be assigned to the research area "Holistic Procedure to Identify and Evaluate IT*

69 Argumentative-deductive analysis account for 35 % of the applied methods in Wirtschaftsinformatik (Finkler 2008).

Business Value". Paper IV thus addresses the existing research gap that a procedure is needed to identify, evaluate, agree, and control the IT business value of an IT investment (see Chapter 2.2.4). Overall, paper IV focuses on the third research question.

The last part of the thesis contains the critical reflection as well as the conclusion of the thesis. In the critical reflection a summary of the key findings is given, the contribution to research and practice is highlighted, the design science research of the thesis is evaluated, and the limitations and implications for future research are explained.

Part II

Impact of IT Investments on a Company’s Strategic Level

5 Paper I: Impact of IT on Dynamic Capabilities and Vice Versa - Measurement and Management Through the Design of Dynamic Capability Profiles

Abstract

Dynamic capabilities are increasingly discussed in recent IS literature to explain the impacts and potential of IT innovations for firms. While originating in the strategic management literature, its adaption to analyze IT innovations' impacts on firm performance offers fruitful avenues. Although there is the general agreement that dynamic capabilities positively impact firm performance, the conceptualizations of dynamic capabilities, and their interplay with IT is differently perceived in related literature. In order to better capture dynamic capabilities as a multidimensional construct, dynamic capability profiles can be a possible approach. Since dynamic capability profiles are not yet further explored in the literature, we first developed a meta-model in order to get a better understanding. We systematically analyzed 30 definitions of dynamic capabilities from strategic management and IS literature. Key findings show that several definitions of dynamic capabilities neglect the "dynamic", and that the differentiation between a dynamic capability and related concepts is often not clear. We therefore deliberate with our meta-model a clearer understanding of dynamic capabilities and related concepts. We added operationalization entities to the meta-model, resulting in the meta-model of dynamic capability profiles. A dynamic capability profile can be understood in this paper as a set of multiple capabilities and their measurement characteristics in a particular organization at a particular time in a particular environment. With the help of the development of design guidelines, a dynamic capability profiles template can then be created on a more operational level. The filling in and use of the template then becomes clear in a procedure that allows the results of the work to be applied in practice. The application of the procedure in a case study shows how dynamic capabilities can be measurable and manageable in a company, which has been a major challenge so far. In particular, conclusions can be drawn about the impact of IT on dynamic capabilities and vice versa. In the future, the application of dynamic capability profiles will be supported by an IT-based tool to make the dependencies of IT and dynamic capabilities even more visible.

Keywords: Dynamic Capability, Dynamic Capability Profiles, IT Capability, IT Business Value, IT Innovation, Firm Performance

5.1 Introduction

The investigation of information technology (IT) impact on firm performance has a long history in information systems (IS) research. In recent years, an increasing number of studies draws on the dynamic capabilities approach to investigate the impact of IT innovation on organizational capabilities, competitive advantages, and firm performance. Examples for this can be found for technologies such as cloud computing (Gupta et al. 2020), artificial intelligence (Gallego-Gomez and De-Pablos-Heredero 2020), blockchain (Asl et al. 2021), and Big Data (Cetindamar et al. 2022; Shamim et al. 2021; Mikalef et al. 2020). These recent examples show that drawing on the dynamic capabilities approach seems to be a timely and fruitful avenue to investigate the relation of IT innovations to organizational capabilities and firm performance.

When we take a look at the origin of the dynamic capability approach, IS research seems to be a slow adopter, as dynamic capabilities have been investigated in strategic management literature since the beginning of the 21st century. While the market-based view (MBV) and resource-based view (RBV) have been the dominating views in earlier days to analyze competitive advantages and firm performance (McGee 2015; Wernerfelt 1984), the dynamic capabilities view has been derived from the latter to better address the dynamics of rapidly changing environments (Chien and Tsai 2012). It is undeniable that these increasingly fast-paced and ever-changing environments that companies face today are driven by IT innovations.

Against this background, dynamic capability research on IT, and its impact on firm performance is likely to further increase in the future, given that there is an increasing IT integration in companies' value chain. However, with the current state of the art in IS literature, some concerns may be raised when it comes to the understanding of a dynamic capability and its distinction from related concepts. This becomes evident in definitions of dynamic capabilities, where the concept is also referred to as "patterns" (Zollo and Winter 2002), "potentials" (Barreto 2010), "capacity" (Wolf et al. 2012), "routines" (Daniel et al. 2014), "portfolio" (Soluk and Kammerlander 2021) or "capability" (Helfat et al. 2007). These used synonyms, however, are concepts of their own that are distinct from dynamic capabilities. Therefore, it may become problematic when they are used to describe dynamic capabilities without clearly distinguishing them. Next to these ambiguities, the relationship between dynamic capabilities and IT is also differently understood. For instance, while IT infrastructure has no direct significant influence on dynamic capabilities in some papers (Bhatt and Grover 2005), this is refuted in other papers (Liu et al. 2013; Kim et al. 2011) or becomes significant as an indirect influence in others (Cai et al. 2013).

This exemplifies that despite there being a common understanding of dynamic capabilities, clearance on the concept and its distinction to these related concepts lacks when we start looking at the details. Furthermore, the relation between IT and dynamic capabilities also seems to be still unclear in related IS literature. This is also due to the fact that dynamic capabilities seem to be a multidimensional construct, so that dynamic capabilities cannot be determined by a single metric. Laaksonen and Peltoniemi (2018) plead for the need to describe profiles, through which the quality of a company's unique dynamic capability can then be assessed using various measures. We follow these remarks and argue that looking at dynamic capability profiles is helpful in several ways. Schilke et al. (2018, p. 417) "see particular merit in studying more than one functional dynamic capability at once, so as to uncover similarities and differences between individual capabilities and analyze firms' dynamic capabilities profiles as a whole". Abdelzaher and Ramadan (2023, p. 158) follows Laaksonen and Peltoniemi (2018) "research recommendations of building dynamic capability profiles relative to environmental contextual characteristics". Mazumder and Garg (2021, p. 12) criticize the lack of analysis of "the firm's dynamic profiles as a whole". Apart from the authors mentioned above, the topic of dynamic capability profiles has not yet been further explored and fleshed out in the literature. We would like to take up the idea of dynamic capabilities profiles in this paper to also address the overarching question of how we can determine whether dynamic capabilities have an impact on IT and/or vice versa.

Therefore, we tackle the following research goal:

Research Goal: Design and application of dynamic capability profiles to make the relationship between dynamic capabilities and IT visible.

To achieve the goal, the paper is divided into 3 parts, in each of which an artifact is designed. First, a *meta-model for dynamic capability profiles* is developed on an abstract level. This also contributes to a strategic understanding of dynamic capabilities. Based on this developed understanding, we would like to turn our attention to the question of how IT affects dynamic capabilities and how dynamic capabilities affect IT. To achieve this, the dynamic capabilities must be made operationalizable.[70] For this reason, secondly, *design guidelines for dynamic capability profiles* are then developed, which further complement the meta-model on a more operational level. From this, a dynamic capability profiles template can then be created. Thirdly, in order that the abstract and concrete perspective on dynamic capability profiles can also be applied in practice, a *procedure for the creation of dynamic capability profiles* in companies is presented.

The remainder of this paper is structured as follows: Firstly, we consider the related literature of dynamic capabilities and, in particular, possible operationalization approaches. Secondly, we explain our scientific approach. Thirdly, we develop a

70 In this paper, the term "operationalizable" is intended to mean that dynamic capabilities can be made measurable so that they can then be managed.

meta-model that represents our understanding of dynamic capabilities profiles. For this purpose, the relevant concepts of dynamic capabilities are identified, explained, and related to each other based on a structured analysis of definitions. Fourth, design guidelines for dynamic capability profiles can be developed based on the meta-model and the related literature of dynamic capabilities. Fifth, we develop a procedure to derive and to use dynamic capability profiles in a company. Sixth, the application of the paper's artifact, the dynamic capability profiles, is then demonstrated in a fictitious case study. Finally, we discuss our findings, summarize our main contributions, and provide an outlook on future research.

5.2 Related Literature: Dynamic Capabilities

The dynamic capability view is based on the RBV (Lin and Wu 2014). The RBV is a "core theory in the area of management" (Lockett et al. 2009, p. 10)[71] and was transferred to other areas such as Information Systems (Steininger et al. 2021; Talafidaryani 2021). The RBV refers to the internal resources that should be valuable, rare, inimitable, and not substitutable (Barney 1991), which are the basis for a company's sustained competitive advantage (Barney 1991). This can explain why companies in the same industry can differ in performance (Kraaijenbrink et al. 2010; Lockett et al. 2009). Penrose (1959) already had the idea that competitiveness can come from a better use of resources. Since than, the resource-oriented perspective was considered in more detail in further research papers such as Wernerfelt (1984), Mahoney and Pandian (1992), Conner (1991), and Priem and Butler (2001). According to the RBV the creation and application of the resources in the firms lead to their performance and competitiveness against their competitors (Kraaijenbrink et al. 2010; Zhao and Morgan 2017). The dynamic capabilities view has been derived from the RBV to better address the dynamics of rapidly changing environments (Chien and Tsai 2012), which are not taken into account in the RBV. The dynamic capability view can thus be seen as a complement to the RBV.

The original definition of dynamic capabilities goes back to Teece et al. (1997), who define dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. 1997, p. 516). Although this introduction has been made 25 years ago, it is noticeable that even the more recent definitions mostly refer to this original definition. In the last few years, therefore, no further explanation of the construct has taken place to concrete it further. Table 5.1 in the appendix[72] shows the definitions in ascending

71 That the RBV is a theory of the firm is doubted by some authors (see exemplary Conner (1991); Kogut and Zander (1992); Foss (1996)). There are also other diverse criticisms of the RBV. For further details, please refer to Kraaijenbrink et al. (2010).

72 Note that the table was moved to the appendix 5.10.1 to improve the readability of this manuscript. The appendix was placed directly after the paper in order to be able to assign the contents directly to the paper. The same procedure was followed for the subsequent papers. A central appendix at the end of the thesis was therefore dispensed with.

order by year and the definitions ID on which they are based. The original definition by Teece et al. (1997) is still used in the IS community to this day. However, as elaborated in the introduction, the definitions are often too vague to allow for an actionable understanding of dynamic capabilities of a firm, and thus, also to understand the interplay of IT and dynamic capabilities.

From the dynamic capability definition of Teece (2007), three types of dynamic capabilities are mentioned in particular: Sensing, Seizing, and Transformation. Sensing describes "Analytical Systems (and Individual Capacities) to Learn and to Sense, Filter, Shape, and Calibrate Opportunities" (Teece 2007, p. 1326), seizing describes "Enterprise Structures, Procedures, Designs and Incentives for Seizing Opportunities" (Teece 2007, p. 1342), and transforming describes "Continuous Alignment and Realignment of Specific Tangible and Intangible Assets" (Teece 2007, p. 1342). Leemann and Kanbach (2022) take the previously mentioned types and assign further sub-capabilities to them, thereby developing a taxonomy of dynamic capabilities. Mikalef and Pateli (2016) in contrast, breaks down dynamic capabilities into five types: sensing, coordinating, learning, integrating, and reconfiguring. To give another example, Pohjola and Stenholm (2012, p. 7) uses the types: "reconfiguration, leveraging, and learning and knowledge creation, integration, and sensing and seizing". It becomes clear that there is no agreed upon set of types of dynamic capabilities. More clearance on and dynamics in dynamic capabilities is necessary. Although more clearance is needed, some operationalization approaches for dynamic capabilities already exist in the literature.[73]

There is one precondition for operationalizing a dynamic capability: the dynamic capability must be known. If they have not yet been identified, they must be determined beforehand[74] (Austerschulte 2014). In order to be able to operationalize them, it should be clear which capabilities and resources make up the dynamic capability and how it is embedded in the company and the environment.

In the literature there are many authors (e.g., Hawass (2010); Henneke (2015); Kump et al. (2019); Naldi et al. (2014); Pavlou and El Sawy (2011); Rashidirad et al. (2017); Pandit et al. (2017); Protogerou et al. (2012)) who operationalize dynamic capabilities

73 The following details do not only refer to papers from the information systems discipline. Dynamic capabilities originated in strategic management (Barreto 2010) and were then transferred to a wide variety of areas (Barreto 2010; Eriksson 2014; Schilke et al. 2018), e.g., Daniel and Wilson (2003) transfer dynamic capabilities from strategic management to e-business. In particular, the information systems discipline was considered, as information systems are "one of the most substantial resources having a profound effect on the firms’ survival and success" (Talafidaryani 2021, p. 241). In order to obtain a broad base of operationalization approaches, a variety of areas were therefore considered.

74 Austerschulte (2014), for example, consider an identification of dynamic capabilities based on Porter and Millar (1985)’s value chain analysis to be suitable. In the literature, there is the taxonomy of dynamic capabilities by Leemann and Kanbach (2022), which a company also can use to identify dynamic capabilities. However, the taxonomy is generic and needs to be adapted to the company, but it can be a starting point.

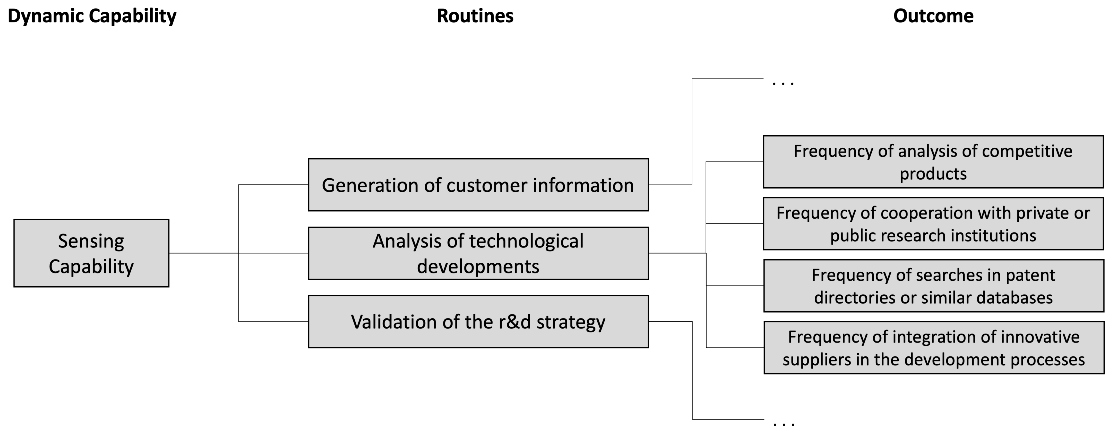

Figure 5.1: Operationalization Using the Example of the Sensing Capability Through Routines and Outcome according to Henneke (2015)

via observable routines and the outcome from them (Figure 5.1). The sensing capability can be operationalized, for example, by the routine of analyzing technological developments. The routine then becomes clear, for example, in terms of the frequency with which products of the competition are analyzed, which represent the outcome of the routine. Most of the literature that proceeds according to this operationalization is based on Teece et al. (1997) and Teece (2007)'s model (Kump et al. 2019), which typically refers to sensing, seizing, and transforming capabilities. The capabilities are then queried with a questionnaire represented by several questions.[75] The indicators for the capabilities are recorded on a likert scale, which varies.[76] Nevertheless, it is clear that the indicators are not only evaluated as present or absent, but also the degree of fulfillment is relevant. This makes sense, as the statements are usually to be evaluated in comparison to the top competitors (Pavlou and El Sawy 2011). However, this can also lead to statements being assessed better than they really are, because the surveys are subjective. It may happen that the managers interviewed overestimate the capabilities of their area because they want to appear good. Since it is a standardized questionnaire, it is easy to use. The standardized questionnaires enable the comparison of dynamic capabilities between companies, but the significance of this should be critically reflected. Standardization and the broad questions associated with it is also a disadvantage, since standardized questionnaire cannot take company- or industry-specific aspects into account (Henneke 2015). However, it is precisely

75 For example, the analysis of technological developments was identified as an indicator for seizing capability. The associated questions are: How often do you find out about new technological developments using the following activity? (1) analysis of competitor products, (2) cooperation with private or public research institutions, (3) research in patent directories or similar databases, and (4) integration of innovative suppliers into your development processes (Henneke 2015). For sensing capabilities, for example, statements such as "We often review our product development efforts to ensure they are in line with what the customers want" (Pavlou and El Sawy 2011) and for transforming capability such as "In our company, change projects can be put into practice alongside the daily business" (Kump et al. 2019) must be assessed.

76 For example Rashidirad et al. (2017) use a 7-point scale, while Kump et al. (2019) use a 6-point scale and Pavlou and El Sawy (2011) use a 5-point scale.

these that can help explain the influence of dynamic capabilities on firm performance (Eisenhardt and Martin 2000; Helfat and Peteraf 2003). Moreover, the questionnaires are limited in scope, as they have only a few indicators (Kump et al. 2019). As a result, it is not possible to query all the indicators for a dynamic capability, and for this reason the meaningfulness of the results may be restricted. The assessment can relate to the company level (Kump et al. 2019) or to individual teams (Pavlou and El Sawy 2011). In general, however, this approach raises the question of the extent to which the dynamic is taken into account. The questionnaires can only ask about the current situation and the change from a previous situation.

Barreto (2010), Helfat et al. (2007), Leiblein (2011), and Pohjola and Stenholm (2012) operationalize dynamic capabilities by using the evolutionary fitness of the firm as a performance measure. The evolutionary fitness can be measured "in terms of growth of the firm in relation to its competitors. This measure gives a standardized account of how firms perform" (Pohjola and Stenholm 2012, p. 10). It should be noted that dynamic capabilities increase the evolutionary fitness of the firm only indirectly through the improved sense of opportunity and enhanced capabilities to expand or change its resource base (Barreto 2010; Zahra et al. 2006). Pohjola and Stenholm (2012) measure the dynamic capability through two multidimensional constructs: regenerative capabilities (containing the dimensions reconfiguration, leverage, learning) and renewing capabilities (containing the dimensions knowledge creation, recognition and grasping, knowledge integration) using a questionnaire with a 7-point scale. This operationalization is thus based on a different type of processes that are considered in which dynamic capabilities are used. The operationalization approach follows the same procedure as when considering the processes according to Henneke (2015).

While the questionnaires can be used to ask the managers evaluation[77] "how well do you do specific things" (Laaksonen and Peltoniemi 2018), according to Laaksonen and Peltoniemi (2018) there are three further operationalization options for dynamic capabilities: Financial data (e.g., using the ROA), Company's experience, actions, and performance (e.g., on the basis of the market share gain), and manager's or employees' experience, actions, and performance (e.g., through diversification of the employees) (Figure 5.2). Secondary data such as analysis reports, employee figures, and annual reports can be used to obtain the information.

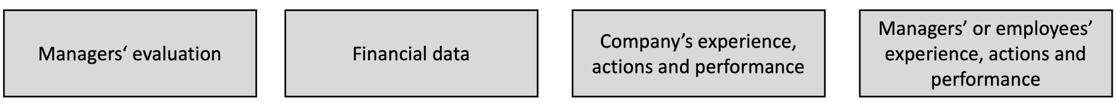

Figure 5.2: Four Types of Dynamic Capabilities Operationalizations according to Laaksonen and Peltoniemi (2018)

77 Barreto (2010) notes that in addition to evaluating firm's managers, third parties should also be involved.

Schelling and Pierling (2015, p. 22) follows a completely different operationalization approach. Schelling and Pierling (2015, p. 22) operationalize dynamic capabilities in projects, as "Companies increasingly rely on projects as a mean to translate strategy into practice". Already De Toni and Tonchia (2005) had assumed that dynamic capabilities can be transferred to a project level. The connection of the project level and the strategic level represents the strategic and project flexibility at Schelling and Pierling (2015) (Figure 5.3). Flexibility is characterized in particular by resource flexibility[78] as a 1st level capability and knowledge management process[79] as a 2nd level capability. In an open interview, Schelling and Pierling (2015) ask how a company implements resource flexibility (e.g., as a project manager, how do you keep your project flexible?) and knowledge management (e.g., how do you promote knowledge sharing?). Schelling and Pierling (2015) thereby obtain a list of tools/processes/actions (e.g., Benchmarking, Collaborative Physical Workspace, Knowledge Café, Periodic Trend Reporting, Revision of Risk Assessment, and Wikis) that increase flexibility in projects. There is no assessment of the extent to which the dynamic capabilities are available in projects[80] and to what extent. This is not sufficient for the goals of this paper and will therefore not be considered further, even though the idea of linking it to projects seems interesting and should be elaborated in more detail in future research.

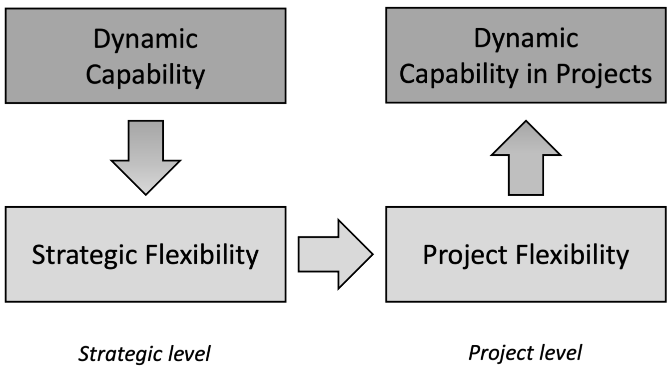

Figure 5.3: Operationalization Through Flexibility according to Schelling and Pierling (2015)

In summary, it appears that executive surveys are currently the most frequently used data source for measuring dynamic capabilities.

78 "Resource Flexibility is achieved through management practices encouraging vagueness and late commitment of resources – as an example serve over budgeting in the project planning phase or Risk Management practices such as the delay of decisions, and thus resource commitment, to late stages of the project" (Schelling and Pierling 2015, p. 69).

79 "Knowledge Management is strengthened through a knowledge infrastructure which consists of supporting IT systems and data bases, as well as a culture of knowledge sharing, communication, and collaborative learning" (Schelling and Pierling 2015, p. 69).

80 In Schelling and Pierling (2015)'s study, it also became clear that the term dynamic capabilities is not known in practice. Instead, the respondents were able to make statements about flexibility, which then represents the operationalization.

5.3 Scientific Approach

We aim to achieve our research goal, a first step into the operationalization of dynamic capabilities through dynamic capability profiles in the context of IT, by following a design-science research approach. The reason for this is that there is a problem of understanding which has to be solved for future dynamic capability research, and can be understood as a precursor to action in practice. The design science research approach according to Hevner et al. (2004) aims at the construction of artifacts to solve problems, and thus, seems to be suitable for our research goal. In order to obtain an overview of the subject area of dynamic capabilities and to make the complexity of this concept more manageable, the relevant objects and relationships can be represented in a model. Because we derive a common understanding of dynamic capabilities profiles from definitions of dynamic capabilities, we refer to our artifact as meta-model as it aims to synthesize the knowledge from related works. Based on this, the design guidelines of dynamic capability profiles and the procedure to develop and to use dynamic capability profiles can be developed. Consistent with the general design science approach of Hevner et al. (2004), we use the design science research methodology (DSRM) for information systems research of Peffers et al. (2007) as a concrete method for developing the meta-model, the design guidelines, and the procedure to derive and to use dynamic capability profiles (Figure 5.4).

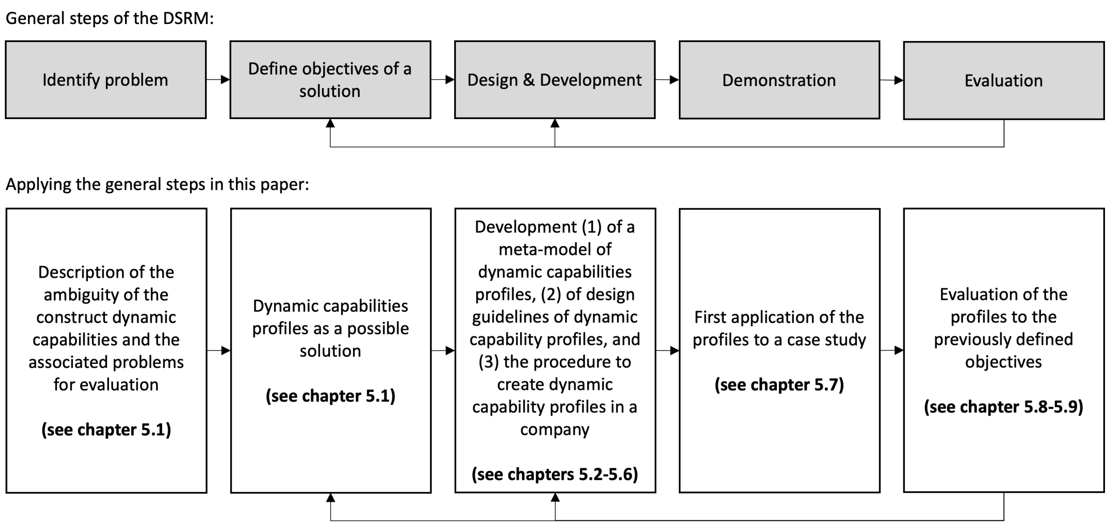

Figure 5.4: Scientific Approach

Following the DSRM, the first two steps involve identifying the problem and outlining the objectives; both of which is elaborated in the introduction section of this paper. In the design and development phase, we proceeded as follows: (1) We analyzed the IS and strategic management literature for definitions of dynamic capabilities as they are understood there. As a starting point, the definitions of Teece et al. (1997) and Eisenhardt and Martin (2000) were used, because they are the original and most cited dynamic capabilities definitions across all disciplines. From these, further definitions were identified through forward and backward searches. Through this procedure, we identified definitions that are referenced so that we can trace back the identified definitions. For example, the definition of dynamic capabilities by Saldanha et al. (2020) goes back to the definitions by Zollo and Winter (2002) as well as Eisenhardt and Martin (2000), which in turn go back to the original definition by Teece et al. (1997). Overall, we were able to identify 30 definitions from 1997 to 2022. After that, we stopped the search process because we did not receive any more details about the concept. Based on the identified definitions, we have gained an overview about related concepts that are relevant to explain dynamic capabilities. With further literature on the respective concepts, they are explained in detail, and the relationships between the concepts are elaborated. The result of this process is the "design artifact" of a meta-model of dynamic capability profiles. The meta-model is presented in this paper in the form of an entity-relationship (ER) model according to Chen (1976).[81] (2) Based on the meta-model, design guidelines for dynamic capability profiles can then be derived in order to apply them in the information system discipline. In order to facilitate the application in practice, a template for dynamic capability profiles is shown on the basis of the design guidelines. (3) Furthermore, a procedure will be developed to ensure usability in practice. In the next step, the demonstration phase, the dynamic capabilities profiles are then applied to a fictitious case study. The final step is an evaluation of the dynamic capability profiles. The discussion will focus on the extent to which the dynamic capability profiles help to make the impact of IT on dynamic capabilities and vice versa transparent.

5.4 Development of a Meta-Model of Dynamic Capabilities Profiles

We take a closer look at the concepts mentioned in the definitions of dynamic capabilities, and select the most used concepts (resources, assets, firm, environment, time, capability, dynamic capability, firm performance) for our meta-model of dynamic capability profiles, which we present in the following sections. We also place the other concepts (skills, routines, competence) from the definitions in our meta-model, and explain why they are not included as entities in their own right.

Since dynamic capabilities are as a successor of the RBV, we take a look at **(1) resources** first. Already in earlier days, the "theory of the growth of the firm" from 1959 underlines the relevance of resources for a company, because the quality of resources it possesses represents the uniqueness of a company (Penrose 1995). In some definitions analyzed, it is explicitly mentioned that resources are the object of consideration that is modified by dynamic capabilities (Chen et al. (2015a); Daniel

81 This modeling language was selected because it is commonly understood and provides a standardized notation (Elmasri and Navathe 2016). At this point, reinterpreted relationship types should be pointed out as a special feature, which are thus reinterpreted to an entity type and are displayed with a rectangle around the diamond of the relationship type. The interpretation is necessary, since a direct connection of two types of relationship following the ER notation is not possible, for the modeling of some circumstances however quite necessary is (Becker and Schütte 2004).

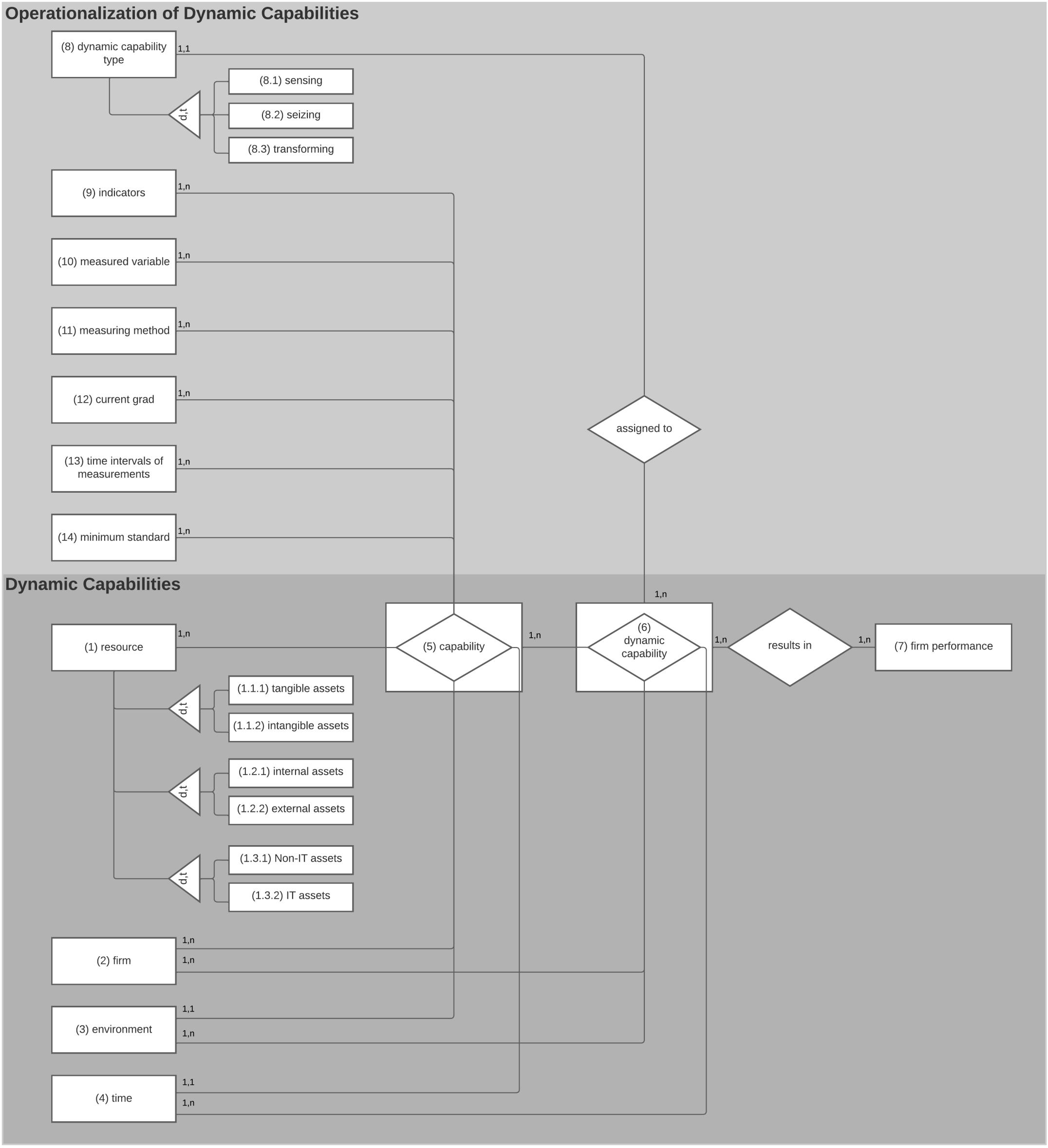

Figure 5.5: Meta-Model of Dynamic Capabilities Profiles

et al. (2014); Wolf et al. (2012)). Resources can be defined as assets which are used to produce goods or services that meet the needs of customers (McConnell et al. 2009). Assets are usually divided into **(1.1.1) tangible assets** (e.g., IT infrastructure) and **(1.1.2) intangible assets** (e.g., knowledge). Given that concepts of "intangible assets" are frequently used to define dynamic capabilities (Butler and Murphy 2008; Wu and Hu 2012), they seem to play a major role. In the IS literature, in addition to tangibles and intangibles, there are also other characteristics such as human skills (Yang and Chen (2009)). In this line, some of the analyzed definitions also refer to "internal and external organizational skills" (Wolf et al. (2012)). Therefore, we model skills in our meta-model under intangible resources, because for us tangible and intangible are two expressions that exclude other possibilities. However, a certain skill is an ability that can also be acquired by employees or bought in from externals (e.g., by consultants). In line with that we also distinguish between **(1.2.1) internal assets** and **(1.2.2) external assets**. With our research question in mind, we also make an explicit distinction between **(1.3.1) Non-IT assets** and **(1.3.1) IT assets**. Nevertheless, resources do not have a direct impact on the performance of the company, because they have to be applied correctly in the company in order to achieve economic value. Resources are thus an input factor for the value creation of a company, and are therefore modeled in our meta-model as an entity type with the disjoint specializations tangible/ intangible and internal/ external. Each resource must be a member of the sub classes in the specialization. We have indicated this in the model by marking d (disjoint) and t (total) on the specialization item (Elmasri and Navathe 2016).

Based on its resources, the value creation of a firm can be further traced through the value chain according to Porter (1985a). He shows that resources are acquired and consumed for inputs, transformation processes, and outputs to ultimately deliver a valuable product or service to the end customer. In some of the definitions analyzed, the change in this process is mentioned as the object of consideration (Kim et al. 2011; Soluk and Kammerlander 2021). Processes are a sequence of activities that are performed by the involved parties according to established rules (Davenport 1993). Yeow et al. (2018) focus on the specific actions, which correspond to the sequence of activities. A process thus follows a routine. Therefore, it is also understandable that some of the analyzed definitions referenced to operating routines (Saldanha et al. 2020; Soluk and Kammerlander 2021). The efficient execution of a process in a company through a target-oriented combination of resources in a firm can be understood as competence. It should be emphasized here that the effective and successful application is always specific and is difficult to imitate by other firms in order to achieve competitive advantages. In the analyzed definitions, the internal and external competencies are also mentioned (Park et al. 2017; Wolf et al. 2012). Competence and capability are often used interchangeably in the literature (Bhatt and Grover 2005). We agree with this opinion and select capability for the rest of the paper since the term is included in dynamic capabilities. Capabilities of firms are also mentioned in the analyzed definitions as an object of consideration (Daniel et al. 2014; Kathuria et al. 2018; Dong and Wu 2015). In our meta-model, we model the **(2) firm** as an entity type. A firm has its own identity, which can be revealed through its business culture, behavior, communication, and philosophy, among other things. The analyzed definitions agree that dynamic capabilities are considered at the firm level (Teece et al. 1997; Kim et al. 2011; Benitez-Amado and Walczuch 2012; Park et al. 2017; Helfat et al. 2007; Pavlou and Sawy 2010; Teece 2007). Firms are always embedded in a corporate environment.

The **(3) environment** seems to be very relevant in dynamic capabilities, as they are the drivers of development. The environment is characterized by uncertainty, particularly as a result of digitalization and globalization, which means that firms constantly need to adapt. Technological innovations are created in ever shorter development cycles. Pandemics such as covid-19 or political events such as Russia's war of aggression on Ukraine also show that these events can have a significant impact on firms worldwide. The rapid adaptability of a company to such environmental influences is reflected in the definitions analyzed. On the one hand, firms should adapt to the environment in order to survive in competition (Teece et al. 1997; Wheeler 2002; Zhu and Kraemer 2002; Butler and Murphy 2008; Vial 2019). On the other hand, firms should be able to position themselves better in the market through the use of dynamic capabilities in order to increase their competitiveness (Bhatt and Grover 2005; Pavlou and Sawy 2010; Kim et al. 2011; Bendig et al. 2022). We model environment as an entity type in our meta-model that has an impact on capabilities. Capabilities can be assigned to exactly one environmental state. We do not call the entity type "changing environment" because the change is covered by the concept of time.

We add **(4) time** as a separate entity type because it is underrepresented in the previous definitions, whereas this is precisely what adds the "dynamic" to dynamic capabilities. In the analyzed definitions, the time aspect is mostly found in connection with the environment. Examples are "rapidly changing environments" (Teece et al. 1997), "to respond quickly to environmental threats and leverage opportunities" (Bhatt and Grover 2005), "to sustain competitive advantage" (Dong and Wu 2015), "to effect organizational change" (Yeow et al. 2018), and "to external environments characterized by rapid or discontinuous change" (Soluk and Kammerlander 2021). However, as becomes visible, it is not explicitly pointed out, and therefore can be seen as a unique contribution of our understanding of the concept. Also the capabilities are dependent on a point in time.

Therefore, we model **(5) capability** as the combination of resources, consisting of tangible and, especially, intangible assets that are provided by a firm at a given point in time. There is always a systemic relationship to environmental requirements, the fulfillment of which reflects the quality of the capability. In addition, the existing literature often distinguishes between ordinary and dynamic capabilities - it is important to note that dynamic capabilities are not specializations of capabilities.

(6) Dynamic capabilities modify the capabilities, the combination of resources, of a firm as a pro- or reaction to environmental change between two or more points in time. In the analyzed definitions, there is a plethora of terms describing the modification (e.g., change (Dong and Wu 2015), enable (Helfat and Winter 2011), create (Winter 2003), extend (Helfat et al. 2007), modify (Zollo and Winter 2002), alter (Vial 2019), compose (Yeow et al. 2018), govern (Kathuria et al. 2018), integrate (Wei and Wang 2010)). In order to better classify the possible modifications, high-level categories of dynamic capabilities are formed in the literature.[82] We model dynamic capabilities as reinterpreted relation type. Dynamic capabilities concern the existing capabilities of a firm. These capabilities can vary over time and according to different environmental conditions. In particular, the consideration of several points in time enables a period view, the knowledge of which can be used to achieve a competitive advantage.

The goal of dynamic capabilities is to sustain or expand a competitive advantage (Dong and Wu 2015; Drnevich and Kriauciunas 2011; Kim et al. 2011; Zhu and Kraemer 2002). We can argue that competitive advantage results in customers receiving value from the firm's adapted products/services, which is then reflected in overall firm performance. The adaptation can only take place via an organizational change, so it is understandable that Yeow et al. (2018) take this into account in their dynamic capability definition. Other definitions aim at improving effectiveness (Saldanha et al. (2020)), supporting performance (Teece (2007)), or superior performance (Park et al. (2017)), which are in line with the overall firm performance. We therefore model **(7) firm performance** as result of the dynamic capabilities. Firm performance is also dependent on the organization, the environment, and time, which are already represented through the concept of dynamic capabilities.

The lower part of figure 5.5 represents the meta-model developed and explained so far, showing the entities and the relationships elaborated in this section. This meta-model with entities 1-7 represents the meta-model of dynamic capabilities.[83] With the help of the understanding of dynamic capabilities in the sense of our meta-model, these can be supplemented by operationalization aspects (upper part of figure 5.5) in order to be able to represent our dynamic capability profiles.

In order to better structure the dynamic capabilities of a company, they can be divided into different **(8) dynamic capability types**. For the development of the dynamic capability profiles, we are following the most commonly used types, namely **(8.1) sensing**, **(8.2) seizing**, and **(8.3) transforming**. The different types have already been explained in more detail in chapter 5.2. A dynamic capability can always be assigned to exactly one dynamic capability type, while a dynamic capability type can comprise several dynamic capabilities.

(9) Indicators describe the activity that can be observed and recorded. With reference to the example in figure 5.1, the capability "analysis of technology development" can be operationalized by the indicators "analysis of competitive products", "cooperation with private or public research institutions", "research in patent directories or similar databases", and "integration of innovative suppliers into the development processes".

82 See chapter 5.2.
83 In Appendix 5.10.2, the role of IT in the meta-model of dynamic capabilities is also discussed in more detail.

The recording is carried out via a **(10) measured variable**. In the example in figure 5.1, it is the frequency. This measured variable is recorded using a suitable **(11) measuring method**. If financial data is recorded, the information can be taken from secondary data such as annual reports. If the assessment of the managers is needed, then interviews are possible. Here, the operationalization options of Laaksonen and Peltoniemi (2018) can be used. The result is documented in **(12) current grad**. Through the relationship with the entity time (over capability), a history of the development of capabilities can thus be traced, so that versioning is present. The frequency of application of the measuring method is defined in **(13) time intervals of measurement**. This can be attributed to the fact that dynamic capabilities can change constantly.

For management purposes, a **(14) minimum standard** is also set, which anchors the target, which can then be compared with the current grad in order to be able to make management decisions on this basis.

The entire model (lower and upper parts) represents the meta-model for dynamic capability profiles. Based on this gained understanding, the dynamic capability profiles can now be considered on a more operational level - for this we create design guidelines.

5.5 Creation of Design Guidelines for Dynamic Capability Profiles

A dynamic capability profile can be understood in this paper, in line with our meta-model (Figure 5.5), as a set of multiple capabilities and their measurement characteristics in a particular organization at a particular time in a particular environment (Figure 5.6). Whereby a company can have several profiles with which, on the one hand, individual capabilities and, on the other hand, the dynamic capabilities of the entire company can be analyzed, e.g., with regard to existence, quality, and the influence of capabilities on dynamic capabilities.

We will now take a look at what should be taken into account when operationalizing dynamic capabilities through dynamic capability profiles. Design guidelines (D) can be derived from this.

In order to operationalize dynamic capabilities through dynamic capability profiles, dynamic capabilities must be identified in advance. Leemann and Kanbach (2022) have developed a taxonomy of dynamic capabilities. This taxonomy is divided into sensing (with another 5 dynamic sub-capabilities), seizing (with another 7 dynamic sub-capabilities), and transforming (with another 7 dynamic sub-capabilities) capabilities. Due to the fact that the taxonomy is very generic, it can only be used as a starting point. However, it offers companies that do not yet have an idea of dynamic capabilities the possibility of identifying exemplary dynamic capabilities and then transferring them to their company. In particular, the specifics of firms seem to have an influence on the

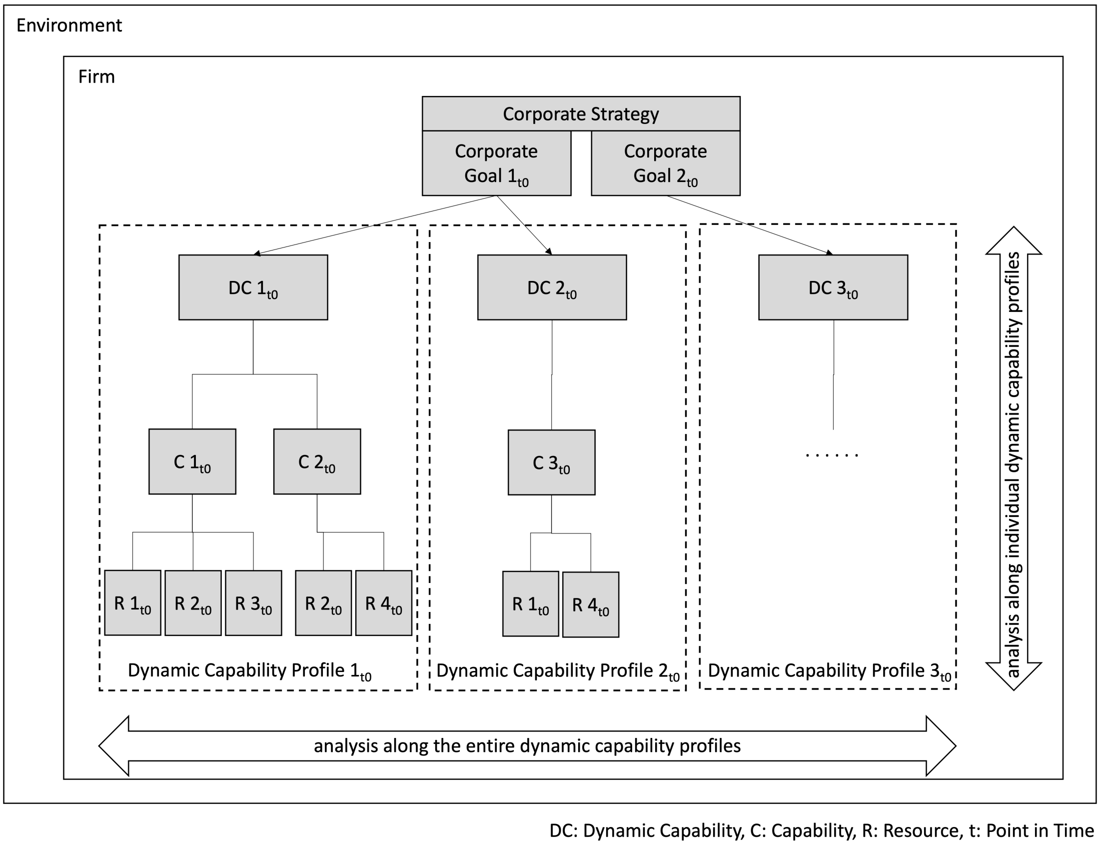

Figure 5.6: Concept of Dynamic Capability Profiles Following the Meta-Model of Dynamic Capabilities

quality of dynamic capabilities (Eisenhardt and Martin 2000; Helfat and Peteraf 2003), which are then ultimately relevant for firm performance and can thus explain why some firms are more successful than others (in terms of firm performance). Thus, dynamic capabilities should be captured on a company-specific basis. The comprehensive analysis of dynamic capabilities seems to be compelling, since they can also influence each other, which is neglected by an isolated consideration of only one dynamic capability. Austerschulte (2014), for example, consider an identification of dynamic capabilities based on Porter and Millar (1985)'s value chain analysis to be suitable.[84] By looking at the value chain, the entire company with all its primary and secondary activities can be analyzed for dynamic capabilities and thus avoid overlooking dynamic capabilities (Austerschulte 2014). In the approach, recommended by Austerschulte (2014), the dynamic capabilities are identified via the company's functions. By looking at the functions of the company, it is already possible to identify company-specific dynamic capabilities. In this paper, we will look at a new approach and identify the dynamic capabilities through a company's strategy and goals (Figure 5.6) to

84 Austerschulte (2014) evaluates the value chain from Porter and Millar (1985) as more suitable than the resource profile of Hofer and Schendel (1978) and the business system of Esser (1989), which are alternatives for identifying internal factors of a system in strategic management (Austerschulte 2014). However, Porter and Millar (1985)'s model covers a broader range of analysis, so it was selected with a view to fully capturing dynamic capabilities.

consider the link from our meta-model of dynamic capabilities to firm performance. In terms of the relationship to firm performance, a link can thus be established between dynamic capability and a goal. This can be used to show what happens to goal achievement when a dynamic capability or a goal changes. In addition, not all dynamic capabilities will be identified in this way, but rather those that are relevant to the company's success. For the identification of dynamic capabilities in general and through dynamic capability profiles in particular, the following design guidelines can be derived:

D1: Dynamic capabilities should be identified on a company-specific and relevant basis.

Dynamic capabilities are mainly operationalized in the literature by routines. Routines can be made measurable by indicators (Chapter 5.2). For the indicators that ultimately represent the resources of a dynamic capability, suitable metrics must be found. These may differ depending on the data collection. In chapter 5.2, four types of operationalization options according to Laaksonen and Peltoniemi (2018) have already been presented. These should be used with care and also as a supplement, since a standardized questionnaire, for example, does not ask about company-specifics. For the operationalization of dynamic capabilities in general and through dynamic capability profiles in particular, the following design guidelines can be derived:

D2: Indicators and their metrics should be defined for each dynamic capability to make them operationalizable.

The degree of dynamic capabilities should be determined. A statement as to whether dynamic capabilities are present or not is too unspecific. We follow Rashidirad et al. (2017) with a 7-point scale because this allows us to evaluate the nuances and thus the quality of a dynamic capability in more detail. Thus, this allows us to measure not only whether a dynamic capability is present, but also in what quality. This is particularly important if you then want to compare yourself with competitors. According to Kraaijenbrink et al. (2010), it is enough to be better than your competitor in order to have a competitive advantage on the market. Further data are required for a comparison with a competitor. Ideally, the competitor must use the same dynamic capabilities profiles. If not, there is a risk that company-specifics will be neglected. For the operationalization of dynamic capabilities in general and through dynamic capability profiles in particular, the following design guidelines can be derived:

D3: Dynamic capabilities should be measured by a scale to capture not only the presence but also the quality.

In addition, it should be determined in which time intervals the dynamic capability is measured. Austerschulte (2014) recommends that the time interval be based on the external environment, as dynamic capabilities allow the company to adapt to changes in the environment and the market. In a strongly changing external environment, the time interval should be chosen shorter, while companies which are in a stable environment can choose a longer time interval (Austerschulte 2014). Figure 5.7 shows the evolution of a dynamic capability profile over time. For the operationalization of dynamic capabilities in general and through dynamic capability profiles in particular, the following design guidelines can be derived:

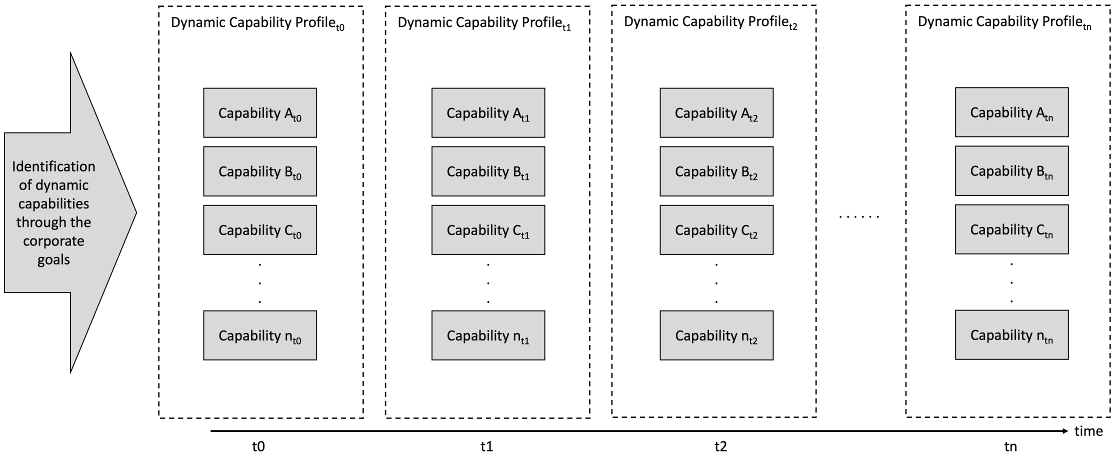

Figure 5.7: Evolution of a Dynamic Capability Profile over Time

D4: Time intervals at which dynamic capabilities are reviewed should be specified.

The minimum standard of a dynamic capability should be defined. The minimum standard determines whether a dynamic capability exists at all (Austerschulte 2014). The minimum standard cannot be defined forever, but can also change over time intervals (Austerschulte 2014). It is conceivable that the minimum standard can be derived from further analyses, which can e.g., determine the necessary and sufficient capabilities. It is also possible to check which characteristics of a capability must have in order to be able to influence firm performance significantly (Austerschulte 2014). These thresholds can then be used in setting the minimum standard. This research direction should be considered in future research because it is underrepresented in current research.

For the strategic management of dynamic capabilities in general and through dynamic capability profiles in particular, the following design guidelines can be derived:

D5: A minimum standard should be set for each dynamic capability.

A template for a dynamic capability profile can be derived from the design guidelines. It can be seen in figure 5.8 where it is marked at which position which design guideline is considered. A company consists of several dynamic capabilities - for each of which a dynamic capability profile is created (D1). The associated capabilities and resources are assigned to each dynamic capability (D1). Indicators (D2), measured variables (D2), measuring method (D2), current degree on a 7-likert scale (D3), time interval of measurements (D4), and a minimum standard (D5) are then specified for these. The individual dynamic capability profiles are interlinked.

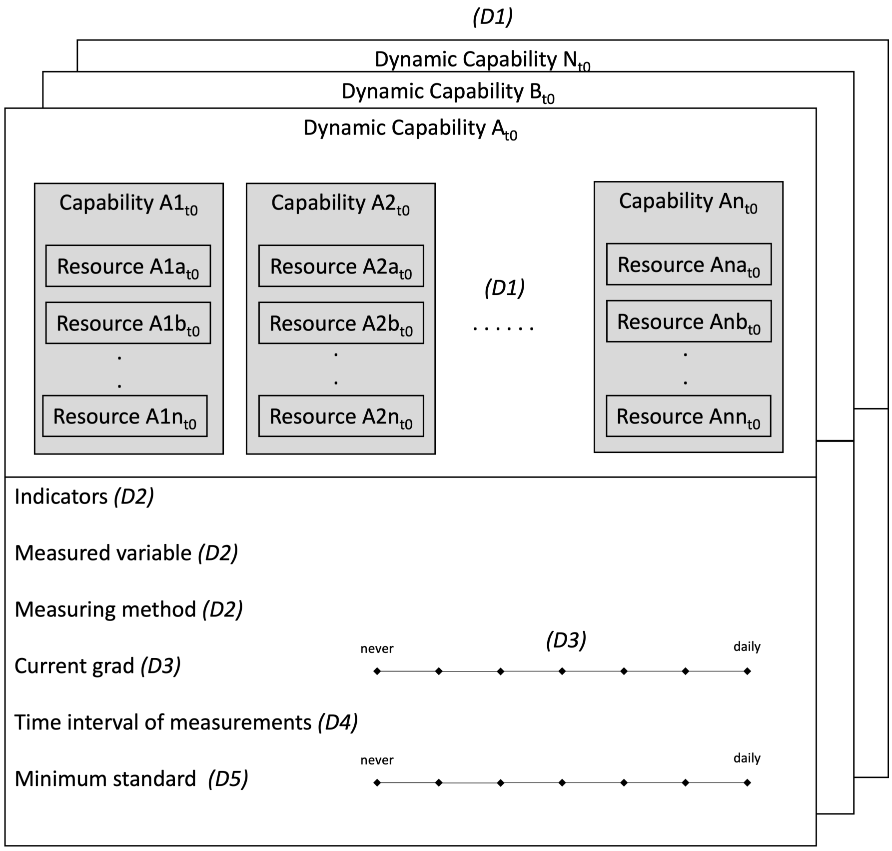

Figure 5.8: Template of the Dynamic Capability Profile for the Dynamic Capability A at Time 0

We also recommend documenting the dynamic capability profiles with IT tools. This can be helpful in analyzing how IT affects dynamic capability or otherwise. IT can be a resource such as employee skills. Since we capture the dynamic capability on a company-specific basis, the employee can be very important as an IT expert for one capability. If this person were to resign, it is possible that this capability would then no longer exist and the dynamic capability would be weakened as a result. By linking the dynamic capability profiles to each other, it is therefore also possible to make a statement about the extent to which this change will have an effect overall. In this way, a statement can be made about the extent to which IT has an effect on dynamic capabilities. Through the dynamic capability profiles this then becomes visible. But it also becomes clear when minimum standards for dynamic capabilities are not met. This can make demands on IT transparent, such as an IT system needed to be able to analyze social media data. In this way, statements can also be made about the extent to which dynamic capabilities has an effect on IT. Based on the statements, the strategic management of a company can then act in a goal-oriented manner.

5.6 Procedure to Derive and to Use Dynamic Capability Profiles in a Company

To ensure that the dynamic capability profiles can also be applied in practice, the procedure to derive and to use precisely these dynamic capability profiles follows. There are a number of steps to be taken, which are presented below (Figure 5.9).

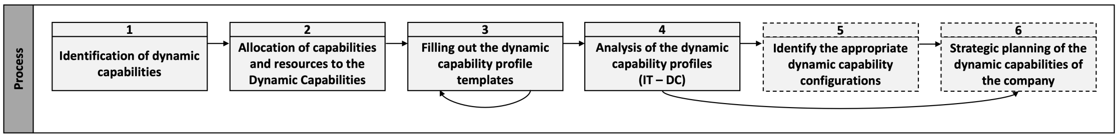

Figure 5.9: Procedure to Derive and to Use Dynamic Capability Profiles

Step 1 - Identification of dynamic capabilities: The first step is the identification of dynamic capabilities in a company. We recommend deriving the dynamic capabilities from the corporate objectives in order to be able to map the influence on the corporate objectives more straightforwardly in a later step. However, other identification approaches are also possible, as already mentioned in the paper, e.g., through the value chain of Porter and Millar (1985), the resource profile of Hofer and Schendel (1978), and the business system of Esser (1989). It is important that dynamic capabilities are identified on a company-specific basis.

Step 2 - Allocation of capabilities and resources to the dynamic capabilities: In the second step, the identified dynamic capabilities must be further differentiated in capabilities and resources in order to make them operational. This makes it clear which IT resources play a role in which dynamic capabilities.

Step 3 - Filling out the dynamic capability profile templates: In the third step, the dynamic capability profile is filled in. This includes defining the measurement methods and then applying them for the first time. We provide the dynamic capability template as a support. This step must be repeated as soon as the defined time intervals in the profiles have been reached.

Step 4 - Analysis of the dynamic capability profiles: The quality of the current dynamic capabilities can be analyzed and first conclusions for the further development of the dynamic capabilities can be made. If IT resources change over time, it can be analyzed to what extent the changes, whether negative or positive, have an impact. The important aspect is that dynamic capabilities, as the name suggests, are not always equally available. These can also change over time. We follow the most established understanding in the literature that dynamic capabilities are observable routines (Eisenhardt and Martin 2000). Through this routine and its associated metrics, dynamic capabilities can then be operationalized (Chapter 5.2). Since it is a multi-dimensional construct, a dynamic capability is made up of several capabilities, each of which is characterized by various measures. Figure 5.10 shows an example of how a dynamic capability can change over time. The dynamic capability is assessed on a likert scale of 1-7. While the dynamic capability "Screening opportunities and risk" is rated at 1 in t0, it is already rated at 4 in t1. Between the two points in time, for example, regular monitoring of new technology trends was established, which can be assigned to capability "Analysis of technological developments". On the other hand, price information on competitors was purchased in order to expand capability "Collection of information about competitors' offers" as well. The analysis can also explicitly consider IT, so that statements can be made about the influence of dynamic capability on IT and vice versa. In the case of weaknesses in dynamic capabilities, consideration can be given to the extent to which these can be supported by IT. This may result, for example, in the need for a new IT system. On the other hand, it can become clear to what extent new IT systems influence dynamic capabilities (positively and negatively). The profiles must then be adjusted accordingly. The analysis should be supported by an IT-based tool in order to also be able to show the interrelationships between dynamic capabilities profiles.

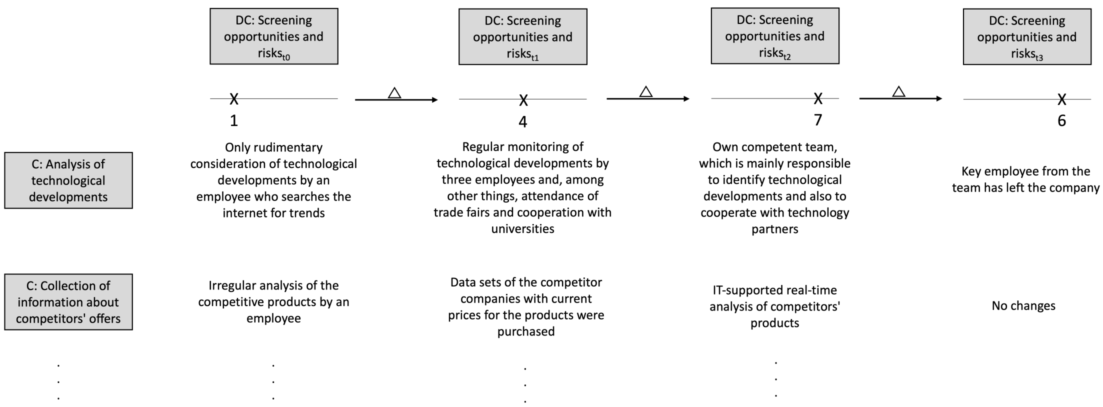

Figure 5.10: Exemplary Change of a Dynamic Capability over Time according to Gebauer (2011), Henneke (2015), and Leemann and Kanbach (2022)

Step 5 - Identify the appropriate dynamic capability configurations: In the future, suitable dynamic capability configurations can be defined for the company and thus the strategic further development of the dynamic capabilities in the companies can be planned. In addition to the information on whether a dynamic capability is present and in what quality, it is also relevant for the future which dynamic capabilities are more relevant for the achievement of goals than others, in order to then develop these in a targeted manner.

Step 6 - Strategic planning of the dynamic capabilities of the company: The further analysis from step 5, can then also be used to consider the extent to which dynamic capabilities could be further developed (always in line with the company's objectives) in the context of strategic management. For this reason, it is helpful to derive dynamic capabilities directly from a company's objectives.

To illustrate the application of the procedure, it will now be applied to a case study.

5.7 Application of the Dynamic Capability Profiles to a Case Study

SilverFashion is a fictitious textile retail group with sales of 500 million euros and focuses on premium fashion. The company's target group is the silver society in particular. Silver society refers to people over 60. Between 2000 and 2050, the number of people over 60 will rise from 600 million to 2 billion. The company has set up a digital department in 2022 to strengthen its own e-commerce platform and to be able to carry out online marketing measures. These two measures are seen as growth drivers by the management. It has become increasingly clear in recent years that the target group is making extensive and sophisticated use of the company's digital offerings. The company is operating in a very dynamic and competitive environment. Due to this environmental situation, the management now wants to deal more intensively with dynamic capabilities in order to be able to strengthen and expand them for the future. This is because SilverFashion wants to remain competitive. To this aim, the digital department is to create dynamic capability profiles to better understand the company's capabilities on firm performance.

In the first step, we derive the dynamic capabilities that the company needs to achieve its objectives from the the mid-term corporate objectives "Increase in market share by 5 % in the next year".[85] This approach also allows us to identify dynamic capabilities that do not yet exist in the company, but would be helpful in achieving the goal. In addition, it can also be assigned which dynamic capabilities, capabilties and resources are required. In this example, the dynamic capabilities are "Screening opportunities and risks" (assigned to sensing), "Shaping ecosystems and markets" (assigned to seizing), and "(Re-)Structuring the organization" (assigned to transforming)[86] with the sensing capability still differentiated between competitor, customer, and technology. In this case study, we will focus in particular on the sensing capabilities. Figure 5.11 shows the result of step 1 of the procedure to derive and to use dynamic capability profiles.[87]

In the second step, the dynamic capabilities must be assigned to the capabilities and resources. For example, in order to screen opportunities and risks by competitor, information about the competitors' offers is collected at SilverFashion. This is realized by data from competitive products, real-time IT systems, and the analysis skills of an employee. Resources can also be assigned to multiple capabilities just as capabilities can be assigned to multiple dynamic capabilities. The analysis skills of an employee are

85 In addition to the content of the goal, corporate objectives should also include the scope and have a time reference (Heinen 1977).

86 We use in this case study the examples of dynamic capabilities from the taxonomy of Leemann and Kanbach (2022).

87 For the dynamic capabilities profile the dynamic capabilities should be on one level. This is an important recommendation, because in the literature dynamic capabilities differ in hierarchical levels.

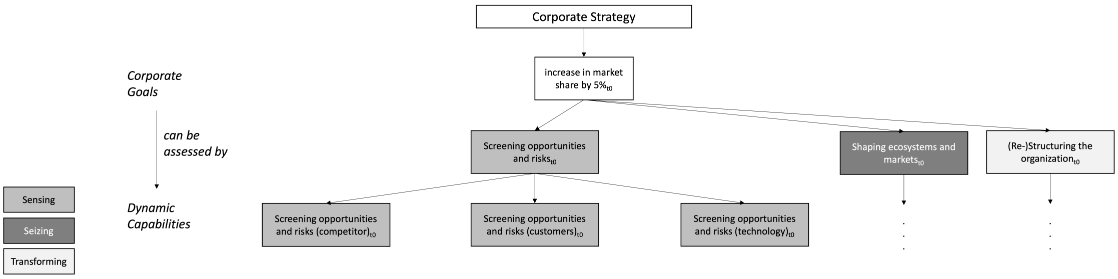

Figure 5.11: Step 1: Exemplary Results of the Derivation of Dynamic Capabilities from the Strategic Goals of a Company

needed in the analysis of the customer as well as the technologies. As recommended, this allocation should be supported by an IT tool so that it is also visible when the same resources are used for different capabilities. In figure 5.12, a distinction was only made between tangible and intangible assets for presentation reasons. The distinction between internal and external assets or between Non-IT and IT assets should still be included in this step. Figure 5.12 shows the result of step 2 of the procedure to derive and to use dynamic capability profiles.

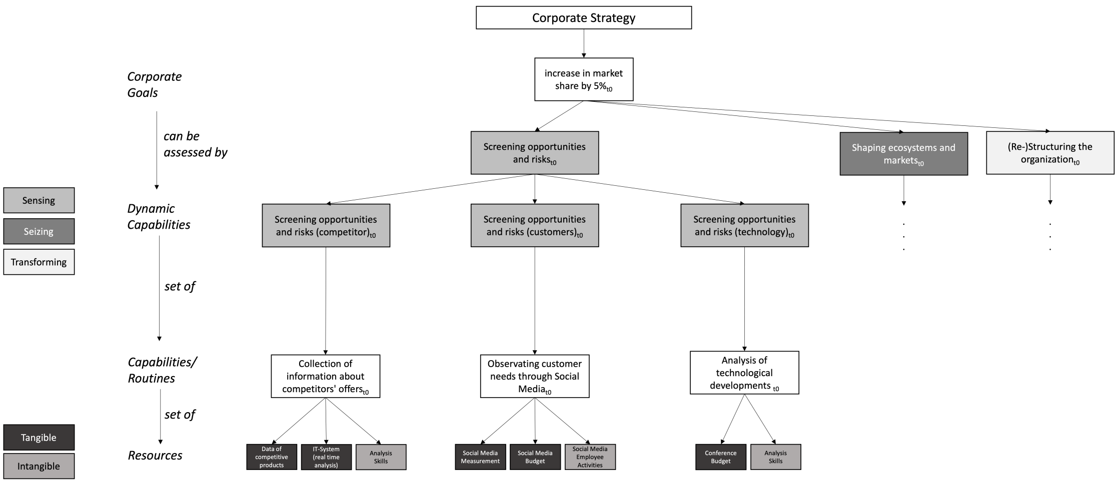

Figure 5.12: Step 2: Exemplary Results of the Allocation of Resources, Capabilities to the Dynamic Capabilities of SilverFashion

In order to be able to carry out a transparent evaluation of capabilities, the dynamic capabilities profiles should be filled out in a third step. Among other things, the indicators and metrics (measured variable and measuring method) should be defined in this process (Figure 5.13). Each dynamic capability profile should also specify the time interval of measures and the minimum standards. The fact that company-specific resources can also be considered in this way allows the uniqueness of the capability to be presented. The assessment by the defined indicators, measured variables and measuring methods is not only carried out at one point in time, but also in the defined time intervals. The changes between two measurements are particularly important for the analyses in the next step, in order to also be able to make statements on the development of dynamic capabilities.

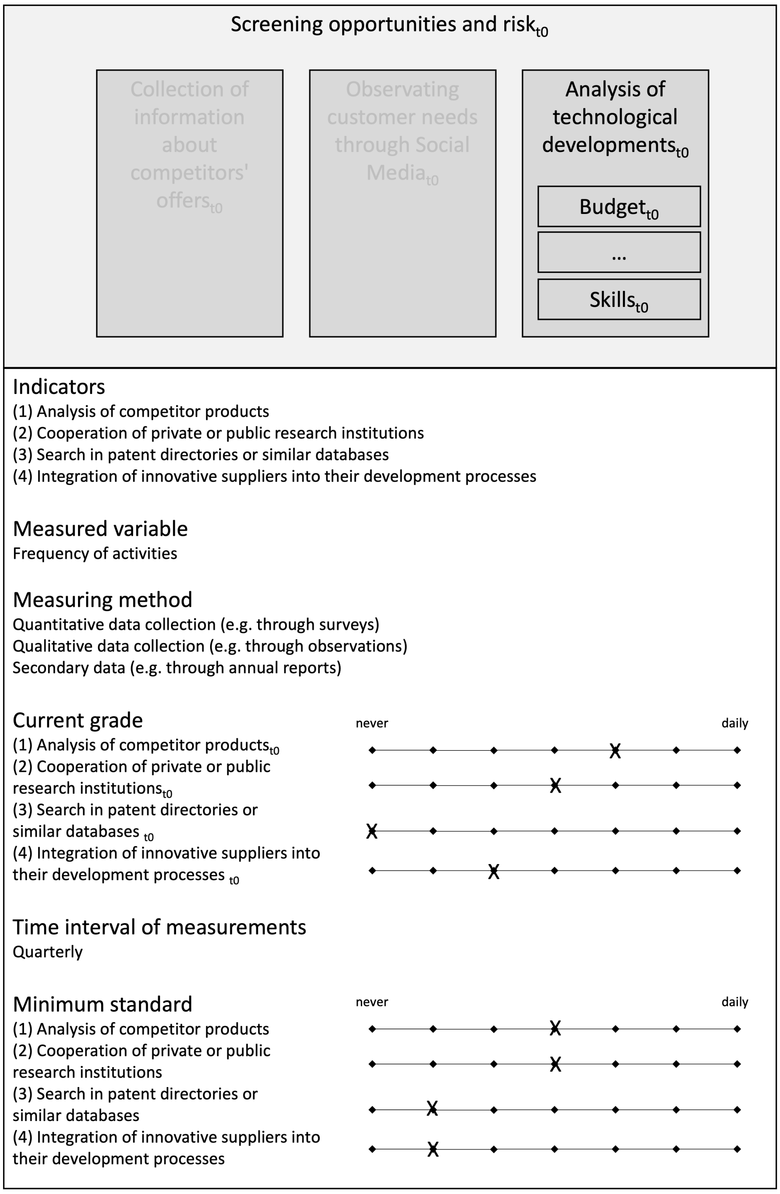

Figure 5.13: Step 3: Dynamic Capability Profile „Screening Opportunities and Risk", Focusing on the Capability "Analysis of Technology Developments"

Once the assessment has been done for the dynamic capabilities, it can then be seen where strengths and weaknesses currently exist in the dynamic capabilities. The analysis of the existing dynamic capability profiles takes place in the fourth step. The weaknesses can then be minimized, for example, through better IT support. This approach can clarify the question of the extent to which dynamic capabilities can lead to more IT. But it also becomes clear where dynamic capabilities are already supported by IT. When considering the introduction of a new IT system, it is then possible to highlight which capabilities would be affected and to forecast how the introduction of the system will affect the quality of dynamic capabilities. This also makes it possible to see what influence IT has on dynamic capabilities. By using an IT-supported application, the relationship can be made visible and thus the influence can be made clearer. In the case study, the minimum standard for "search in patent directories or similar databases" was not achieved. This result is derived from the comparison of the current grade and the minimum standard. Thereupon, management can initiate countermeasures to ensure that this indicator is met in the next measurement.

The fifth and sixth steps are not considered further for the case study, as they require further research. Nonetheless, the goal at the end is to be able to derive strategic decisions for the future development of dynamic capabilities, e.g., to be able to answer the question: how can the screening of competitors be further strengthened by IT so that the market share can grow by 5 % through combination with further dynamic capabilities?

5.8 Discussion and Implications

With the development and use of dynamic capability profiles the research goal stated at the beginning can be fulfilled. Nevertheless, there are still some open research gaps that need to be discussed.

The question arises, for example, to what extent an improvement in a dynamic capability leads to added value or a competitive advantage. This is illustrated below by the example that higher frequency in the analysis of technological developments. Figure 5.14 shows four different situations in which the identification of an opportunity can be a competitive advantage. Company A analyzes the development of technology four times a year, while company B only does so in the middle of the year. In the situations A, C, and D, company A has a competitive advantage because the company recognizes an opportunity with a time advantage over company B. Nevertheless, it should be noted that the identification of a new technology does not represent added value for the company unless something is also done with the recognition of the opportunity. It is therefore necessary that the dynamic capabilities are not considered in isolation but for the entire company.

The results of this paper did not answer the question whether certain dynamic capabilities are more relevant than others. In order to clarify whether there are capabilities that are more important than others, necessary and sufficient capabilities can then be analyzed. Necessary conditions to fulfill a dynamic capability can be identified by an necessary condition analysis[88] (NCA). In combination with a Qualitative Comparatives Analysis[89] (QCA), the degree can also be analyzed, so that finally high and low performance of the capabilities can be determined[90]. Secondary data such as "analyst

88 A NCA is a method to identify necessary conditions (Dul 2016).

89 A QCA is a method for analyzing the causality of configurable data (Misangyi et al. 2017; Mattke et al. 2021). The goal is the identification of minimum necessary and sufficient conditions for the presence of a variable to be explained, i.e. the outcome (Ragin 2014). For further information on the QCA in information systems research, see Mattke et al. (2022); Anton et al. (2022).

90 For an exemplary application see Mazumder and Garg (2021).

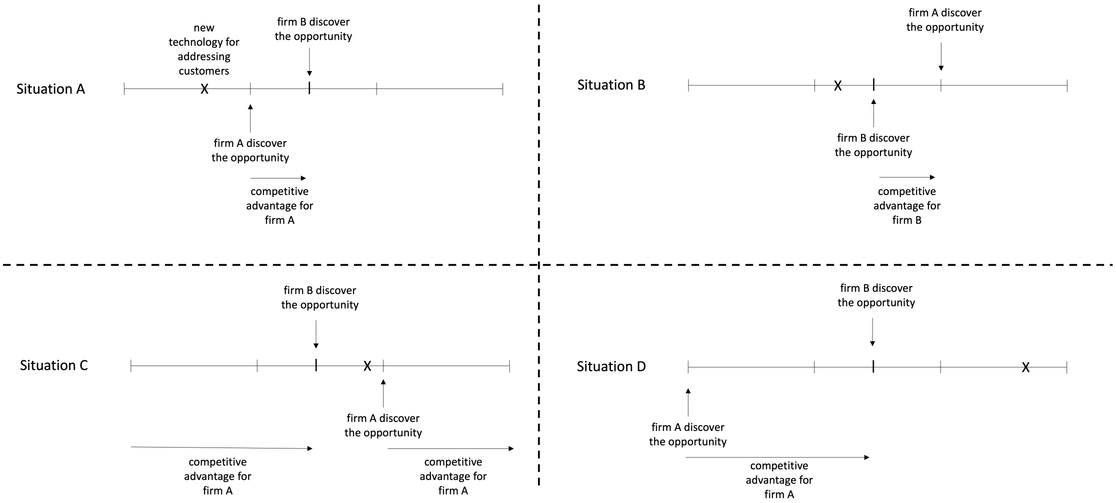

Figure 5.14: Step 4: Exemplary Advantage for Companies with Higher Dynamic Capability than Competitors (Shown by Frequency in Analyzing Technological Developments)

reports, databases, annual reports, and press releases" (Mazumder and Garg 2021) can be included. However, further research is necessary for this step, as a comparison must be made with several companies. The indicators from the previous procedure can be used further to enable a comparison at different companies. The consideration of different configurations of dynamic capabilities can then also help to identify low and high performance capabilities (e.g., with the help of a true table, see figure 5.15). Using the true table, various successful[91] configurations from other companies can be identified and then transferred to a company.

C: Analysis of technological developments	C: Collection of information about competitors' offers	. . . . . .	C: ...	Screening opportunities and risks
0	0		0	0
0	0		1	0
.	.		.	.
.	.		.	.
.	.		.	.
1	1		0	1
1	1		1	1

Figure 5.15: Step 5: True Table of Configurations of the Dynamic Capability "Screening Opportunities and Risks"

This can be the starting point to analyze more precisely in the future which capabilities/resources are mandatory for a dynamic capability in a company and to what extent they should be developed in order to achieve an efficient profile. The results can then be used to analyze the extent to which (dynamic) capabilities should be modified in order to secure a better position for the company, so that the profiles

91 The successful configurations are those with a 1 in the "screening opportunities and risks" column.

change over time. This can also happen, for example, when an employee leaves the company, thus changing the human resources. From a strategic perspective, a plan for development in the near future can thus be derived, which is well-founded to justify the required changes in the company, e.g., the introduction of a new IT system is necessary to strengthen certain dynamic capabilities.

A useful addition to a dynamic capability profiles tool in the future could be the integration with process mining tools. Available data about the different states about dynamic capabilities can then be adjusted using process mining. This approach makes it possible to operationalize dynamic capabilities more automated. IT thus represents an aid to observing dynamic capabilities or is itself a component of dynamic capabilities.

5.9 Conclusion

In order to create a common understanding of dynamic capabilities and the associated concepts, we have created a meta-model of dynamic capability profiles in this paper by discussing the concepts and relating them to each other. Building on the meta-model, we were then able to derive design guidelines for dynamic capability profiles, which should help in the operationalization of dynamic capabilities, offering fruitful avenues for future research.

Nonetheless, this research also underlies certain limitations. On the one hand, we looked at 30 definitions from IS and strategic management, from which we derived the concept for our meta-model. Due to the fact that firms from the most diverse industries are permeated by IT, definitions from other disciplines may further complement our meta-model. As a next step, it may therefore be tested for companies of different industries, whether the proposed model still hold true. On the other hand, the use of dynamic capability profiles has so far only been applied in an exemplary and simplified manner on the basis of a fictitious case study. For more complex case studies, it is relevant to implement an appropriate IT tool to perform the analysis of dynamic capability profiles.

As scientific contribution, we have created a basis on which current research can be considered and compared, because only if there is an equal understanding of the terms can research results be compared. Through the meta-model, the ambiguous concept of dynamic capabilities and their interplay with IT gets better graspable, through which it becomes measurable, and thus, manageable. To support this, we have developed dynamic capability profiles, which can also be used to answer the question of the extent to which IT affects dynamic capabilities and vice versa. In this context of measurement, IT innovations such as data and process mining become interesting approaches for IS and strategic management research, as well as for industry applications. As a result, this work also contributes to practice by offering a first step towards measurement and management of dynamic capabilities and IT.

5.10 Appendix - Paper I

5.10.1 Overview of Definitions of Dynamic Capabilities

The definitions of dynamic capabilities found are listed in table 5.1. In addition, it is noted from which previous definitions these refer to (e.g., the definition of Wheeler (2002) refers to the definitions of Teece et al. (1997) and Eisenhardt and Martin (2000)). White rows originate from strategic management literature, grey rows originate in IS research.

ID	Source	Refers to	Definition Dynamic Capability
1	Teece et al. (1997)	-	The firms' ability to integrate, build, and reconfigure internal and external competences to adress rapidly chaninging environments.
2	Teece and Pisano (1998)	-	We refer to this source of competitive advantage as "dynamic capabilities" to emphasize two key aspects which were not the main focus of attention in previous strategy perspectives. The term "dynamic" refers to the shifting character of the environment; certain strategic responses are required when time-to-market and timing is critical, the pace of innovation accelerating, and the nature of future competition and markets difficult to determine. The term "capabilities" emphasizes the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences toward changing environment.
3	Eisenhardt and Martin (2000)	1	A firm's processes that use resources – specifically, the processes required to integrate, reconfigure, gain, and release resources – to match and even create market change.
4	Wheeler (2002)	1,3	The ability of a firm to achieve new forms of competitive advantage by renewing competencies – organizational resources – to achieve congruence with a changing business environment.
5	Zhu and Kraemer (2002)	1,3	The change-oriented capabilities that help firms reconfigure their resource base to meet evolving customer demands and competitor strategies.
6	Zollo and Winter (2002)	1	A learned and stable pattern of collective activity through which an organization systematically generates and modifies its operating routines in pursuit of improved effectiveness.
7	Dehning and Stratopoulos (2003)	1	Capabilities reflect a company's ability to combine resources that the organization can muster in ways that promote superior performance in spite of the opposition stemming from the competition and circumstances.
8	Winter (2003)	-	The capabilities that operate to extend, modify, or create ordinary capabilities.
9	Bhatt and Grover (2005)	1	A broad organizational capability that captures the ability to search, explore, acquire, assimilate, and apply knowledge about resources and opportunities and how resources can be configured to exploit these opportunities. This allows firms to respond quickly to environmental threats and leverage opportunities.
10	Zahra et al. (2006)	-	The ability to reconfigure a firm's resources and routines in the manner envisioned and deemed appropriate by its principal decision maker(s).
11	Helfat et al. (2007)	-	A dynamic capability is the capability of an organization to purpoefully create, extend, or modify its resource base.
12	Teece (2007)	-	The capabilities that enable business enterprises to create, deploy, and protect the intangible assets that support superior, long-run business performance. The microfoundations of dynamic capabilities – the distinct skills, processes, procedures, organizational structures, decision rules, and disciplines – that underpin enterprise-level sensing, seizing, and reconfiguring capacities are difficult to develop and deploy.

Table 5.1 continued from previous page

ID	Source	Refers to	Definition Dynamic Capability
13	Butler and Murphy (2008)	1,3,4	The firm-specific processes or routines that integrate its activities, promote learning, and help firms build, reconfigure, and transform their asset/resource positions (tangible and intangible), processes, and structures to deliver products and services that are of value to all stakeholders, both internal and external.
14	Barreto (2010)	-	A firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base.
15	Koch (2010)	3	As capability-building mechanisms, dynamic capabilities are a "firm's processes that use resources – specifically the processes to integrate, reconfigure, gain, and release resources – to match and even create market change" (Eisenhardt and Martin, 2000, p. 1107).
16	Pavlou and Sawy (2010)	1,3,12	[...] dynamic capabilities were proposed and conceptualized as specific capabilities by which organizations reconfigure existing operational capabilities into new ones to better match the environment.
17	Wei and Wang (2010)	1,3	The unique processes required to integrate, reconfigure, gain, and release resources.
18	Helfat and Winter (2011)	1	[...] a dynamic capability is one that enables a firm to alter how it currently makes its living.
19	Kim et al. (2011)	1,3,11	Process-oriented dynamic capabilities are defined as a firm's ability to change (e.g., improve, adapt, adjust, reconfigure, refresh, renew, etc.) a business process better than the competition.
20	Benitez-Amado and Walczuch (2012)	1,14	A firm's ability to change its resource base to sense and seize opportunities and to cope with threats to increase its competitiveness.
21	Roberts and Grover (2012)	1	[...] dynamic capabilities refer to the ability to detect opportunities and threats, capture market opportunities, and change or revise existing substantive capabilities.
22	Wakefield (2013)	1,8,10	The dynamic capabilities approach describes firm-specific capabilities as combinations of organizational, functional and technological skills that are difficult to imitate and become a source of advantage, because they are firm-specific, non-transferable and organizationally embedded.
23	Chen et al. (2015a)	3	Dynamic capabilities can also be defined as unique organizational processes—specifically the processes to integrate, reconfigure, gain, and release resources—used to match and even create market change.
24	Dong and Wu (2015)	1,3,8,12	DC [...] explains firms' capabilities to innovate constantly in a fast-changing market environment to sustain competitive advantage.
25	Park et al. (2017)	1	Researchers have formally defined dynamic capability as a "firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments", which ultimately focuses on an organization's capability to effectively and efficiently address and manage environmental changes for superior performance.
26	Kathuria et al. (2018)	1,8,12	Such capabilities are dynamic; they "govern the rate of change of ordinary capabilities".
27	Shanks et al. (2018)	11	Dynamic capabilities are "the capacity of an organisation to purposefully create, extend or modify its resource base".
28	Saldanha et al. (2020)	3,6	Dynamic capabilities consist of strategic organizational processes that help firms to systematically generate and modify operating routines in pursuit of improved effectiveness. With dynamic capabilities, firms can achieve new resource configurations by integrating, reconfiguring, gaining, or releasing resources to match market changes.
29	Soluk and Kammerlander (2021)	1,2	[...] dynamic capabilities are defined as the portfolio of specific and distinguishable processes or routines that reflect "those enabling adaptation[s] to external environments characterized by rapid or discontinuous change".

Table 5.1 continued from previous page

ID	Source	Refers to	Definition Dynamic Capability
30	Bendig et al. (2022)	1,11,12	The dynamic capabilities view maintains that dynamic capabilities – a firm's capacity to "purposefully create, extend, or modify its resource base" – can systematically improve operational efficiency and alignment with the industry environment.

Table 5.1: Definitions of Dynamic Capabilities in Ascending Order by Year and Author(s)

5.10.2 Towards an Understanding of the Role of IT in the Meta-Model of Dynamic Capabilities

Having developed the meta-model, we now demonstrate how IT is integrated in, and and impacting factor on, dynamic capabilities by going through the main entities of the model.

IT as a resource. IT can be seen as a resource and thus as an input into capabilities (Ayabakan et al. 2017). In this context, IT can serve as an asset in many ways and must be further differentiated. On the one hand, there are the IT systems, which are attributed to the tangible assets, and on the other hand, there are the IT employees, whose IT skills can be attributed to the intangible assets (Kaplan and Norton 2004). While the IT systems and IT employees are internal assets, external systems or employees such as IT consultants can also serve as inputs. The combination of IT resources and non-IT resources can then lead to capabilities.

IT as a capability. The term IT capabilities is often found in the literature. If an IT capability is a specialization of capability, an IT capability is in the sense of our meta-model the efficient combination of resources, especially IT resources like IT skills as intangible asset and IT infrastructure as tangible asset that are provided by a firm at a given time. There is a systematic relationship to environmental requirements, the fulfillment of which reflects the quality of the IT capability. At this point, the question arises as to whether capabilities are still possible at all without IT and whether a subdivision into IT capabilities is necessary, since IT is a component of the capabilities and only differs in intensity. Bharadwaj et al. (1999) describe IT capabilities as a multidimensional construct that includes the technical and organizational dimensions (e.g., IT business partnerships and IT business process integration). This also reinforces our modeling of the entity type firm, since business processes or behavior, for example, are part of it.

IT in the firm. Also the firm is affected by IT. Here, for example, the current level of IT in a firm can be distinguished. The more IT is already used in a company, the more open employees can be to new IT innovations and changes. The behavior of top management with regard to IT can also play a role. Besides the cultural aspects, the level of IT can also have an influence on the quality of the capabilities, since IT-savvy companies can then already make more efficient resource combinations, and thus, gain a better competitive advantage (see also the comments by Aral et al. (2006) on IT and productivity).

IT in the environment. The environment in which the firm is embedded is also influenced by IT. As already mentioned, IT innovations are an important driving force for the increasingly fast-paced and ever-changing environment that firms face today. Time can be considered as the only entity type independent of IT. In summary, dynamic capabilities are affected by IT in various ways. This is also what makes it so difficult to precisely capture and measure the dynamic capabilities in addition to the non-IT aspects.

IT in dynamic capabilities. Steininger et al. (2021) see the dynamic capabilities view as a complement to the previous IT Business Value (ITBV) discussion to highlight specific resources and capabilities that are created or supported by the deployment, use, and mobilization of IT. IT Business Value can be defined as the impact of IT on firm performance (Mooney et al. 1996; Devaraj and Kohli 2003; Melville et al. 2004), which is widely established in the literature (Pathak et al. 2019). In the context of dynamic capabilities, it is assumed that more IT leads to more/better dynamic capabilities, which in turn positively influence firm performance. Since the discussion about the productivity paradox of IT (Brynjolfsson 1996), this underlying assumption can be considered naive. Dynamic capabilities must be measurable so that they can be managed in a targeted manner in strategic management. Several IT-focused papers that try to make dynamic capabilities measurable use subjective, perceived measures through questionnaires answered by high-level executives (Bhatt and Grover 2005; Cai et al. 2013; Kim et al. 2011; Liu et al. 2013; Wetering et al. 2017). Objective metrics at the process level are still rare (Ayabakan et al. 2017). These papers usually examined a specific type of IT resource or IT capability and its influence on firm performance via dynamic capabilities. IT can also play a role here, but on a higher level. States about dynamic capabilities at different points in time can be recorded using IT. We would like to emphasize again the time period consideration. Dynamic capabilities need at least two points in time in which they can be measured. The dynamic is characterized in particular by the fact that a capability has changed from time t_0 to at least time t_1. The delta between the points in time represents exactly the way in which the company reacts to environmental changes. Otherwise, only a capability of a firm at a time in a current environment is explained. These available data about the diffent states about dynamic capabilities can then be analyzed using process mining, for example. This approach makes it possible to operationalize dynamic capabilities. IT thus represents an aid to observing dynamic capabilities or is itself a component of dynamic capabilities.

Part III

Impact of IT Investments on a Company’s Operational Level

6 Paper II: A Literature-Based Derivation of a Meta-Framework for IT Business Value

Abstract

The business value of IT in companies is a highly discussed topic in information systems research. While the IT business value is an agreed upon term, its decomposition and assessment on a more detailed level is ambiguous in literature and practice. However, assessing the IT business value is pivotal for goal-oriented IT management. Therefore, we suggest a hierarchical decomposition of the IT business value along aggregated impacts and atomic impacts. We introduce a taxonomy to gain a better understanding of what types of atomic impacts may be caused by IT investments. With the help of the taxonomy, we classify a total of 957 values from existing value catalogs and derive 29 archetypal IT impacts grouped by a company's business units. Bundling this grouping with exemplary impacts for the IT value assessment, we finally propose an IT value meta-framework for the structured business value assessment.

Keywords: IT Business Value, IT Value Framework, Impact of IT, IT Investments, Literature Review, Meta-Framework

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6.1 Introduction

The business value of information technology (IT) in companies is a highly disputable topic in information systems (IS) research (Melville et al. 2004; Brynjolfsson and Hitt 2003; Mirani and Lederer 1998; Müller et al. 2018; Pathak et al. 2019). Without an understanding of the business value of IT investments within a company, no goal-oriented IT management is possible (Schütte et al. 2019). The "naive" expectations about only positive economic effects of IT have been discussed for a long period in literature as IT productivity paradox, focusing on the value contribution of IT and its contribution to the success of companies in the 1980s and 1990s (Brynjolfsson 1993; Brynjolfsson and Hitt 1998). More recently, the opinion has become accepted that IT in general has a positive influence on a company's productivity (Brynjolfsson and Hitt 2003). But the problem still exists that the variance in the return (positive and negative) on IT investments is still high and the IT business value, defined as extent of the contribution of IT investments to the productivity or success of a company (Cao 2010), is therefore still difficult to determine. Despite these uncertainties in the IT business value, companies extend their IT budgets for investments in digitalization endeavors (Fersht and Snowdon 2020). Nevertheless, the assessment of IT business values prior to an IT investment is especially important in times of crises such as the American subprime mortgage crisis, the European debt crisis and currently the coronavirus disease in which IT budgets are typically reduced. With reduced IT budgets, decisions demand for more elaborated business cases and cost-benefit analysis to approve IT investments (Hajli et al. 2015). Nevertheless, despite the crises, investments in IT are still necessary, for example to be able to react more flexibly to changes or to adapt the current business model to changes caused by the crises. However, the IT business value of single IT investments is often assessed by a decision maker's rule of thumb (Schniederjans et al. 2010).

To better deal with IT investment decisions, IS researchers so far have proposed approaches to assess the IT business value of an IT investment in a company (Mooney et al. 1996; Tallon and Kraemer 2006) and have introduced a number of value catalogs including specific impacts and expected business values of IT (Melville et al. 2004; Samulat 2015; Porter 2001a; Farbey et al. 1992; Gregor et al. 2006; Kurniawan et al. 2016). A value catalog is a reference list of positive and negative effects (Schulze 2009) that can be attributed to the launch or productive operation of an IT system (Schütte et al. 2019). These catalogs consist of a set of either specific or abstract possible impacts for IT systems in general or specific industry or system constellations with the downside that these impacts are not always directly quantifiable in an arbitrary company (Bartsch 2015). Nevertheless, value catalogs indicate possible IT business values and allow decision makers – at least for one catalog – to fully assess the business value of a future IT investment and avoiding formally defective decision models that cannot be solved (Adam 1996). The literature already contains a few value catalogs for the identification of the IT business value that are intended to serve this purpose. However, the lists vary in the number, the definitions and the granularity of categories (Schryen 2013). Also, many existing catalogs are prone to problems regarding a comprehensive and customizable IT value assessment (exemplary IT value catalogs in brackets). Oftentimes, catalogs do not sufficiently indicate atomic impacts and are rather abstract (Mirani and Lederer 1998). Related to this issue are missing or insufficient hierarchizations of impacts. While the majority of catalogs aims to assess the IT business value as a whole (Baumöl and Ickler 2008), those approaches are oftentimes incomplete due to abstractions from context specific aspects. Specific catalogs on the other hand (Schulze 2009) appear to dismiss important aspects mentioned in the taxonomy of IT impacts (Table 6.1). In general, IT value catalogs are also not designed to be configured for a specific application context, missing necessary mechanisms and methods for such customizations (Porter 2001a).

Conducting a structured literature review (Webster and Watson 2002), we have identified 33 catalogs including 957 impacts. These impacts both contain several duplicates and vary in their scope and meaning. Thus, we aim at providing archetypal IT impacts for the assessment of arbitrary IT investments. Based on these archetypes we will propose a meta-framework for the IT business value assessment. Our research enables practitioners to extend their IT business value assessment with our archetypal impacts or build IT value catalogs themselves. Researchers may build on our archetypal IT impacts for further quantitative analysis of the IT business value.

The remainder of this research is structured as follows: firstly, we will set the foundations for the meta-framework development involving IT business value and value catalogs in general and characteristics of atomic IT values in particular. Secondly, we will sketch our scientific approach followed by a presentation of our IT value archetypes within the meta IT value framework. Finally, we discuss our findings and briefly summarize our main results and provide an outlook on future research.

6.2 Foundations

6.2.1 IT Business Value Decomposition

The IT business value can be defined as the impact of IT on organizational performance (Melville et al. 2004; Mooney et al. 1996; Devaraj and Kohli 2003), which is widely established in the literature (Pathak et al. 2019). Melville et al. (2004) complement this general definition with an indication of the level and also the type of impacts: "at both the intermediate process level and the organization-wide level, and comprising both efficiency impacts and competitive impacts". While efficiency refers to internal impacts such as productivity enhancement (Tallon and Kraemer 2003), product quality (Barua et al. 1995), profitability improvements (Melville et al. 2004) or cost reduction

(Tallon and Kraemer 2003), competitive refers to external impacts such as competitive advantage (Parsons 1983), product differentiation (Belleflamme 2001) or market expansion (Tallon and Kraemer 2003). Although there is a general agreement about what an IT business value can be and the topic has been discussed for many years, "the relation between IT investments and firm performance remain elusive" (Masli et al. 2011). It is still not clear what are the returns and the concrete values generated by IT investments in particular, and the decomposition of the IT business value in general (Pathak et al. 2019; Wang et al. 2012).

Some authors have already addressed this gap in research and decomposed the IT business value to possibly observable impacts. We propose value catalogs as an important starting point for the identification of the IT business value in a specific organization (Schütte et al. 2019). An optimal value catalog hierarchically decomposes the IT business value (Level 1) into aggregated values (Level 2), observable, atomic impacts (Level 3) and guides the assessment providing key questions (Level 4) for the impact identification (Figure 6.1). The hierarchical decomposition avoids formally defective decision problems (Adam 1996).

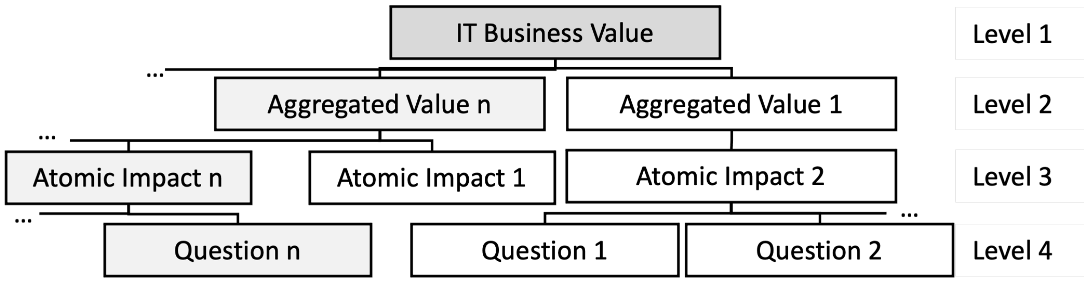

Figure 6.1: Decomposition of IT Business Value

6.2.2 IT Value Dimensions and Characteristics

The variety of atomic IT impacts can be classified according to the following dimensions and characteristics (Nickerson et al. 2013) presented in the taxonomy in table 6.1. The proposed taxonomy consists of six dimensions each consisting of several mutually exclusive and collectively exhaustive characteristics (Nickerson et al. 2013; Bailey 1994). The *Business Unit* (1) characteristics are based on the value chain introduced by Porter (2001a) which disaggregates a firm in strategically relevant primary and supporting activities. Logistics (Log) activities are originally divided in inbound and outbound logistics (Porter 2001a). Under logistics we comprise all activities associated with receiving, storing, and disseminating inputs to the product and with collecting, storing, and physically distributing the product to buyers. Under Operations (Ops) we subsume all activities associated with transforming inputs into the final product. Due to the original focus of Porter (2001b) on industrial enterprises with mainly physical products, we retrospectively also assign the creation and provision of services to this activity in order represent today's business environment (Parasuraman et al.

2005). Marketing and Sales (M&S) refers to activities that make the product or service appealing to customers and also to activities that are necessary for the buyer to purchase the product. Services (Ser) includes activities to maintain or increase the value of the product or service. Thus, this activity contains the delivery of services created by operations and services accompanying physical goods. Procurement (Proc) includes all activities that are necessary to purchase resources and necessary material used in the operations and other business unites of the company. Technological Development (TD) is understood to comprise of a variety of activities that deal with the improvement of a product or service and in particular with the process associated with it. Human Resources Management (HR) consists of the activities related to the recruitment, training, development, and remuneration of all types of personnel (Porter 2001b). For coding impacts that have an influence on several business units we introduce Cross-Organizational-Activities (COA) as further characteristic. It includes activities that involve general management, planning, finance, accounting, legal, governance affairs, and quality management which usually supports the entire chain and not individual activities.

Dimensions	**Characteristics**							
Business Unit (1)	Log	Ops	M&S	Ser	Proc	TD	HR	COA
Tangibility (2)	Tangible Impacts				Intangible Impacts			
Level of Examination (3)	Individual Level			Firm Level		Industry Level		
Performance Focus (4)	Operational Process Peformance				Management Process Performance			
Time of Occurence (5)	Immediate Impact				Anticipated Impact			
Direction (6)	Positive				Negative			

Table 6.1: Taxonomy of IT Impacts

The *Tangibility* (2) of an IT impact is concerned with the extent to which it can be measured and evaluated in economic terms (Lucas 1999). The literature generally distinguishes between tangible and intangible impacts. Tangible impacts represent impacts that can be measured and quantified economically (Mirani and Lederer 1998). Intangible impacts on the other hand are very hard to quantify, oftentimes not allowing for such economic evaluations (Lucas 1999). Thus, a qualitative assessment of the impact is necessary (Kesten et al. 2007).

A widespread distinction in the *Level of Examination* (3) is the individual level, the firm level, and the industry level (Bakos 1987; Chau et al. 2007; Kauffman and Weill 1989). We are following this view, especially since this distinction plays an important role in explaining the productivity paradox. The individual level effects of the IS affecting employees on an individual level, such as improving skills or increasing the employee's satisfaction (Chau et al. 2007). Firm level is concerned with IT impacts which have an influence on the whole organization including cross-organizational processes. For example, process improvements or increased organizational performance (Soh and Markus 1995). This level of examination also refers to the value chain of the organization, thus customer and supplier related activities or processes. The industry level contains IT impacts going beyond the organizational boundaries and its value chain, e.g. on the entire industry or the national economy (Chau et al. 2007).

The definition of IT business value already emphasizes that the *Performance Focus* (4) is a central aspect, which should also be considered when identifying impacts. Operation process performance is usually created by tangible impacts of the IT. They represent automatizations of activities or processes which constitute the regular day-to-day business, thus affecting the performance of the organization. However, they also oftentimes form the basis for intangible impacts that build on them (Mooney et al. 1996). Management process performance increases the availability and quality of information, allowing for better coordination, control and a decision making by the management.

IT systems produce a (potentially continuous) stream of net benefits. Thus, this dimension focuses on the *Time of Occurrence* (5) of the impacts. Conducting an a priori assessment of the impact of the IT at the time of the investment decision, the impacts until and exploitable immediately at the go-live (immediate impacts) of the IT can be determined and probable future impacts (anticipated impacts), by accessing the quality of the IS as a proxy measure, can be anticipated (Figure 6.2) (Gable et al. 2008).

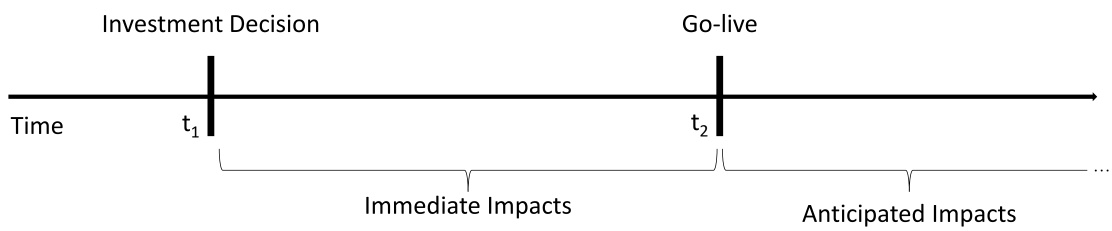

Figure 6.2: Time of Occurrence

Investments in IT systems do not only provide positive impacts to the organization. To assess the overall benefits of an IT systems, it is necessary to analyze the *Direction* (6) of these impacts (Schumann 1992). As the majority of the literature focuses on positive benefits of IT, our presupposition is to regard IT impacts as positive, if a negative character of an impact is not explicitly stated. Positive impacts have contributed to an overall corporate objective, to justify the IS investment (Schulze 2010). The implementation and the operation of an IT system may also cause direct (one-time) and indirect (ongoing) negative impacts such as costs for the organization (Schulze 2010).

6.3 Research Approach

To analyze possible IT impacts and derive a profile of aggregated clusters of impacts, we conduct a structured literature review and cluster identified IT impacts accordingly. Our analysis begins (1) with the identification of IT impacts already discussed in the literature (Figure 6.3) to build upon existing knowledge regarding IT-impacts (Webster and Watson 2002). The review starts by identifying and selecting qualified sources upon which the relevant data can then be extracted. This data, primarily the individual IT impacts, builds the foundation for the subsequent creation of the IT value framework. By limiting the keyword search (Urbach et al. 2009) to leading journals (AIS Senior Scholars' Basket), the quality of the results should be ensured (Webster and Watson 2002). Based on an initial screening of the literature we formulated the following generic search string that is customized for EBSCOHost: *(Information Technology OR Information System* OR IT OR IS) AND (Value Catalog* OR Impact* Catalog* OR Value Catalog*)*

To broaden the possible literature pool, German publications where also recognized by translating the search string. After an initial screening based on the criteria according to Fink (2019, p. 53) (e.g., language: German/English; research subject: IT systems; etc.), a total of 57 contributions could be identified. Due to the lack of a common generic term, the keyword search yielded rather imprecise results, putting special importance on the subsequent forward and backward search (Webster and Watson 2002). The identified contributions were subjected to a thorough selection process defined by the following selection criteria: (a) the content must meet the previously established definition of IT impacts, (b) the catalog must be based on some form of categorization, and (c) the catalog must contain atomic impacts. A total of 33 sources were deemed suitable for extracting and analyzing their contents.[92] Key sources for developing our meta-framework are illustrated with exemplary impacts in table 6.2.

We then (2) extracted all impacts from the identified sources with focus on the atomic impacts. Following a systematic selection process (Schwarz et al. 2007), all sources were read to document relevant data in a structured form. Specifically, atomic impacts and their respective categories were collected in an Excel spreadsheet, while additional aspects of each IT value catalog were documented separately. This selection process resulted in a collection of 957 IT impacts, of which 682 can be designated as atomic (level 3). Aggregating the impacts in a concept matrix (Webster and Watson 2002) led to the overarching dimensions and characteristics describing the variety of impacts identified (Chapter 6.2.2).

Using this data-set of 682 atomic IT impacts, we firstly conducted a qualitative content

92 For the overview of the value catalog considered, see appendix 6.7.1. This overview was not included in the accepted paper due to page limitations, but should be added to this thesis for completeness.

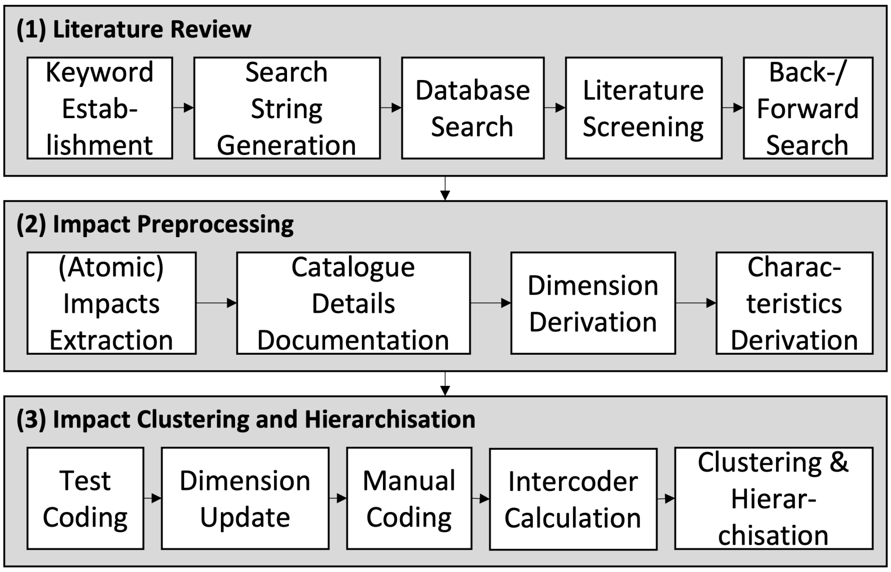

Figure 6.3: Research Approach

analysis involving each (hierarchy of) impacts and their respective research paper and codified (3) each IT impact regarding the presented dimensions and characteristics. After an initial test coding with a set of 50 impacts, we updated the dimensions and their respective characteristics. For example, it appeared that the dimension *Form of Investment* investigating the type of IT and related staff to be invested in could not be coded reliably and therefore had to be dismissed. Also, the characteristic *All* had to be removed from the dimension *Performance Focus* due to its distorting effect. Having the dimensions and characteristics established, five independent coders knowledgeable about IT business value in general and IT value catalogs in particular manually assessed the selected IT impacts.[93] As suggested in the literature (Nili et al. 2017), those coders where trained in the coding procedure and provided with a coding guide[94] stating the definitions of each code. Due to the large number of IT values, the coding was done in multiple stages in order to prevent coder fatigue (Jourdan et al. 2008; Neuendorf 2002). We used Microsoft Excel and VBA to support the coding process. If information for an IT impact is missing, we considered supplementary material such as referenced papers. If an IT impact is assigned with diverging characteristics during the coding process, the characteristic used by the majority of the coders is assigned. Cases in which an unambiguous decision cannot be made as the coders all assigned different characteristics are discussed among the five coders via online communication media, referring to the respective reliability measures (Weber 1990). To assess the coding quality, we calculated Fleiss' Kappa as suggested indicator (Landis and Koch 1977) for the intercoder reliability (Fleiss 1971) for each dimension. This

93 For the results of the coding of the individual impacts to the dimensions and characteristics, see appendix 6.7.2. This overview was not included in the accepted paper due to page limitations, but should be added to this thesis for completeness.

94 For the coding manual, see appendix 6.7.3. The coding manual was not included in the accepted paper due to page limitations, but should be added to this thesis for completeness.

method allows for determining the agreement between more than two coders while accounting for agreements by chance (Nili et al. 2017). The calculated kappa values are benchmarked against a set of fixed agreement measures in order to access the reliability of our coding (Landis and Koch 1977). The intercoder reliability for the dimension Direction is almost perfect (0.98) and substantial for Business Unit (0.61). The dimensions Tangibility (0.47) and Level of Examination (0.54) both constitute a moderate level of agreement between the coders. For Performance Focus (0.35) and Time of occurrence (0.40) a fair strength of agreement could be measured. The coding processes leads to a codified table of 682 IT impacts. After qualitatively assessing the IT impacts, the clusters are established by statistical methods (Denscombe 2008). We cluster the hand-coded IT impacts to derive archetypal IT impacts generalizable for arbitrary IT investments. The clustering is used to abstract from the diverging connotations of the IT impacts used by the authors of the value catalogs under consideration. The meta-framework provides an overview on the existing IT impacts as previously described in literature. We applied hierarchical clustering on the set of 682 IT impacts with their respective coding. For deriving the number of clusters, we visually examined the dendrogram resulting in a number of 29 clusters[95] (Ketchen and Shook 1996). Aiming at maximizing the homogeneity within each cluster, we apply the Ward method with squared Euclidean distances (Täuscher and Laudien 2018). The clusters as archetypal IT impacts form level 3 in our decomposition of the IT business value (Figure 6.1). In order to aggregate the impacts we used the business unit dimension as it includes the highest number of characteristics, thus allowing for the highest degree of differentiation. This dimension also seemed to be a key differentiator among the derived clusters. Additionally, the business unit dimension is perceived to be the most relevant for the internal organization of a company, regarding a practical application of the framework. This aggregation follows Porter (2001b), taking the perspective of key organizational activities, also building upon previous classifications of IT impacts (Anselstetter 1984). The resulting meta IT value framework is presented in the following chapter indicating the number of IT impacts summarized in each cluster following the cluster ID in brackets (cluster ID - number of impacts).

6.4 IT Value Framework

By applying the hierarchical cluster analysis to the IT impacts, we identify 29 distinct archetypal IT impacts for the third level of the IT business value decomposition. These impacts can be aggregated (level 2) to the business units (Chapter 6.2.2). For exemplary archetypal IT impacts, we propose exemplary IT impacts and leading references allowing practitioners to better assess the IT business value of their respective IT investment. Further guiding questions can be derived based on the following de-

95 For the overview of the derived clusters, see appendix 6.7.4. This overview was not included in the accepted paper due to page limitations, but should be added to this thesis for completeness.

scriptions of the archetypal IT impacts and mentioned literature. This also allows for a customization of the framework to the specific IT investment decision regarding organization, IT system, and other environmental factors (Brynjolfsson and Hitt 2003). An extract of the developed IT value framework is depicted in figure 6.4 illustrating the structure and design of the framework (level 1-3). The extract is detailed in table 6.2 presenting the clustered archetypal IT impacts as level 3 impacts and exemplary impacts for level 4. We used the characteristics of the business unit dimension (level 2) for aggregating the clusters of IT impacts (level 3) and developing a hierarchical IT value framework.

The *Log* aggregated value consists of two impacts. Better inventory management (Log 1 - 32) which leads to cost reductions in this domain. This can be achieved by impacts reducing the inventory (O'Leary 2004), e.g. delivering products electronically (Schumann 1992), increasing the turnover (Vanlommel and De Brabander 1975), or reducing the storage requirements (Andresen et al. 2002). IT systems can also improve the incoming goods inspection (Log 2 - 9), e.g. by impacts decreasing reclamation and spoilage risks (Anselstetter 1984).

By clustering the *Ops* aggregated values two distinct, archetypal impacts can be identified. The first cluster involves improvements to production processes (Ops 1 - 27). Those production related efficiency and effectively benefits can materialize in various immediate impacts. Some examples are an IT-based increased throughput (Mooney et al. 1996), optimized capacity utilization (Schulze 2009), reduced operational costs, or higher production reliability (Anselstetter 1984). Another cluster is constituted by impacts which improve the product quality (Ops 2 - 8). This can be achieved by providing lean production (Shang and Seddon 2002) or a higher degree of standardization (Vanlommel and De Brabander 1975).

Six archetypal clusters are identified for the *M&S* aggregated value. Impacts of the IT system can improve the M&S capabilities (M&S 1 - 8) of the organization. Examples are the ability to provide instant price quotations to clients (Andresen et al. 2002), analyzing ordering behaviors (Schumann 1992), or adding multi-currency capabilities in IT systems (Shang and Seddon 2002). Another aspect of the M&S business unit is represented by the cluster which improved customer retention (M&S 2 - 12). Those impacts can improve the overall customer relations (Gammelgård et al. 2006; Mirani and Lederer 1998) or by saving customer requests and utilizing such data in order to provide personalized offers (Schumann 1992). Some impacts are specifically directed towards increasing sales (M&S 3 - 7) and the respective business unit. Possible approaches are to implement ordering systems in order to develop new sales areas (Schumann 1992) and to increase responsiveness to customers (O'Leary 2004). The sales management (M&S 4 - 6) cluster contains impacts that support decision makers in this domain, e.g. by providing faster and cheaper information about the success of marketing measures (Schumann 1992) or more elaborated product range analysis

(Anselstetter 1984). Besides increasing and managing sales, IT systems can also provide time savings in marketing, sales, and product delivery (M&S 5 - 23). By introducing sales automation (O'Leary 2004), faster billing (Gable et al. 2008), or immediate price and availability information (Schumann 1992) can, for example, result in decreased capital commitment or less delayed deliveries (Anselstetter 1984). By developing competitive sales capabilities (M&S 6 - 10) consist of impacts which improve the company image and public relations (Andresen et al. 2002). Additionally, through superior marketing (Vanlommel and De Brabander 1975), market (Anselstetter 1984) and sales analyses (Schumann 1992) , the company can improve its competitive position (Anselstetter 1984).

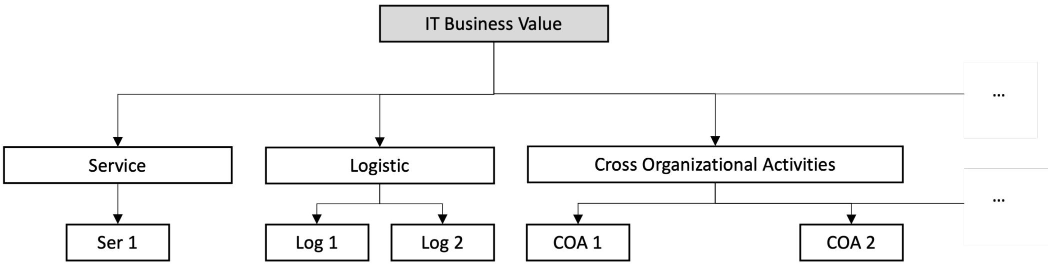

Figure 6.4: Extract from the IT Value Framework

All impacts assigned to *Ser* can be represented by the archetype improved customer services (Ser 1 - 18) that contains operational, cross organizational activities which improve the quality and delivery of customer services (Gammelgård et al. 2006). Improvements can be achieved, for example, by impacts accelerating responses to such inquiries and a faster, better delivery of the requested service (Andresen et al. 2002), or by reducing the overall need for services (e.g. maintenance) (O'Leary 2004). The customer interaction can also be impacted by interactive and customizable services (Shang and Seddon 2002) or 24/7 service availability (Riggins 1999).

The *Proc* cluster analysis resulted in two archetypal impacts. On an operational level, IT can contribute to a more efficient procurement of resources (Proc 1 - 15). This refers to faster (Anselstetter 1984) and cheaper (Vanlommel and De Brabander 1975) procurement by e.g. improving the order management (O'Leary 2004) or faster responses to supplier quotations (Andresen et al. 2002). Improved bargaining against suppliers (Proc 2 - 6) involves IT impacts improving the supplier selection resulting in improved supplier identifications and assessments (Andresen et al. 2002) as well as improvements to the order planning, control, and monitoring (Anselstetter 1984).

The aggregation of the *TD* impacts can be decomposed into two IT value archetypes. Improved IT infrastructure support (TD 1 - 18) constitutes impacts which provide immediate benefits by improving upon the IT infrastructure of the company. Those can materialize in improvements to the data security (Kesten et al. 2007), quicker, easier, and cheaper incorporation of product features (Porter and Millar 1985), or reduced communication costs (Mirani and Lederer 1998). Impacts assigned to the improved R&D (TD 2 - 16) cluster allow a company to make product, service and business process innovations and to alter their product life cycles (Mooney et al. 1996), thus possibly utilizing IT as an competitive weapon (Parsons 1983). Exemplary impacts consist in a faster application development (Mirani and Lederer 1998) and the ability to apply previously unfeasible business technology (Porter and Millar 1985).

The clustering revealed two impacts for the aggregated *HR* values. Staff reductions (HR 1 - 22) constitutes, e.g. impacts to increase employee productivity (Gable et al. 2008) in order to avoid the need to increase the work force (Anselstetter 1984) or decrease the current number of employees (Petrovic 1994). Another approach is to reduce the staff requirements (Andresen et al. 2002). Impacts which improve the employee's skills (HR 2 - 17) focus on learning using IT. Those skills can materialize in a broadened skill level (Shang and Seddon 2002) and enhanced recall of job-related information (Gable et al. 2008) as well as social skills such as the ability to work autonomously (Shang and Seddon 2002) and improved human relations (Anselstetter 1984).

The aggregated *COA* values can be decomposed into twelve archetypal impacts. Operational time and cost savings (COA 1 - 109) at firm level constitutes the largest cluster. Those impacts represent classic effectiveness and efficiency benefits which can be achieved through investment in IT. Examples are various forms of cost reductions (e.g., staff, transactions, etc.) (Andresen et al. 2002; Shang and Seddon 2002) and process improvements (Riggins 1999). Those impacts are mostly tangible and occur immediately after the implementation of the IT system. The improvements in management process (COA 2 - 62) cluster is primarily concerned with immediate information-related impacts of the IT investment and how they affect the management. For example, IT investments can increase the availability and accuracy (Gregor et al. 2006) of information, enabling faster, and more efficient decision making (Parker et al. 1988). Impacts enabling the development of new business areas (COA 3 - 6) constitute a relatively small cluster. This can be done by new products and applications (Bartsch 2015) or amendments to the workforce, policies, and procedures (Shang and Seddon 2002). Impacts clustered in the improve market position (COA 4 - 63) group are cross-organizational, mostly anticipated and directed towards management processes. To name a few, IT systems may support strategic goals of the company (Baumöl and Ickler 2008), constitute a competitive advantage (Weill and Broadbent 1998), or enable changes to the business model (Schulze 2009). The cluster improved corporate growth (COA 5 - 11) contains impacts which enable the company to grow or ones that minimize related risks. IT can create such growth by increasing the operational readiness (Anselstetter 1984), allowing for new services (Shang and Seddon

2002), or minimizing the risk of new business ventures (Andresen et al. 2002). IT systems can also increase the company flexibility (COA 6 - 53) allowing the company to adapt to future changes. Exemplary impacts for this cluster are an increase level of standardization (O'Leary 2004) and an improved change management (Gammelgård et al. 2006). The growth management (COA 7 - 11) cluster contains impacts IT can have on the highest company level to generate growth. Examples are building a cost leadership (Shang and Seddon 2002), leveraging the companies size (O'Leary 2004) and to increase the market share (Andresen et al. 2002). Impacts of IT systems can also create and defend competitive advantages (COA 8 - 16) by developing new markets and influencing the relationship to competitors. For example, impacts creating or removing barriers for market entry (Schulze 2009), allowing expanding to e-markets (Shang and Seddon 2002), and improving relations to external parties (Gammelgård et al. 2006). By improving the integration and information flow (COA 9 - 66) across the company, IT impacts can provide various positive, but oftentimes intangible benefits. This allows to perform tasks separated in time and space or to increase idea and information sharing among project teams (Andresen et al. 2002). The cluster improved employee satisfaction and performance (COA 10 - 12) shows how IT impacts can directly affect the workforce. Those impacts usually apply to all business units and are difficult to quantify in monetary terms. For example, a better performing system can increase the moral or the interpersonal communication (Shang and Seddon 2002), some impacts may also boost employee's creativity (Mooney et al. 1996). Besides those primarily positive impacts of IT, such investments also cause considerable costs. The IT investment costs (COA 11 – 12) represent direct and indirect costs associated with the IT investment. For example, acquisition and personnel costs as well as an increased dependence on the IT (Anselstetter 1984). In the cluster time savings in daily business operations (COA 12 - 5) IT systems contribute to such savings by reducing calls and mails (Anselstetter 1984) as well as changes to the individual workplace (Schumann 1992).

ID	Aggregated Values	Examples of Impacts of the Aggregated Values
COA 1	Operational time and cost savings at firm-level	Labor cost reduction (Shang und Sheddon, 2002; Mooney et al., 1996), Cost reductions (Porter and Millar, 1985; Parsons, 1983; O'Leary, 2004; Gammelgard et al., 2006; Gable et al., 2008), Productivity Improvements (O'Leary, 2004; Gable et al., 2008; Andresen et al., 2002; Parson, 1983), Overall operation efficiency and effectiveness (Shang und Sheddon, 2002; Mooney et al., 1996; Bamöl und Ickler, 2008), Speed up transactions or shorten product cycles (Mirani und Lederer, 1998), Reduced planning times (Andresen et al., 2002), Enabling faster access to information (Gregor et al., 2006), ...
COA 2	Immediate improvements in management process	Improving information accuracy (Gregor et al., 2006), Availability of new, better or more information providing opportunity to compete more effectively (Parker et al., 1988), New Reports/Reporting Capability (O'Leary, 2004), Improved ability to coordinate and integrate (Gammelgard et al., 2006), Increase the flexibility of information requests (Mirani und Lederer, 1998), Better asset management (Shang und Sheddon, 2002), ...
COA 3	Development of new business fields	Business growth with increased employees, new policies and procedures (Shang und Sheddon, 2002), Improved capture of design and construction decisions (Andresen et al., 2002), Development of new business fields (Baumöl and Ickler, 2008; Bartsch, 2015), Better research/development planning (Anselstetter, 1984), ...
COA 4	Improved market positioning of the company	Enable new market strategy (Shang und Sheddon, 2002), Help establish useful linkages with other organizations (Mirani und Lederer, 1988; Andresen et al., 2002; Gregor et al., 2006), Improved strategy formulation and planning (Gammelgard et al., 2006), Strategic competitive advantage (Andresen et al., 2002; Weill and Boradbent, 1998), ...
COA 5	Improved corporate growth (and reporting)	Business growth in transaction volume, processing capacity and capability (Shang und Sheddon, 2002), Reporting (Mooney et al., 1996), Business growth in new markets (Shang and Sheddon, 2002), . . .

Table 6.2 continued from previous page

ID	Aggregated Values	Examples of Impacts of the Aggregated Values
COA 6	Increased flexibility to addapt to future changes	Global resource management (Shang und Sheddon, 2002), Expandable to a range of applications (Shang und Sheddon, 2002), Improved organizational culture (Gammelgard et al., 2006), Improved change management (Gammelgard et al., 2006), Increased business flexibility (Andresen et al., 2002; O'Leary, 2004), Reduced technology risks (Andresen et al., 2002), ...
COA 7	Growth management	Build cost leadership (Shang und Sheddon, 2002), Increased market share (Andresen et al., 2002), Leverage Size (O'Leary, 2004), Revenue increases through product differentiation (Schumann, 1992), ...
COA 8	Creating/defending competitive advantages	Enable the organization to catch up with competitors (Mirani and Lederer, 1998), Improved relations with external parties that are neither customers, competitors nor suppliers (Gammelgard et al., 2006), Negating existing entry barriers (Parsons, 1983; Schulze, 2009), Creating new entry barriers (Parsons, 1983; Schulze, 2009), ...
COA 9	Improved integration and information flow	Improved communication (Gammelgard et al., 2006), Make use of extensive user feedback (Riggins, 1999), Fewer information bottlenecks (Andresen et al., 2002), Enabling easier access to information (Gregor et al., 2006), Smoother work flow (Vanlommel and Brabander, 1975), Business integration (Weill and Broadbent, 1998), Information processing efficiency (Parker et al., 1988), ...
COA 10	Improved employee satisfaction and performance	Greater employee involvement in business management (Shang and Seddon, 2002), Increased employee satisfaction with better decision making tools (Shang and Sheddon, 2002), Satisfied employees for better employee service (Shang and Sheddon, 2002), Creativity (Mooney et al., 1996), ...
COA 11	IT-Investment costs	Acquisition and implementation costs (Anselstetter, 1985), Personnel costs for training and instruction (Anselstetter, 1985), indirect investment costs (Schulze, 2010), . . .
COA 12	Time savings in daily business operations	Labor time saving (Kesten et al., 2007), Fewer phone calls (Anselstetter, 1985), Fewer letters (Anselstetter, 1985), . . .
HR 1	Staff reductions	Save money by avoiding the need to increase the work force (Mirani and Lederer, 1998; Gregor et al., 2006), enhances effectiveness in the job (Gable et al., 2008), Reduced staff requirement (Andresen et al., 2002), Personnel Reduction (O'Leary, 2004; Petrovic, 1994; Anselstetter, 1984), . . .
HR 2	Improving employee skills	Shorten learning time (Shang and Sheddon, 2002), Improved learning and/or increased knowledge of persons in the organization (Gammelgard et al., 2006; Gregor et al., 2006), learning through the presence of IS (Gable et al., 2008), Enabling of cross-functional teams (Andresen et al., 2002), ...
Log 1	Reduced inventory and better inventory management	Inventory Reduction (O'Leary, 2004; Schumann, 1992), Higher turnover inventory (Vanlommel and Brabander, 1975; Anselstetter, 1984), Increasing the speed of distribution (Parsons, 1983), Improved delivery scheduling (Andresen et al., 2002), . . .
Log 2	Improved inventory control	Better inventory management (Shang and Sheddon, 2002), More precise production planning, control and monitoring (Anselstetter, 1984), Improved operational decisions (Shang and Sheddon, 2002), . . .
M&S 1	Improved Marketing & Sales capabilities	Multi-currency capability (Shang and Sheddon, 2002), Improving external access to stock levels and price information (Andresen et al., 2002), Ability to provide instant price quotations to clients (Andresen et al., 2002), . . .
M&S 2	Improved customer retention	Improve customer relations (Gammelgard et al., 2006; Gregor et al., 2006), Customer loyalty (Schulze, 2009; Kesten et al., 2007), ...
M&S 3	Increased Sales	Provide new products or services to customers (Mirani and Lederer, 1998), Increased Sales (Andresen et al., 2002, Weill and Broadbent, 1989), Customer Responsiveness (O'Leary, 2004), . . .
M&S 4	Time savings in Marketing & Sales and product delivery	Sales Automation (O'Leary, 2004), Faster invoicing (Andresen et al., 2002), Easily find the best offer (Schumann, 1992), Faster and more secure checkout processing (Anselstetter, 1984), . . .
M&S 5	Leveraging marketing and sales capabilities as competitive advantages	Improved company image (Andresen et al., 2002), Easier decision making for buyers due to improved evaluation of sources of materials (Porter and Millar, 1985), Better marketing information (Vanlommel and Brabander, 1975), More detailed market analyses (Anselstetter, 1984), . . .
M&S 6	Improved sales management	More precise sales planning, control and monitoring (Anselstetter, 1984), More precise assortment analysis (Anselstetter, 1984), Faster and more cost-effective information on the success of marketing measures (Schumann, 1992), ...
Ops 1	Improved production processes	Reduced construction time (Andresen et al., 2002), Manufacturing performance (Shang and Sheddon, 2002), Improved outcomes or outputs (Gable et al., 2008), Reducing operating costs (Gregor et al., 2006), Throughput (Mooney et al., 1996), . . .
Ops 2	Improved product and production quality	Quality improvement (Shang and Sheddon, 2002; Kesten et al., 2007), Higher degree of standardization of operations (Vanlommel and Brabander, 1975), Contribute to high quality (Parsons, 1983), . . .
Proc 1	More efficient procurement of materials	Improved supplier relations (Gammelgard et al., 2006), Procurement Cost Reduction (O'Leary, 2004), Faster response to supplier quotations (Andresen et al., 2002), Cost reduction in the area of raw materials (Vanlommel and Brabander, 1975; Anselstetter, 1984), . . .
Proc 2	Strengthening the companies position towards suppliers	Better supplier selection (Anselstetter, 1984), Strengthening negotiating power with suppliers (Bartsch, 2015), . . .
Ser 1	Improved quality and delivery of customer services	Faster delivery of services (Andresen et al., 2002), Improved delivery of products/services (Gammelgard et al., 2006), Improved quality of products/services (Gammelgard et al., 2006), Better customer service (Anselstetter, 1984), Providing customized product or services (Shang and Sheddon, 2002), Improved focus on client requirements (Andresen et al., 2002), Better service to customers (Vanlommel and Brabander, 1975; Anselstetter, 1984), Establish 24 × 7 customer service (Riggins, 1999), Contribute to superior customer service (Parsons, 1983; Shang and Sheddon, 2002; Schumann, 1992), ...
TD 1	Improved IT-Infrastructure support	Save money by reducing system modification or enhancement costs (Mirani and Lederer, 1998), Mainframe or hardware replacing (Shang and Sheddon, 2002), Provide the ability to perform maintenance faster (Mirani and Lederer, 1998), Integration of new functions (Baumöl and Ickler, 2008), Increasing system stability (Kesten et al., 2007), ...
TD 2	Improved R&D and Life Cycles	Continuous improvement in system process and technology (Shang and Sheddon, 2002), Allow other applications to be developed faster (Mirani and Lederer, 1998), Speed up by product life cycle by shortening the development process (Parsons, 1983; Mooney et al., 1996), Making new businesses technologically feasible (Porter and Millar, 1985), ...

Table 6.2: IT Value Framework

6.5 Discussion and Implications

Although, the meaning of the IT business value is agreed upon in literature (Melville et al. 2004; Devaraj and Kohli 2003; Mooney et al. 1996), its decomposition to detailed and measurable atomic impacts of the IT system remains either undescribed or varies strongly across existing literature. Hence, we provide decision makers with an IT value framework with possible IT system related impacts and exemplary references for the structured assessment of IT impacts. The framework is customizable to a specific IT investment situation. A proper IT business value assessment requires for IT- and company-specific impacts (Brynjolfsson and Hitt 2003). However, the IT value framework is neither IT- nor company-specific so that it requires further customization. Nevertheless, the IT value framework allows for a more comprehensive IT business value assessment as it contains more information in a (more) structured form as decision makers usually attempt when applying rules of thumb (Schniederjans et al. 2010). While existing IT value catalogs only incorporate impacts from a single existing catalog (Samulat 2015; Gregor et al. 2006; Riggins 1999; Bartsch 2015), we draw on 33 value catalogs with a total of 957 impacts and propose a hierarchy to aggregate the impacts to a single root value (Level 1). With our IT value framework we aim at aligning the different connotations of the IT impacts in existing value catalogs (Melville et al. 2004). During the coding we deviate from the author's classification of impacts. O'Leary (2004) for example, categorizes some impacts as intangible (e.g. customer responsiveness, cost reduction) that we coded as tangible as KPIs exist to economically measure them. There exist further alternatives for the aggregated values besides the business units. Below the business unit level, several clusters are concerned with the competitive positioning (e.g., Proc 2, COA 4, COA 8) or the organizational capabilities to exploit future potentials (e.g., M&S 1, COA 6). These aggregations may also serve as aggregated values in customized versions of the framework. We provide an overview of the existing literature on IT impacts and provide decision makers with additional exemplary IT impacts and references. The framework can be used both for the identification of impacts a priori to an IT investment decision and during the project implementation for the controlling of impact achievement (Schütte et al. 2019).

Due to the changing role of IT and the progress (DeLone and McLean 2003) from the early 1970s until today, existing catalogs must be viewed critically. While Anselstetter (1984) for example highlights the reduction of paperwork as a main IT business value, more recent catalogs focus on capabilities enabled by introducing future IT systems (Melville et al. 2004; Kurniawan et al. 2016). IT systems have developed from the support of human actors to a high level of automation in many industries. This development needs to be considered when dealing with general impacts extracted from IT value catalogs. Applying our IT value framework or IT value catalogs in general, decision makers must pay attention that specific atomic impact are only included in one impact category. Otherwise, a possible double accounting would distort the IT business value assessment (Bartsch 2015). Although our sample of 33 IT value catalogs results in a total of 957 impacts, we do not raise a claim for completeness, as our systematic literature review was rather narrow compared to vague terminology on value catalogs. Thus, we started our literature research on major IT business value (and German equivalent) literature and focused on forward and backward search (Webster and Watson 2002). Because of our focus on scientific literature, we excluded practitioner contributions on IT value catalogs and did not include additional impacts not mentioned in prior research. As indicated in the scientific approach chapter (Chapter 6.3), we reached substantial results for the coding of the business unit and direction dimension but only achieved fair results for the performance focus and time of occurrence. The coders disagreed on the performance focus of impacts such as "Creating competitive advantage" (Gregor et al. 2006), "Create service excellence" (Gregor et al. 2006), or "Altering the product lifecycle" (Parsons 1983). It seems that these dimensions require for further characteristics as a differentiation between operational and management level is difficult. For the dimension time of occurrence an additional characteristic indicating the quality of the IT system as enabler for future impacts may be more comprehensive (Gable et al. 2008). Nevertheless, we argue that the independent coding of five experts with a Fleiss' Kappa of 0.35 is still a valid result (Landis and Koch 1977). While recent research generally suggest Krippendorff's alpha (Nili et al. 2017), Fleiss' Kappa is expected to provide similar results for the specifications of our coding (Landis and Koch 1977) while being much more adaptable to the tools for the statistic evaluation (VBA) (Nili et al. 2017). Kappa statistics may also be subject to a paradox in which a strong agreement between the coders is reflected by a disproportionately low index, which has to be taken into account during the analysis. The rather complex coding scheme and the large amount of codes increases the probability for coding errors (Campbell et al. 2013). We tried to minimize the cognitive difficulty for the coders by training, providing a coding manual (Nili et al. 2017), and conducting the coding in multiple stages (Jourdan et al. 2008; Neuendorf 2002). However, this circumstance must also be considered during our analysis. Once the intercoder reliability has been calculated, the question arises as to what constitutes an acceptable reliability level. While most reliability measures, e.g. percenter agreement, require a high level of agreement, Kappa values can be accessed by more liberal criteria due to their relatively conservative indices (Lombard et al. 2002). Thus, we adopted the agreement measures by Landis and Koch (1977), which of cause represent an arbitrary division. However, they provide fixed measures against which we can benchmark our Kappa values to access the reliability of our coding. Even more importantly those agreement measures allow us to better identify deviating understandings of the IT impacts and analyze such coding variation (Olson et al. 2016). Those findings could then be integrated into our IT value framework to account for different perspectives on IT impacts.

6.6 Conclusion

The IT business value on the highest level of abstraction is an agreed upon term in literature. However, its decomposition and assessment on a detailed level of atomic impacts is often not described. We propose to hierarchically decompose the IT business value to an assessable and atomic level via aggregated impacts, atomic impacts and questions. For assessing the expected IT business value of an IT investment there already exist 33 IT value catalogs including 957 possible impacts for IT that partially differ in denomination and definition. The classification of 682 atomic IT impacts results in 29 clusters of atomic impacts that can be aggregated to a company's business units as aggregated values. The meta IT value framework further provides exemplary impacts and further literature for assessing each of the atomic impacts more specifically. The contribution of this paper is to provide a comprehensive meta-framework of IT impacts that takes into account all the key aspects identified earlier. This allows a holistic IT impact assessment to be performed in any practical context, which was not possible with previous frameworks. We have deliberately chosen the perspective of key business functions to guide practitioners, but other perspectives may be considered in future papers.

Another important avenue for future research is the further operationalization of atomic and exemplary impacts with guiding questions, making them configurable for specific IT investments decisions and industries. As this research focuses on the atomic impacts within existing values catalogs ignoring the specifics and peculiarities of the catalogs itself, future research may investigate the IT system- and company-specifics of these catalogs. Additionally, as we solely rely on impacts from existing IT value catalogs taken from the literature, future research should also integrate practitioner sources and may also incorporate additional impacts derived from IT projects. These additional impacts can reflect current trends in IT system development and incorporate state of the art processes. In addition, the IT value framework should be applied in practice to get insights into, for example, whether the abstraction of IT business values is sufficient. This evaluation will be the next step in our research.

6.7 Appendix - Paper II

6.7.1 Overview of the Value Catalogs Considered

Table 6.3 contains an overview of the value catalogs that we could identify in the existing literature. The list is sorted by author(s) in ascending order. The value catalogs with the catalog IDs 5, 6, 7, 13, 15, 16, 23, 26, 27, and 33 could not be used for the further analysis of the individual effects, since they did not mention impacts at level 3 (atomic impacts). Melville et al. (2004), for example, lists human IT resources and business processes as aggregate values at level 2. However, these aggregate values are not broken down further, so they are not included in our analysis, which focuses on atomic impacts.

Catalog ID	Authors	Year
1	Andresen et al.	2002
2	Anselstetter	1984
3	Bartsch	2015
4	Baumöl and Ickler	2008
5	DeLone and McLean	2003
6	Dos Santos	1991
7	Farbey et al.	1995
8	Gable et al.	2008
9	Gammelgård et al.	2006
10	Gregor	2006
11	Hammer and Mangurian	1987
12	Kesten et al.	2007
13	Kurniawan et al.	2016
14	Kütz	2013
15	Lucas	1999
16	Melville et al.	2004
17	Mirani and Lederer	1998
18	Mooney et al.	1996
19	O'Leary	2004
20	Parker et al.	1988
21	Parsons	1983
22	Petrovic	1994
23	Porter	2001
24	Porter and Millar	1985
25	Riggins	1999
26	Samulat	2015
27	Schubert and Williams	2009
28	Schulze	2009
29	Schumann	1992
30	Shang and Seddon	2000
31	Vanlommel and De Brabander	1975
32	Weill and Broadbent	1998
33	Weill and Olson	1989

Table 6.3: Value Catalogs Considered Ascending by Author(s)

6.7.2 Detailed Result of the Coded IT Impacts

Table 6.4 shows the results of the coding process for the individual IT impacts. The level of examination was omitted from the table for presentation reasons, as firm level was selected for all impacts. In a next step, clusters were formed, which are necessary for the hierarchization of the impacts, and added to this table by the field "Cluster ID".

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
1	Reduced planning times	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
2	Reduced marketing costs	1	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
3	Ability to handle more enquiries	1	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	8
4	Reduced communications costs	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
5	Reduced paperwork	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
6	Reduced IT costs	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
7	Reduced storage requirements	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	2
8	Reduced transaction times	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
9	Reduced transaction costs	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
10	Improved delivery scheduling	1	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
11	Faster invoicing	1	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
12	Reduced transaction costs	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
13	Quicker response to client enquiries	1	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	3
14	Quicker response on current project progress	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
15	Reduced lead times for design	1	Technology Development	Tangible	Operational process	Immediate impacts	Positive	20
16	Reduced rework	1	Technology Development	Tangible	Operational process	Immediate impacts	Positive	20
17	Increased information exchange	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
18	Reduced construction time	1	Technology Development	Tangible	Operational process	Immediate impacts	Positive	6
19	Improved productivity	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
20	Reduced waste	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
21	Reduced operating costs	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
22	Quicker access to operation and maintenance data	1	Operations	Tangible	Operational process	Immediate impacts	Positive	1
23	Reduced staff requirement	1	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
24	Reduced training requirements	1	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
25	Increased Sales	1	Marketing and Sales	Tangible	Operational process	Anticipated impacts	Positive	26
26	Minimising business risk	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	19
27	Strategic competitive advantage	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
28	Increased business flexibility	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
29	Maintaining competitive capacity	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
30	Reduced risk in new business ventures	1	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	14
31	Improved company image	1	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	28
32	Generating new business	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
33	Increased market share	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	16
34	Easier international links	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
35	Fewer information bottlenecks	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
36	Improved quality of output	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
37	Sustaining market share	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
38	Maintaining competitive capacity	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
39	Faster response to supplier quotations	1	Procurement	Tangible	Operational process	Immediate impacts	Positive	5
40	Ability to provide instant price quotations to clients	1	Marketing and Sales	Intangible	Management process	Anticipated impacts	Positive	17
41	Minimising business risk	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
42	Better control of cash flow	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	9
43	Reduced lead times for financial reporting	1	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
44	Improved quality of output	1	Operations	Intangible	Operational process	Anticipated impacts	Positive	6
45	Faster delivery of services	1	Service	Tangible	Operational process	Anticipated impacts	Positive	3
46	Improved focus on client requirements	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	8
47	Improved quality of output	1	Operations	Intangible	Operational process	Anticipated impacts	Positive	6
48	Reduced technology risks	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
49	More responsive ability to arrange meetings	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	19
50	Increased speed of new design development	1	Technology Development	Tangible	Operational process	Anticipated impacts	Positive	20
51	Improved quality of output	1	Operations	Intangible	Operational process	Anticipated impacts	Positive	6

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
52	Reduced technology risks	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
53	Ability to exchange data	1	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
54	Improved quality of output	1	Operations	Intangible	Operational process	Anticipated impacts	Positive	6
55	Ability to refer back to data	1	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
56	Improved record of staff skills	1	Human Resource Management	Intangible	Management process	Anticipated impacts	Positive	22
57	Improved ability to select appropriate team members	1	Human Resource Management	Intangible	Operational process	Anticipated impacts	Positive	22
58	Providing space and capacity for business growth	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
59	Safeguarding future flexibility	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
60	Overcoming obsolescence	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
61	Increasing responsiveness of senior management to business problems	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
62	Improved strategic intelligence for new markets	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
63	Improved public relations targeting and delivery	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	28
64	Improved information version control	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
65	Ease of capture of meaningful information	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
66	More relevant and reliable data	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	9
67	Improved filtering of info	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	19
68	Improving external access to stock levels and price information	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	17
69	More effective identification and assessment of new suppliers	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	13
70	Improved/new transaction methods	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
71	Improved forecasting and control	1	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
72	Greater integration with other functions	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
73	Improved information exchange with clients	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
74	Increased client satisfaction	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
75	Strategic competitive advantage	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
76	Improved idea sharing among project teams	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
77	Improved integration	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
78	Improved idea sharing among project teams	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
79	Improved integration	1	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
80	Improved project relationships with strategic partners	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
81	Improved capture of design and construction decisions	1	Technology Development	Intangible	Management process	Anticipated impacts	Positive	11
82	Improved full life-cycle information management	1	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
83	More effective assembly of project teams	1	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	22
84	Enabling of cross-functional teams	1	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	22
85	Improved human relations	1	Human Resource Management	Intangible	Operational process	Anticipated impacts	Positive	22
86	Regularised working arrangements	1	Human Resource Management	Intangible	Operational process	Anticipated impacts	Positive	22
87	Anschaffungs und Implementierungskosten	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Negative	25
88	Personalkosten für Schulung und Einweisung	2	Human Resource Management	Tangible	Operational process	Immediate impacts	Negative	25
89	Sonstige Kosten (z.B. Materialbedarf, Datenschutz, etc.)	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Negative	25
90	Personalkosten	2	Human Resource Management	Tangible	Operational process	Immediate impacts	Negative	25
91	Übertragungskosten	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Negative	25
92	Materialkosten	2	Procurement	Tangible	Operational process	Immediate impacts	Negative	5
93	Stärkere Abhängigkeit von der DV	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Negative	25
94	Geringere Flexibilität	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Negative	25
95	Weniger Innovationen	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Negative	25
96	Höhere Anfälligkeit/ Verletzlichkeit	2	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Negative	25
97	Implementierungs-/ Umstellungs-/ Akzeptanzprobleme	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Negative	25
98	Verkürzung Zeitaufwand für manueller Tätigkeiten	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
99	Reduzierung machineller Bearbeitungszeiten	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	6
100	Erhöhung des Arbeitsvolumen bei gleicher Mitarbeiterzahl	2	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
101	Gleiches Arbeitsvolumen vie verminderter Mitarbeiterzahl	2	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of oc-curence	Direction	Cluster ID
102	Weniger Personal	2	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
103	Weniger Materialverbrauch	2	Procurement	Tangible	Operational process	Immediate impacts	Positive	6
104	Geringerer/Kürzerer Kapitaleinsatz	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
105	Höhere Lieferbereitschaft	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	1
106	höhere Kapazitätsauslastung	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
107	Mittelbare Umsatzsteigerungen aus Wirkungsketten	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
108	Bessere Informationsaufbereitung, -dokumentation, -erschließung, -übermittlung	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
109	Schnellere Informationsbeschaffung	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
110	Höhere Auskunftsbereitschaft	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
111	Effizientere Kommunikation	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
112	Bessere Ablaufstranzparenz	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
113	Bessere und genauere Kennzahlen	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	14
114	Weniger Reisen	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
115	Flexiblere Arbeitsorganisation	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	15
116	Weniger Telefonate	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	29
117	Weniger Briefverkehr	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	29
118	Besseres Schriftgut	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
119	Schnellere Schriftguterstellung/ -übermittlung	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
120	Größere Planungs- und Prognosegenauigkeit	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
121	Geringerer Papierverbrauch	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
122	Geringerer Dokumentationsaufwand	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
123	Effizientere Entscheidungsprozesse	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
124	Schnellere Entscheidungen	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
125	Kürzere Durchlaufzeiten	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
126	Bessere Forschungs-/ Entwicklungsplanung	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	11

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
127	Weniger Routinearbeiten	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	19
128	Bessere Nutzung der Konstruktionserfahrung	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
129	Weniger Fehler	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	1
130	Schnellere Zeichnungserstellung	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	1
131	Kürzere Durchlaufzeiten eines Konstruktionsauftrages	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
132	Zusätzliches Potenzial für Kreative Tätigkeiten	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
133	Genauere Fertigungsplanung, -steuerung,-überwachung	2	Operations	Intangible	Management process	Immediate impacts	Positive	10
134	Bessere Fertigungsqualität	2	Operations	Intangible	Management process	Immediate impacts	Positive	6
135	Bessere Materialdisposition	2	Operations	Intangible	Management process	Immediate impacts	Positive	6
136	Bessere Anlagenpflege/ Instandhaltung	2	Operations	Intangible	Management process	Immediate impacts	Positive	7
137	Weniger Rüst-, Warte, Stör-, Prüfzeiten	2	Operations	Tangible	Operational process	Immediate impacts	Positive	6
138	Höhere Fertigungsausfallsicherheit	2	Operations	Intangible	Management process	Immediate impacts	Positive	6
139	Bessere Kapazitätsauslastung	2	Operations	Intangible	Management process	Immediate impacts	Positive	6
140	Kürzere Durchlaufzeiten	2	Operations	Tangible	Operational process	Immediate impacts	Positive	6
141	Geringere Fertigungsauftragsbestände	2	Operations	Tangible	Operational process	Immediate impacts	Positive	6
142	Weniger Zwischenlagerbestände	2	Operations	Tangible	Operational process	Immediate impacts	Positive	2
143	Geringere Kapitalbindung	2	Operations	Tangible	Operational process	Immediate impacts	Positive	6
144	Genauere Lagerbestandsführung/ Materialdisposition	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
145	Geringeres Veralterungsrisiko	2	Logistics	Intangible	Management process	Immediate impacts	Positive	10
146	Geringere Inventrudifferenzen	2	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
147	Bessere Lieferantenauswahl	2	Logistics	Intangible	Management process	Immediate impacts	Positive	13
148	Schnellere materialbeschaffung	2	Logistics	Tangible	Operational process	Immediate impacts	Positive	5
149	Bessere Nutzung von Einkaufschancen	2	Logistics	Intangible	Management process	Anticipated impacts	Positive	10
150	Geringerer Lagerbestand/Sicherheitsbestand	2	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
151	Besserer Materialfluss	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
152	Weniger fehlerhaftes Material	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
153	Bessere Wareneingangskontrolle	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
154	Höherer Lagerumschlag	2	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
155	Bessere Nutzung des Lagerraums	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
156	Geringere Kapitalbindung	2	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
157	Genauere Absatzplanung, -steuerung, - überwachung	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	30
158	Genauere Marktanalysen	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	28
159	Bessere Verköufereinsatzsteuerung	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	30

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
160	Besseres Angebot	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	27
161	Schnellere Fakturierung	2	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
162	Schnellere Angebotserstellung und Auftragsabwicklung	2	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
163	Geringerer Debitorenbestan, geringere Kapitalbindung	2	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
164	Kürzere Lieferzeite	2	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
165	Größere Termintreue, weniger Verzug	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	27
166	Höherer Umsatz	2	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
167	Höhere Lieferbereitschaft	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	27
168	Besserer Kundenservice	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	17
169	Größere Flexibilität	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	24
170	Bessere Wettbewerbsposition/ Konkurrenzfähigkeit	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	28
171	Genauere und bessere Bestellplanung, -steuerung,- überwachung	2	Procurement	Intangible	Management process	Immediate impacts	Positive	13
172	Bessere Lieferantenauswahl	2	Procurement	Intangible	Management process	Immediate impacts	Positive	13
173	Besseres Nutzen von Einkaufschancen	2	Procurement	Intangible	Management process	Anticipated impacts	Positive	5
174	Weniger Bestellformulare	2	Procurement	Tangible	Operational process	Immediate impacts	Positive	5
175	Weniger Erfassungsfehler	2	Procurement	Tangible	Operational process	Immediate impacts	Positive	5
176	Weniger fehlerhafte Bestellungen	2	Procurement	Tangible	Operational process	Immediate impacts	Positive	5
177	Bessere Bestelldisposition	2	Procurement	Intangible	Management process	Immediate impacts	Positive	5
178	Schnellere und sicherere Bestellabwicklung	2	Procurement	Intangible	Management process	Immediate impacts	Positive	5
179	Genauere und bessere Lagerbestandsführung/ -disposition	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
180	Geringerer Lagerbestand/Höherer Lagerumschlag	2	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
181	Bessere Nutzung des Lagerraums	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
182	Effizientere Lagerprozesse	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
183	Bessere Wareneingangskontrolle/ Weniger Reklamation	2	Logistics	Intangible	Management process	Immediate impacts	Positive	10
184	Höhere Verkaufs-/Lieferbereitschaft	2	Logistics	Intangible	Management process	Immediate impacts	Positive	2
185	Weniger Schwund/ Inventurdifferenz	2	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
186	Geringeres Veralterungs-/ Verderbrisiko	2	Logistics	Intangible	Management process	Immediate impacts	Positive	10
187	Geringere Kapitalbindung	2	Logistics	Intangible	Management process	Immediate impacts	Positive	10
188	Geringere Verkaufsvorbereitung	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	30
189	Schnellere und sicherere Kassenabwicklung	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	27
190	Genauere Sortimentsanalyse	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	30
191	Besserer Kundenservice	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	3
192	Besseres Angebot	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	30
193	Größere Felxibilität	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	28

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
194	Bessere Wettbewerbsposition/ Konkurrenzfähigkeit	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	28
195	Entlastung des Schalterpersonals von Routine	2	Human Resource Management	Intangible	Management process	Immediate impacts	Positive	4
196	Höhere Auskunftsbereitschaft	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	19
197	Mehr Beratungskapazität	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	27
198	Kürzere Bedienzeiten	2	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
199	Bessere beratung	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	17
200	Schnellere Schaltergeschäftsabwicklung	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	27
201	Bessere zeitliche und räumliche Versorgung von Bankkunden	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	27
202	Höhere Betriebsbereitschaft	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	14
203	Besserer Kundenservice	2	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	8
204	Bessere und aktuellere Informationen	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
205	Schnellere Kreditbereitstellung/ -abwicklung	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
206	Bessere Kreditwürdikeitsprüfung	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	1
207	Bessere kreditüberwachung	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	14
208	Bessere Anlagedisposition	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	1
209	Weniger Kreditausfälle	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	14
210	Weniger zahlungsverkehrsträger	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
211	Schnellere zahlungsabwicklung	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
212	Görßere Abwicklungssicherheit	2	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	1
213	Substitution von Zweigstellen	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
214	Mehr Dienstleistungen	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	3
215	Weniger Belastungsspitzen	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
216	Weniger Rückstände	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
217	Zusätzlicher Ertrag	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
218	Höhere Liquidität	2	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
219	Erhöhung von Markteintrittsbarrieren	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
220	Bedrohungsmiderung durch weitere Anbieter	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
221	Stärkung der Verhandlungsstärke gegenüber Lieferanten	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	13

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
222	Stärkung der Verhandlungsstärke gegenüber Abnehmern	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	28
223	Verringern Bedrohung durch Substitution	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	19
224	Entwicklung neuer Geschäftsfelder durch neue Applikationen und Produkte	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	11
225	Umsetzung strategischer Unternehmensziele	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
226	Schaffen Wettbewerbsvorteile	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
227	Infrastruktur zur langfristigen Bedarfsdeckung	3	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
228	Erhöhung der Kundenbindung	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	26
229	Reduktion von IT-Kosten	3	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
230	Verringerung von mittelbaren Geschäftsprozesskosten	3	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
231	Erhöhung finanzieller Rückflüsse	3	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	16
232	besserer Zugang zu Informationen	3	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
233	qualitativ besserer Informationsgehalt durch größere Genauigkeit, Verlässlichkeit und Verständlichkeit	3	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
234	flexiblere Informationsversorgung	3	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
235	Erfüllung von Compliance-Anforderungen	3	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
236	Minimierung IT-interner Risiken	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	9
237	Minimierung von Betriebsrisiken	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	9
238	Minimierung von Projektrisiken	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	9
239	Minimierung von Portfoliorisiken	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	9
240	Minimierung von Outsourcingrisiken	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	9
241	Schaffung langfristiger Voraussetzungen für die Erstellung bedarfsgerechter Produkte und Dienstleistungen	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
242	Schaffung von technischer Grundlagen für darauf aufbauende Projekte/Synergieeffekte	3	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
243	Erzielung zusätzlicher Wettbewerbsvorteile	4	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	12
244	Unterstützung strategischer Ziele	4	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
245	Umsetzung neuer Geschäftsmodelle	4	Technology development	Tangible	Operational process	Immediate impacts	Positive	15
246	Entwicklung neuer Geschäftsfelder	4	Technology development	Tangible	Operational process	Immediate impacts	Positive	11
247	Innovative Unterstützung von Geschäftsprozessen	4	Technology development	Tangible	Operational process	Immediate impacts	Positive	21
248	Integration neuer Funktionen	4	Technology development	Tangible	Operational process	Immediate impacts	Positive	20
249	Strategische Veränderung	4	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
250	Veränderung der Prozesse	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
251	Veränderung der Steuerungssysteme	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
252	Veränderungen der IT	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	16
253	Anpassung der Kultur	4	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
254	Effektivität und Effizienz bei der Abwicklung von Prozessen	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
255	Automatisierung von Prozessen	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
256	Erreichung des Break-Even	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
257	Reduktion von manuellen Aktivitäten	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
258	Eingabe und Veränderungs Verfolgung	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
259	Einsatz von Applikationen	4	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
260	Datenschutz und Datensicherheit	4	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
261	Business Continuity	4	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
262	learning throug the presence of IS	8	Human Resource Management	Intangible	Operational process	Anticipated impacts	Positive	22
263	enhanced awareness and recall of job related information	8	Human Resource Management	Intangible	Operational process	Anticipated impacts	Positive	22
264	enhances effectiveness in the job	8	Human Resource Management	Intangible	Operational process	Anticipated impacts	Positive	4
265	increases productivity	8	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
266	IS is cost effective	8	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
267	reduced staff costs	8	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
268	general cost reductions	8	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
269	overall productivity improvement	8	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
270	improved outcomes or outputs	8	Operations	Tangible	Operational process	Immediate impacts	Positive	6
271	increased capacity to manage a growing volume of activity	8	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	15

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
272	improved business processes	8	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
273	better positioning for e-Government/Business	8	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
274	Better decision support	9	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
275	Improved learning and/or increased knowledge of persons in the organization	9	Human Resource Management	Intangible	Management process	Immediate impacts	Positive	22
276	Improved organizational culture	9	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	15
277	Improved information and information support	9	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
278	Improved non-IT tools and machinery used to produce products and/or services	9	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	15
279	Improved strategy formulation and planning	9	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
280	Efficiency	9	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
281	Productivity	9	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
282	Cost reductions	9	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
283	Improved communication	9	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
284	Improved flow of products/services	9	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	19
285	Improved ability to control and follow up	9	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	12
286	Improved change management	9	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	15
287	Improved ability to coordinate and integrate	9	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
288	Improved ability to adapt to changes	9	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
289	Improved inblund logistics	9	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
290	Improved supplier relations	9	Procurement	Intangible	Operational process	Anticipated impacts	Positive	5
291	Improved customer relations	9	Marketing and Sales	Intangible	Operational process	Anticipated impacts	Positive	24
292	Improved lock-in effect/switching costs	9	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	15
293	Improved competitor relations	9	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
294	New products/services	9	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	20
295	Differentiations in products/services	9	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
296	Improved quality of products/services	9	Service	Intangible	Operational process	Immediate impacts	Positive	3
297	Improved delivery of products/services	9	Service	Tangible	Operational process	Immediate impacts	Positive	3

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
298	Improved relations with external parties that are neither customers, competitors nor suppliers	9	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
299	Enabling faster access to information	10	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
300	Enabling easier access to information	10	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
301	Improving information for strategic planning	10	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
302	Improving information accuracy	10	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
303	Providing information in more useable formats	10	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
304	Savings in supply chain management	10	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	2
305	Reducing operating costs	10	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	6
306	Reducing communication costs	10	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
307	Avoiding the need to increase the workforce	10	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
308	Increasing return on financial assets	10	Marketing and Sales	Tangible	Operational process	Anticipated impacts	Positive	1
309	Enhancing employee productivity	10	Human Resource Management	Tangible	Operational process	Anticipated impacts	Positive	4
310	Creating competitive advantage	10	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
311	Aligning ICT strategy with business strategy	10	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
312	Establishing useful links with other organizations	10	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
313	Enabling quicker response to change	10	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	9
314	Improving customer relations	10	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	24
315	Providing better products or services to customers	10	Marketing and Sales	Intangible	Management process	Anticipated impacts	Positive	24
316	An improved skill level for employees	10	Human Resource Management	Intangible	Management process	Anticipated impacts	Positive	22
317	Developing new business plans	10	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
318	Expanding organizational capabilities	10	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
319	Improving business models	10	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
320	Improving organizational structure/processes	10	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
321	Accelerate Business Process (Value)	11	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
322	Recapture Scale (Value)	11	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
323	Bypass Intermediaries (Value)	11	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
324	Reduce Information Float (Value)	11	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
325	Esnure Global Management Control (Value)	11	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
326	Replicate Scarece Knowledge (Value)	11	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
327	Create Service Ecellence (Value)	11	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	8
328	Penetrate New Markets (Value)	11	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
329	Build Umbilical Cords (Value)	11	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
330	Arbeitszeiteinsparung	12	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	29
331	Schnellere Reaktionsmöglichkeiten	12	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
332	Bessere Entscheidungsgrundlagen	12	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
333	Verbesserung der Prozessqualität	12	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
334	Verringerung des Raumbedarfs	12	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
335	Verringerung des Materialbedarfs	12	Procurement	Tangible	Operational process	Immediate impacts	Positive	6
336	Verbesserung der Produktqualität	12	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	7
337	Erschließung neuer Märkte	12	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
338	Erhöhung der Kundenbindung	12	Marketing and Sales	Intangible	Management process	Anticipated impacts	Positive	24
339	Verbesserung der Datensicherheit	12	Technology Development	Intangible	Management process	Immediate impacts	Positive	20
340	Steigerung der Systemstabilität	12	Technology Development	Intangible	Management process	Immediate impacts	Positive	20
341	Senkung von Wartungskosten	12	Technology Development	Tangible	Operational process	Anticipated impacts	Positive	21
342	verminderte Auszahlungen an externe Geschäftspartner	14	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	16
343	Reduktion interner Ressourcenverbräuche	14	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	1
344	Erhöhung der Systemverfügbarkeit	14	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
345	Schnellere Rechnungsstellung	14	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	27
346	Beschleunigung von Produktionsabläufen	14	Operations	Tangible	Operational process	Immediate impacts	Positive	6
347	Kundenbindung	14	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	24
348	Verbesserung der Marktposition	14	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
349	Einhaltung gesetzlicher Vorschriften	14	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
350	Enhance competiveness or create strategic advantages	17	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
351	Enable the organization to catch up with competitors	17	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
352	Align well with stated organizational goals	17	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
353	Help establish useful linkages with other organizations	17	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
354	Enable the organization to respond more quickly to change	17	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
355	Improve customer relations	17	Marketing and Sales	Intangible	Operational process	Anticipated impacts	Positive	24
356	Provide new products or services to customers	17	Service	Tangible	Operational process	Immediate impacts	Positive	26
357	provide better products or services to customers	17	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	20
358	Enable faster retrieval or delivery of information or reports	17	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	9
359	Enable easier access to information	17	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	9
360	Improve management information for strategic planing	17	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
361	Improve the accuracy or reliablitity of information	17	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
362	Improve information for operational control	17	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
363	Present information in a more concise manner or better format	17	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
364	Increase the flexibility of information requests	17	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
365	Save money by reducing travel costs.	17	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
366	Save money by reducing communication costs	17	Technology development	Tangible	Operational process	Immediate impacts	Positive	20
367	Save money by reducing system modification or enhancement costs.	17	Technology development	Tangible	Operational process	Immediate impacts	Positive	20
368	Allow other applications to be developed faster	17	Technology development	Tangible	Operational process	Immediate impacts	Positive	21
369	Allow previously infeasible applications to be implemented	17	Technology development	Intangible	Operational process	Immediate impacts	Positive	21
370	Provide the ability to perform maintenance faster	17	Technology development	Tangible	Operational process	Immediate impacts	Positive	20
371	Save money by avoiding the need to increase the work force	17	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
372	Speed up transactions or shorten product cycles	17	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	1
373	Increase return on financial assets	17	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
374	Enhance employee productivity or business efficiency	17	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	4
375	Labor cost reduction	18	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	1
376	Reliability	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
377	Throughput	18	Operations	Tangible	Operational process	Immediate impacts	Positive	6
378	Inventory cost reduction	18	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
379	Efficiency	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	6
380	Administrative expenses reduction	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
381	Control	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	19
382	Reporting	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	14
383	Routinization	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	15
384	Utilization	18	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	1
385	Wastage	18	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	1
386	Operational flexibility	18	Operations	Intangible	Management process	Immediate impacts	Positive	7
387	Responsiveness	18	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	19
388	Quality improvement	18	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	15
389	Effectiveness	18	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	1
390	Decision quality	18	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
391	Recource usage	18	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	1
392	Empowerment	18	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
393	Creativity	18	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	23
394	Product and service innovation	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	21
395	Cycle time reduction	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	21
396	Customer relationships	18	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	24
397	Competetive flexibility	18	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	18
398	Competetive capability	18	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	15
399	Organizational form	18	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	12
400	Inventory Reduction	19	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
401	Personnel Reduction	19	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
402	Productivity Improvements	19	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
403	Order Management Improvements	19	Procurement	Tangible	Operational process	Immediate impacts	Positive	5

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
404	Financial Close Cycle Reduction	19	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
405	IT Cost Reduction	19	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
406	Procurement Cost Reduction	19	Procurement	Tangible	Operational process	Immediate impacts	Positive	5
407	Cash Management Improvement	19	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
408	Revenue/Profit Increases	19	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
409	Transportation/Logistics Cost Reductions	19	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
410	Maintenance Reductions	19	Service	Tangible	Operational process	Immediate impacts	Positive	3
411	On-Time Delivery	19	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
412	Information Access/Visibility	19	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
413	New Improved Processes	19	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
414	Customer Responsiveness	19	Marketing and Sales	Tangible	Operational process	Anticipated impacts	Positive	26
415	Cost Reduction	19	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
416	Integration	19	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
417	Standardization	19	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	15
418	Flexibility	19	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
419	Globalization	19	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
420	Y2K	19	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
421	Business Performance	19	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
422	Supply/Demand Chain	19	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
423	Acquisitions	19	Marketing and Sales	Intangible	Operational process	Anticipated impacts	Positive	19
424	New Reports/Reporting Capability	19	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
425	Sales Automation	19	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
426	Change Business Model/-Competitive Advantage	19	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
427	Growth	19	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	16
428	Financial Controls	19	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
429	Better Decisions	19	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
430	Leverage Size	19	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	16

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
431	Increased Time for Analysis	19	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	14
432	No Redundant Data Entry	19	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	1
433	Reduce Training with Transfer	19	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	1
434	Speed	19	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	1
435	Cost savings	20	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
436	Cost avoidance	20	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	1
437	Mandatory information needs	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
438	Information processing efficiency	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
439	Improved asset utilization	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
440	Improved resource control	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
441	Incrcased accuracy in clerical operations	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
442	More timely information (providing early wamings of change in thc environment)	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
443	Improved organ:zational planning (making the organization more adaptive to change)	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
444	Increased organizational flexibility (allowing the organization to changc more quickly)	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
445	Promotion of organizational leaming and understanding (improving the organizational skills required to successfully initiate change)	20	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	19
446	Availability of new, better or more information (providing opportunity to compete morc effectively)	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
447	Ability to investigate an increased number of alternatives (increasing the ability to make the best decision among alternatives)	20	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
448	Faster decision-making (creating competitive advantage through timely action)	20	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	9
449	Altering the product life cycle	21	Technology Development	Intangible	Management process	Anticipated impacts	Positive	21
450	Íncreasing the speed of distribution	21	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	2
451	Computer-literate consumers	21	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	18
452	Businesses demanding electronically based products and services	21	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	20

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
453	Elimination of geographic market limitations ->obligation to compete in a global markets	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
454	Ability to serve a national market ->breaking the industry pattern of regional distribution	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
455	Enhanced economies of scale	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
456	Changed relationship between an industry and ist buyers	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
457	Changed relationship between an industry and its suppliers	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
458	Change level of sophistication	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
459	Speeded up by product life cycle by shortening the development process	21	Technology Development	Tangible	Operational process	Anticipated impacts	Positive	21
460	Negating existing entry barriers	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
461	Creating new entry barriers	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
462	IT as a new competetive weapon	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	21
463	Cost reductions	21	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
464	Waste reductions	21	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
465	Imporved productivity	21	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	1
466	Identifying marginal customers	21	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
467	Contribute to superior customer service	21	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	8
468	Contribute to high quality	21	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	7
469	Creating better product designs	21	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	20
470	Providing access to markets	21	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
471	Concentration on market or product niche	21	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
472	Ermöglicht neuartige Abläufe	22	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
473	Reduktion der Mitarbeiterzahl	22	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
474	Vermehrte Information über einzelne Geschäftsprozesse	22	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
475	Erhöhung des Informationspotenziales der Mitarbeiter	22	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
476	Zurverfügungstellung von Wissen und Erfahrungen	22	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	9

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
477	Gleichzeitiges Durchführen von zeitlich und/oder räumlich getrennter aufgaben	22	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
478	Zeitliche und räumliche Trennung von zentralisierten Aufgaben	22	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
479	Reduktion der Durchlaufzeiten	22	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
480	Unterstützung funktionaler Arbeitsteilung	22	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
481	Einbindung externer Unternehmen in die Geschäftsprozesse	22	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
482	Easier decision making for buyers due to improved evaluation of sources of materials	24	Procurement	Intangible	Management process	Immediate impacts	Positive	28
483	Raising barriers to entry due to large investments being required	24	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
484	Quicker, easier, and cheaper incorporation of enhanced features into products	24	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	20
485	Cost reductions	24	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
486	Enhanced differentiation	24	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
487	Changed competitive scope	24	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
488	Making new businesses technologically feasible	24	Technology Development	Intangible	Management process	Anticipated impacts	Positive	21
489	Creating derived demand for new products	24	cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	21
490	Creates new businesses within old ones	24	cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
491	Selling information that is a by-product of operations	24	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	19
492	Accelerate user tasks (Value Creation)	25	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
493	Improve scale to look large (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
494	Alter role of intermediaries (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
495	Make use of extensive user feedback (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
496	Automate tasks using software agents (Value Creation)	25	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
497	Eliminate information float (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
498	Present single gateway access (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
499	Engage in micromarketing to look small (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
500	User controls detail of information accessed (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
501	Provide online decision support tools (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
502	Establish 24 × 7 customer service (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	8
503	Achieve global presence (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
504	Create dependency to lock-in user (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
505	Users interact via on-line community (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
506	Bundle information, products, and services (Value Creation)	25	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
507	Direkte Investitionskosten	28	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Negative	25
508	Indirekte Investitionskosten	28	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Negative	25
509	Optimierung von Führungsprozessen hinsichtlich Kosten, Zeit und Qualität	28	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	16
510	Optimierung von Ausführungsprozessen hinsichtlich Kosten, Zeit und Qualität	28	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	16
511	Optimierung der in der Supply Chain gebundenen Materialien und Produkte	28	Procurement	Tangible	Operational process	Immediate impacts	Positive	5
512	Optimierung der Kapazitätsnutzung	28	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	6
513	Reduktion der Kosten der Leistungserstellung	28	Operations	Tangible	Operational process	Immediate impacts	Positive	6
514	Verbesserung der Leistungsqualität	28	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	19
515	Schaffung neuer Leistungsfelder	28	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	15
516	Effizientere Gestaltung der Koordination zwischen Supply Chain-Gliedern	28	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	15
517	Auswirkungen auf Fähigkeiten („Können")	28	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	22
518	Auskunftsfähigkeit	28	Service	Intangible	Operational process	Immediate impacts	Positive	8
519	Kundenbindung	28	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	24
520	Imagewirkung	28	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	24
521	Umsetzung Wettbewerbsstrategie	28	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	12
522	Schaffen oder Auflösen von Eintrittsbarrieren	28	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
523	Veränderung des Geschäftsmodells	28	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	12
524	Kostenvermeidung	29	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	1
525	Kostenreduktion	29	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
526	Kostenverschiebung	29	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
527	Änderungen am einzelnen Arbeitsplatz	29	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	29
528	Änderung bei der Abwicklung von Arbeitsprozessen	29	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
529	Änderlung der Leistungsqualität	29	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
530	Änderlung der Leistungsflexibilität	29	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
531	Änderungen der Entscheidungsqualität	29	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
532	Änderungen der Entscheidungsflexibilität	29	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
533	Ertragssteigerungen durch Produktdlfferenzlerung	29	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	16
534	Ausweitung der Geschäftstätigkeit	29	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
535	Geringere Lagerbestände	29	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
536	Schnellere Informationsverfügbarkeit mit kürzeren Reaktionszeiten	29	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
537	Einfachere Datenverfügbarkeit durch Standardisierung des Datenaustausches	29	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
538	Verlagerung von Aufgaben zu Kunden oder Lieferanten	29	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
539	Bessere Aufgabenkoordination und -kontrolle durch vertikale Integration	29	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	15
540	Prüfung des Auftragsstatus durch den Kunden	29	Service	Intangible	Operational process	Immediate impacts	Positive	8
541	Elektronische Unterstützung von Cross-Selling-Maßnahmen	29	Marketing and Sales	Intangible	Operational process	Immediate impacts	Positive	17
542	Schnellerer und kostengünstigerer Austausch von Verkaufs- und Serviceinformatlonen	29	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	27
543	größere Kapazität des Vertriebs durch den Einsatz elektronischer Medien	29	Marketing and Sales	Intangible	Operational process	Immediate impacts	Positive	17
544	Verkürzen von Distributionskanälen durch Ausschalten von Zwischenhändlern	29	Marketing and Sales	Tangible	Operational process	Anticipated impacts	Positive	26
545	Erschließen neuer Absatzgebiete mit Hilfe von Bestellsystemen	29	Marketing and Sales	Intangible	Operational process	Anticipated impacts	Positive	26
546	Verbesserte Planung durch genauere Auftragsinformationen	29	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	28
547	Schnellere und kostengünstigere Informationen über den Erfolg von Marketingmaßnahmen	29	Marketing and Sales	Tangible	Management process	Immediate impacts	Positive	30
548	Besseres Customizing von Kundenangeboten durch Speichern von Kundenwünschen	29	Marketing and Sales	Intangible	Operational process	Anticipated impacts	Positive	24
549	Einfacheres Überprüfen des Bestellverhaltens der Kunden	29	Marketing and Sales	Intangible	Operational process	Immediate impacts	Positive	17
550	Elektronische Auslieferung von Produkten	29	Logistics	Tangible	Operational process	Immediate impacts	Positive	2

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
551	Interne Nutzeffekte in indirekten Bereichen	29	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
552	Reduzierte Auftragsvorlaufzelten	29	Operations	Tangible	Operational process	Immediate impacts	Positive	6
553	Reduktion des Lagerbestandes,	29	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
554	Reduzierung von Fehlern bei der Übermittlung von Auftragsdaten	29	Marketing and Sales	Intangible	Operational process	Immediate impacts	Positive	1
555	Verfügbarkeit außerhalb der Geschäftszeiten	29	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
556	DV-Systeme erzeugen Eintrittsbarrieren	29	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
557	Aufwand für den Nutzer durch Hard- und Softwarewechsel sowie Schulungskosten bei Wahl eines anderen Systems,	29	Human Resource Management	Tangible	Operational process	Immediate impacts	Negative	29
558	Veränderungen des Anforderungsprofils für das Personal, falls die automatisierte Abwicklung durch ein personelles Vorgehen ersetzt wird	29	Human Resource Management	Intangible	Operational process	Immediate impacts	Negative	22
559	einfachere oder kostengünstigere Produktauswahl, Bestellung, Auslieferung sowie Zahlungsabwicklung	29	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	19
560	Verbesserung des Images	29	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	24
561	Höherer Kunden-Service	29	Marketing and Sales	Intangible	Operational process	Immediate impacts	Positive	8
562	Sofortige Informationen über Preise und Produktverfügbarkeit	29	Marketing and Sales	Intangible	Operational process	Immediate impacts	Positive	27
563	Reduzierte Lagerbestände aufgrund schnellerer Reaktionszeiten	29	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
564	Senken von Kosten zur Produkt-/Leistungsauswahl	29	Procurement	Tangible	Operational process	Immediate impacts	Positive	27
565	Automatischer Vorschlag von alternativen Produktvarianten/Leistungen	29	Procurement	Intangible	Operational process	Immediate impacts	Positive	27
566	Einfaches Auflinden des günstigsten Angebots	29	Procurement	Intangible	Operational process	Immediate impacts	Positive	27
567	Gestaltung von Rabattstaffeln	29	Procurement	Tangible	Operational process	Immediate impacts	Positive	27
568	Labor cost reduction	30	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	1
569	Inventory cost reduction	30	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
570	Administrative expenses reduction	30	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
571	Customer support activities	30	Service	Tangible	Operational process	Immediate impacts	Positive	3
572	Employee support activities	30	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
573	Supplier support activities	30	Procurement	Tangible	Operational process	Immediate impacts	Positive	5
574	Productivity improvement	30	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	6
575	Quality improvement	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	7
576	Customer services improvement	30	Service	Tangible	Operational process	Immediate impacts	Positive	8

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
577	Better asset management	30	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
578	Better inventory management	30	Logistics	Intangible	Management process	Immediate impacts	Positive	10
579	Better production management	30	Operations	Intangible	Management process	Immediate impacts	Positive	10
580	Better workforce management	30	Human Resource Management	Intangible	Management process	Immediate impacts	Positive	11
581	Improved strategic decisions	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
582	Improved operational decisions	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	10
583	Improved customer decisions	30	Service	Intangible	Management process	Anticipated impacts	Positive	13
584	Financial performance	30	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	14
585	Manufacturing performance	30	Operations	Tangible	Operational process	Immediate impacts	Positive	6
586	Overall operation efficiency and effectiveness	30	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
587	Business growth in transaction volume, processing capacity and capability	30	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	14
588	Business growth with new business products or services, new divisions, or new functions in different regions	30	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	14
589	Business growth with increased employees, new policies and procedures	30	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	11
590	Business growth in new markets	30	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	14
591	Business growth with industry's rapid changes in competition, regulation and markets	30	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	12
592	Enable new market strategy	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
593	Build new process chain	30	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	15
594	Create new business	30	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	12
595	Build cost leadership	30	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	16
596	Providing customized product or services	30	Service	Tangible	Operational process	Immediate impacts	Positive	8
597	Providing lean production	30	Operations	Tangible	Operational process	Immediate impacts	Positive	7
598	Build external linkage	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
599	Centralized world operation	30	Operations	Tangible	Operational process	Immediate impacts	Positive	7
600	Global resource management	30	Operations	Tangible	Operational process	Immediate impacts	Positive	15
601	Multi-currency capability	30	Marketing and Sales	Tangible	Operational process	Immediate impacts	Positive	17
602	Global market penetration	30	Cross-Organizational-Activities	Tangible	Management process	Anticipated impacts	Positive	18
603	Deploy solution quickly and cost effectively across worldwide	30	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	19

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
604	Interactive customer service	30	Service	Intangible	Operational process	Immediate impacts	Positive	8
605	Improved product design	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	20
606	Expanding to new E-market	30	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	18
607	Building virtual corporation	30	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	15
608	Deliver customized service	30	Service	Intangible	Operational process	Immediate impacts	Positive	8
609	Provide real time and reliable data enquiries	30	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
610	Increased business flexibility	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	15
611	Legacy system integration and maintenance	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	20
612	Mainframe or hardware replacing	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	20
613	IT expense and staff for developing and maintaining the system	30	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
614	Year 2000 compliance upgrade	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	1
615	System architecture design and development	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	21
616	System modification and maintenance	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	20
617	Disparate information reconciliation and consolidation	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	21
618	Technology R&D	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	21
619	Streamlined and standardized platform	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	15
620	Global platform with global knowledge pipeline	30	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	15
621	Database performance and integrity	30	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
622	IS management transformation and increased IS resource capability	30	Cross-Organizational-Activities	Tangible	Management process	Immediate impacts	Positive	15
623	Continuous improvement in system process and technology	30	Technology development	Tangible	Operational process	Immediate impacts	Positive	21
624	Global maintenance support	30	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	3
625	Modern technology adaptability	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
626	Extendable to external parties	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
627	Expandable to a range of applications	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
628	Comparable with different systems	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
629	Customizable and configurability	30	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	15
630	Support business organizational changes	30	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	15
631	Learned by entire workforce	30	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	22

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
632	Shorten learning time	30	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	22
633	Broaden employees' skill	30	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	22
634	Accountability, more value-added responsibility	30	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	23
635	More pro-active users in problem solving	30	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	22
636	Work autonomously	30	Human Resource Management	Intangible	Operational process	Immediate impacts	Positive	22
637	Users have ownership of this system	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	23
638	Middle management are no longer doers but planners	30	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	23
639	Greater employee involvement in business management	30	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	23
640	Efficient interpersonal communication	30	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	23
641	Interdisciplinary thinking, coordinate and harmonize differences, and interdepartmental processes	30	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	23
642	Consistent vision across different levels of organization	30	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	12
643	More critical managing and planning matters	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	12
644	More concentration on core work	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	15
645	Customer and market focus	30	Cross-Organizational-Activities	Intangible	Operational process	Anticipated impacts	Positive	15
646	Move from back office to the front office	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	15
647	Increased employee satisfaction with better decision making tools	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	23
648	Increased employee efficiency of field operations and services	30	Operations	Intangible	Operational process	Immediate impacts	Positive	23
649	Satisfied users for solving problems efficiently	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	23
650	Built morale with better system performance	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	23
651	Satisfied employees for better employee service	30	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	23
652	Higher turnover inventory	31	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
653	Decreased collect period	31	Logistics	Tangible	Operational process	Immediate impacts	Positive	2
654	Shortening of production-cycle time	31	Operations	Tangible	Operational process	Immediate impacts	Positive	6
655	Better use of fixed assets	31	Operations	Tangible	Operational process	Immediate impacts	Positive	1
656	Cost reduction in the area of raw materials	31	Procurement	Tangible	Operational process	Immediate impacts	Positive	5
657	Reduction of personal cost	31	Human Resource Management	Tangible	Operational process	Immediate impacts	Positive	4
658	Better service to customers	31	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	8

Table 6.4 continued from previous page

Impact ID	Impact	Catalog ID	Business Unit	Tangibility	Performance focus	Time of occurence	Direction	Cluster ID
659	Better marketing information	31	Marketing and Sales	Intangible	Management process	Immediate impacts	Positive	28
660	Smoother work flow	31	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	19
661	Higher degree of standardization of operations	31	Cross-Organizational-Activities	Intangible	Operational process	Immediate impacts	Positive	7
662	Important information becomes more quickly available	31	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
663	Information is of better quality	31	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
664	Information is more adequately distributed over different organizational units	31	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
665	Exception reporting	31	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
666	Standardization of clerical and administrative procedures	31	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
667	Business integration	32	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
668	Business flexibility	32	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
669	Reduced marginal cost of business unit´s IT	32	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
670	Reduced IT costs over time	32	Cross-Organizational-Activities	Tangible	Operational process	Anticipated impacts	Positive	16
671	Standardization	32	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	15
672	Cut costs	32	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
673	Increased throughput	32	Cross-Organizational-Activities	Tangible	Operational process	Immediate impacts	Positive	1
674	Increased sales	32	Marketing and Sales	Tangible	Operational process	Anticipated impacts	Positive	26
675	Competitive Advantage	32	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
676	Competitive necessity	32	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	18
677	Market positioning	32	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	12
678	Innovative services	32	Cross-Organizational-Activities	Intangible	Management process	Anticipated impacts	Positive	21
679	Increased control	32	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
680	Better information	32	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9
681	Better integration	32	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	19
682	Improved quality	32	Cross-Organizational-Activities	Intangible	Management process	Immediate impacts	Positive	9

Table 6.4: Detailed Result of the Coded IT Impacts

6.7.3 Coding Manual

The coding manual was provided for the coders in order to create a common understanding among the coders. The coding manual contains the explanations of the dimensions as well as the individual characteristics of the taxonomy into which the IT impacts should be categorized. In addition to the coding manual, the IT impact taxonomy was provided to them.

Business Function

The characteristics are based on the value chain according to Porter (2001b) which disaggregates a firm in strategically relevant activities. The activities must be cheaper or better than those of competitors in order to have an advantage. The generic value chain consists of the primary activities: Inbound Logistics, Operations, Outbound Logistics, Marketing & Sales and Service. The support activities are: Firm Infrastructure, Human Resource Management, Technology Development and Procurement. This division is established in literature (Porter 2001b) and is therefore used here. Below are Porter (2001b)'s detailed explanations.

- **Logistics:** Originally divided in inbound and outbound logistics by Porter (2001b), under logistics we comprise all activities associated with receiving, storing, and disseminating inputs to the product (e.g. material handling, warehousing) and with collecting, storing, and physically distributing the product to buyers (e.g. finished goods processing, and scheduling).
- **Operations:** Activities associated with transforming inputs into the final product such as machining, packaging, assembly, equipment maintenance, testing, printing, and facility operations. Due to Porter (2001b) originally being focused on industrial enterprises, thus mainly physical goods, we retrospectively also assigned the creation of services to this activity in order represent today's business environment. Therefore, this activity refers to both, the production of physical goods and services.
- **Marketing and Sales:** Activities associated with providing a means by which buyers can purchase the product and inducing them to do so, such as advertising, promotion, sales force, quoting, channel selection, and pricing.
- **Service:** Activities associated with providing service to enhance or maintain the value of the product, such as installation, repair, training, parts supply, and product adjustment. Thus, this activity contains the delivery of services created by operations, and services accompanying physical physical goods.
- **Procurement:** Procurement refers to the function of purchasing inputs used in the firm's value chain, not to the purchased inputs themselves.

- **Technology Development:** Technology development consists of a range of activities that can be broadly grouped into efforts to improve the product or service and related process (e.g. R&D or providing new technological capabilities).
- **Human Resource Management:** Human Resource Management consists of activities involved in the recruiting, hiring, training, development, and compensation of all types of personnel (e.g. staff development, skills, etc.).
- **Cross-Organizational-Activities:** Those activities include general management, planning, finance, accounting, legal, governance affairs, and quality management which usually supports the entire chain and not individual activities.

Tangibility
The Tangibility of an IS impact is concerned with the extend to which it can be measured and evaluated in economic terms (Lucas 1999). The literature generally distinguishes between tangible and intangible impacts.

- **Tangible Impacts:** Those impacts represent a classical investment decision that can be quantified economically. For example determining the ROI of the IS impact (Mirani and Lederer 1998). Recourse reductions and job savings constitute typical, tangible impacts of an IS (Kütz 2013).
- **Intangible Impacts:** Intangible impacts on the other hand are very hard to quantify, oftentimes not allowing for such economic evaluations (Lucas 1999). Thus, a qualitative assessment of the impact is necessary, e.g. conducting a cost-benefit-analysis (Kesten et al. 2007). Those impacts are usually indirect, representing consequential effects of other benefits (Mirani and Lederer 1998). Examples are increasing customer loyalty or improving the market position through the use of the IS (Kütz 2013).

Level of Examination
A widespread distinction is the individual level, the firm level and the industry level (Bakos 1987; Brynjolfsson and Yang 1996; Chau et al. 2007; Devaraj and Kohli 2000; Kauffman and Weill 1989). We are following this view, especially since this distinction plays an important role in explaining the productivity paradox.

- **Individual Level:** Effects of the IS affecting employees on an individual level, such as improving skills or increasing the employee's satisfaction.
- **Firm Level:** IS effects which have an influence on the whole organization. For example, process improvements or new/increased organizational performance. This level of examination also refers to the value chain of the organization, thus customer and supplier related activities/processes.

- **Industry Level:** The industry level contains IS effects going beyond the organization and its value chain, e.g. on the entire industry or the national economy.

Performance Focus

Already the definition of IT Business Value makes it clear that organizational performance is a central aspect, which should also be taken into account when identifying impacts. We can distinguish between operational process performance and management process performance.

- **Operational Process Performance:** Operation process performance is usually created by tangible effects of the IS. They represent automatizations of activities or processes which constitute the regular day-to-day business, thus affecting the performance of the organization. However, they also oftentimes form the basis for intangible impacts that build on them (Mooney et al. 1996).
- **Management Process Performance:** Impacts enabling management process performance increases the availability and quality of information, allowing for better coordination, control and a decision making by the management. They usually constitute intangible benefits, e.g. increasing the organizations capabilities, enabling innovations and transforming the business (Mooney et al. 1996).

Time of Occurrence

Information systems produce a (potentially continuous) stream of net benefits. Conducting an a priori assessment of the impact of the IS at the time of the investment decision, the impacts until and exploitable immediately at the go-live of the IS can be determined and probable future impacts, by accessing the quality of the IS as a proxy measure, can be anticipated (Gable et al. 2008).

- **Immediate Impacts:** Net benefits/impacts of the IS can be exploited immediately at/after go-live of the system (looking backwards). Examples are cost reductions and rationalizations which are made possible using the IS (Schulze 2010).
- **Anticipated Impacts:** Continuous flow of benefits in the future. The potential of the IS can only be (fully) exploited in the future. The IS constitutes a long-term investment dependent on its “quality” (e.g. integration or usability), looking “forward” (Gable et al. 2008). Examples for those anticipated impacts, materializing delayed to the go-live of the IS, are improved customer relations or the creation of market entry barriers (Schulze 2010).

Direction

Investments in IS do not only provide positive effects to the organisation. In order to assess the overall benefits of an IS, it is necessary to compare the benefits achieved or anticipated with the negative effects of the system (Schumann 1992).

- **Positive:** Due to most sources focussing on the benefits of IS, our presupposition is to regard impacts as positive, if a negative character of an impact is not explicitly stated. Positive impacts have contributed to an overall corporate objective, to justify the IS investment (Schulze 2010).
- **Negative:** The implementation and the operation of an IS causes direct (one-time) and indirect (ongoing) costs for the organization (Schulze 2010). Direct costs are for example the acquisition costs for the hardware or initial trainings, while maintenance and software licences constitute indirect costs (Anselstetter 1984). Those costs are relatively easy to quantify monetarily (Schulze 2010). However, IS oftentimes also cause negative effects, such as an increased system dependence or low system acceptance by its users, which cannot be quantified monetarily (Anselstetter 1984).

6.7.4 Derived Clusters and their Focus Areas

Table 6.5 contains the identified clusters with the number of associated impacts. Based on these, the focus of these clusters could be determined in a further step. The clusters are based on the content of the business units of a company. Finally, cluster names were assigned, which were then used in the paper for reasons of clarity. The table is sorted according to the cluster names.

Cluster ID	Number of impacts	Focus	Business Unit	Cluster Name
1	109	Operational time and cost savings at firm-level	Cross-Organizational-Activities	COA 1
9	62	Immediate improvements in management process	Cross-Organizational-Activities	COA 2
11	6	Development of new business fields	Cross-Organizational-Activities	COA 3
12	63	Improved market positioning of the company	Cross-Organizational-Activities	COA 4
14	11	Improved corporate growth (and reporting)	Cross-Organizational-Activities	COA 5
15	54	Increased flexibility to adapt to future changes	Cross-Organizational-Activities	COA 6
16	11	Growth management	Cross-Organizational-Activities	COA 7
18	16	Creating/defending competitive advantages	Cross-Organizational-Activities	COA 8
19	66	Improved integration and information flow	Cross-Organizational-Activities	COA 9
23	12	Improved employee satisfaction and performance	Cross-Organizational-Activities	COA 10
25	12	IT-Investment costs	Cross-Organizational-Activities	COA 11
29	5	Time savings in daily business operations	Cross-Organizational-Activities	COA 12

Table 6.5 continued from previous page

Cluster ID	Number of impacts	Focus	Business Unit	Cluster Name
4	18	Staff reductions	Human Resource Management	HR 1
22	17	Improving employee skills	Human Resource Management	HR 2
2	32	Reduced inventory and better inventory management	Logistic	Log 1
10	9	Improved inventory control	Logistic	Log 2
8[96]	14	Improved customer service	Marketing and Sales	Ser 1
17	8	Improved Marketing & Sales capabilities	Marketing and Sales	M&S 1
24	12	Improved customer retention	Marketing and Sales	M&S 2
26	7	Increased Sales	Marketing and Sales	M&S 3
27	23	Time savings in Marketing & Sales and product delivery	Marketing and Sales	M&S 4
28	10	Leveraging marketing and sales capabilities as competitive advantages	Marketing and Sales	M&S 5
30	6	Improved sales management	Marketing and Sales	M&S 6
6	27	Improved production processes	Operations	Ops 1
7	8	Improved product and production quality	Operations	Ops 2
5	15	More efficient procurement of materials	Procurement	Proc 1
13	6	Strengthening the companies position towards suppliers	Procurement	Proc 2
3	9	Improved quality and delivery of customer services	Service	Ser 1
20	18	Improved IT-Infrastructure support	Technology Development	TD 1
21	16	Improved R&D and Life Cycles	Technology Development	TD 2

Table 6.5: Derived Clusters and their Focus Areas

96 Cluster 8 and cluster 3 were combined into one cluster due to similarities in their content.

7 Paper III: Towards a Reference Value Catalog for a Company-Specific Assessment of the IT Business Value - Proposing a Taxonomy to Select IT Impacts from Existing Catalogs

Abstract

Despite a general agreement on the business value of information technology (IT), the determination of the link between organizational performance and IT investments is still a challenge. Organizations worldwide heavily invest in IT without evidence of productivity improvements. We propose value catalogs as a starting point for the identification of IT business value in an organization. Since the values vary depending on the organizational context, a company-specific value catalog is necessary. To avoid the repeated development of a catalog for each new IT investment, a company-specific reference value catalog is required. Applying a design science research method, we identified four steps to develop this reference value catalog: catalog selection, impact selection, hierarchy establishment, and quantification determination. In this paper, we focus on the first step, which resembles the rigor cycle, and develop a taxonomy for 32 existing IT value catalogs, which form the basis for the next three steps.

Keywords: IT Business Value, IT Investments, Reference Value Catalog, Taxonomy, DSR

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7.1 Introduction

IT business value can be defined as the impact of information technology (IT) on organizational performance (Mooney et al. 1996; Devaraj and Kohli 2003; Melville et al. 2004), which is widely established in the literature (Pathak et al. 2019). Although there is general agreement about what an IT business value can be and the topic has been discussed for many years in the information systems (IS) discipline, "the relation between IT investments and firm performance remain elusive" (Masli et al. 2011). It is still unclear what the returns and concrete values generated by IT investments are (Pathak et al. 2019; Wang et al. 2012). For this reason, determining the value contribution of IT is difficult. In this paper, we use the term value to describe the monetary assessment of an impact. An impact in turn describes – depending on the method used – an observation, measurement, or interview with employees for actual or expected changes caused by a new or modified IT system compared with the initial situation (Schütte et al. 2019). Hence, observing the impacts of IT systems is a prerequisite for determining their value. As values can also become apparent after years, they are not taken into consideration at the beginning, which then leads to an incorrect determination of the overall value of the IT system. This time delay was also discussed in the 1990s under the term "productivity paradox". Nowadays, the opinion has become accepted that IT generally has a positive influence on company productivity (Brynjolfsson and Hitt 2003). Many authors have addressed the topic during this time and have also targeted software tools to support the research (Kesten et al. 2007; Schubert 2013), but it seems that the research has stalled without providing such artifacts to determine IT's contribution to business goals. Schütte et al. (2019) call for a formalized process. Although the problem still exists that the variance in the return (positive and negative) on IT investments is still high and the IT business value is therefore still difficult to predict, huge portions of organizational budgets are invested in IT.

Despite the corona virus pandemic, global IT spending was about $3.4 trillion in 2020 (Gartner 2020), and it can be assumed that IT budgets will increase over the next few years. Irrespective of so much investment, it is still the case that IT projects do not achieve the desired results and are therefore seen as failures. One reason for this may be that there is an unclear, incomplete, or incorrect idea of the value contribution of IT investment in management (Wiese 1998). Therefore, it remains unclear whether and to what extent IT investment contributes to overall business objectives. This knowledge can then also serve as a basis for deciding whether an IT investment should be made at all and is therefore a key issue for goal-oriented IT management (Schütte et al. 2019).

We propose value catalogs as an important starting point for the identification of IT business value in a specific organization. A value catalog is a reference list of values and pre-economic impacts that can be associated with the use of IT systems (Schütte et al. 2019). IS research does not provide any approach to support IT management regarding a reference value catalog for a company-specific assessment (Brynjolfsson and Hitt 2003) of the IT business value. Although the need has existed since the discussion about the productivity paradox and more and more value catalogs have been added, the research gap has not yet been adequately addressed (Schubert 2013; Seufert et al. 2021b). For this reason, we support the development of a reference value catalog to integrate the company-specific assessment into the IT management. This is the overarching goal of our research. We derived four steps for the development of the reference catalog from the literature: catalogs selection, impact selection, hierarchy establishment, and quantification determination. With the help of a reference value catalog, IT investment decisions in companies can be reflected in a structured way and are comparable to each other, for example, whether a project prioritization is necessary (Becker 2011). Moreover, the entire process of identifying potential impacts does not have to be repeated for every new IT project. The first step "catalogs selection" is to identify possible impacts from the literature and is the focus of this paper. Based on this, a company can take existing value catalogs into account when creating its own individual reference value catalog. Since there is also no unified name for searching, the selection of appropriate catalogs in practice is difficult. Additionally, the value catalogs vary in the number, definitions, and granularity of categories. This research-in-progress paper examines the following question: "Which criteria can be used to differentiate between existing value catalogs to ultimately identify the relevant impacts for a particular IT investment in a company?" We would like to answer this question by developing a taxonomy that will be valuable for researchers and practitioners because it represents the first step in the overarching process of developing a company-specific value catalog.

The remainder of the research in progress is structured as follows. First, we briefly sketch the related literature concerning value catalogs. Second, we describe our research approach, which is based on design science, according to Hevner et al. (2004), and especially the development of a taxonomy, following Nickerson et al. (2013) as a first step. Third, we provide initial research results for developing a reference process for the development of a company-specific catalog of values using the developed taxonomy before discussing these first results and subsequent steps.

7.2 Related Literature: Value Catalogs and their Requirements

As already mentioned, a value catalog is understood to be a reference list of values and (preeconomic) impacts that can be associated with the use of IT systems (Schütte et al. 2019). The literature already contains a number of reference lists. To develop a reference value catalog, it is helpful to analyze how catalogs have been developed so far. The processes of creating a catalog are built upon an initial literature analysis to conceptualize IT business value and identify general impacts. For example, Riggins (1999) used Hammer and Mangurian (1987) predefined value catalogs to extend the existing catalog with specific aspects of e-commerce. The identification of specific impacts is often supplemented by additional identification methods, such as interviews (e.g., Andresen et al. (2002)), surveys (e.g., Gable et al. (2008)) or case studies (e.g., DeLone and McLean (2003)), which are then analyzed to extract impacts and impact categories (Schubert 2013)). Upon those findings, a catalog of values (e.g., Shang and Seddon (2000)) or an abstract model of IT impacts (e.g., Gregor et al. (2006)) can then be created (with the valuation pending).

However, the existing lists vary in their focus, number of impacts, definitions, and granularity of categories; thus, the selection of an appropriate catalog for a practical application is difficult. An applicable catalog of values should meet the following requirements.

(1) It is important for the evaluation of IT investments to first know the **possible impacts** so that the impacts can be observed in reality. Without the guidance of value catalogs, IT investments are likely to be characterized as impact defect problem situations, as it is not possible to describe the impact of the investment alternatives on the projected targets by variables (Witte 1979; Rieper 1992; Adam 1996). The value catalogs can be utilized as a checklist for a specific IT investment (Andresen et al. 2002) so that, at least from the perspective of this list, all impacts from the list can be assessed (Wiese 1998). Therefore, the scope and context of the catalogs are crucial for a proper IT business value assessment (Kesten et al. 2007). Moreover, IT reference value catalogs are an option to avoid having to determine the impacts again in every new IT investment situation. The list of impacts, which should also be related to the objectives for further analysis, forms the basis for the evaluation of each IT investment. However, directly quantifiable economic effects (values) are often considered, and the differentiated examination of the impacts is skipped (Pathak et al. 2019), which can lead to effects not being examined carefully and thus also being incomplete. For a more detailed consideration of the subject area, it is important to gain an understanding of when, where, and how IT will impact a firm. To observe something, it is necessary to conceptualize in advance what is to be observed.

(2) Such a general catalog of IT values only provides a starting point for the assessment of a specific IT investment (Becker 2011). To account for an **individual context** of the IT investment, the creation of a customized catalog is necessary (Schubert and Williams 2009a). This can be achieved by carefully selecting suitable value catalogs from the literature and applying methods to identify and quantify company-specific impacts (Schubert 2013). Currently, several processes exist for creating value catalogs (Schubert and Williams 2009a) or evaluating IT investment based on such impacts (Andresen et al. 2002; Kesten et al. 2013). While those processes contain important aspects for creating a company-specific value catalog, such as methods to

identify and monetize IT impacts, some other important aspects have not yet been considered.

(3) A company-specific value catalog must consist of those observable impacts on the bottom, which can be **hierarchically** aggregated based on their value contributions to create a quantifiable hierarchy tree of impacts (Schütte et al. 2019). This hierarchy tree must culminate in a one dimensional target dimension, which allows the evaluation of the overall IT investment (Schumann 1992; Gregor et al. 2006; Gable et al. 2008). The hierarchical structure, with its one-dimensional target dimension, avoids a target-defective problem situation. A frequent cause for this defect is the inability of the decision-maker to assess the target contributions in terms of type, amount, time reference, and certainty or a lack of knowledge on the part of the decision-maker about the objectives in general (Witte 1979; Rieper 1992; Adam 1996).

(4) Existing catalogs in the literature usually do not distinguish observed impacts from (monetary) estimated values. Although the determination of IT business value is the goal of assessing IT investments, observed impacts form a prerequisite for estimating the values of an IT system. Therefore, impacts should be **quantifiable**.

7.3 Scientific Approach

To develop a process for the creation of a reference value catalog specific to an industry or organization, we apply a design science research (DSR) methodology (Hevner et al. 2004). Our artifact is a new solution for an already known problem (IT productivity paradox at the firm level (Brynjolfsson and Hitt 2003)) and thus resembles an improvement (Peffers et al. 2007). According to Hevner and Chatterjee (2010), a DSR should go through three cycles. While the focus of our overall research is on the development and evaluation of the aforementioned process (design cycle), in this research-in-progress paper, we present a first draft of this reference process and focus on structuring the existing knowledge base on IT impacts in general, IT value catalogs in particular, and their relevance for the reference catalog creation process (rigor cycle). For the relevance cycle, we will conduct interviews with decision-makers and responsible IT staff, as well as employees involved in IT investment decisions, and derive possible IT values from practice. As the development of an artifact using a DSR methodology can be understood as a knowledge contribution (Gregor and Hevner 2013), the taxonomy as a partial artifact can also be used by both practitioners and researchers. Our research endeavor is sketched in Figure 7.1.

For the structuring of the existing literature as a first step within the process of developing a reference value catalog, we developed a taxonomy following Nickerson

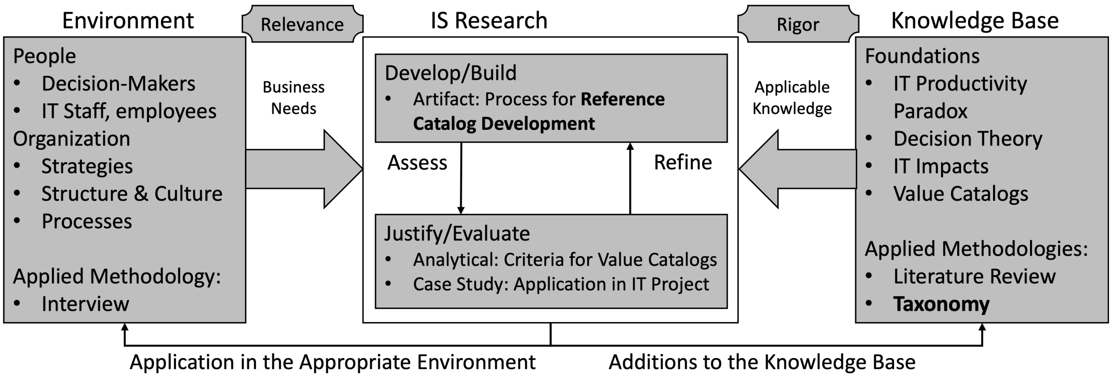

Figure 7.1: Adapted Approach for Design Science Research according to Hevner et al. (2004).

et al. (2013) approach to taxonomy development in the IS discipline. The taxonomy serves the description objective from a research perspective by providing transparency about this important aspect of IS research (Gregor 2006). We identified 32 catalogs[97] of values from related literature for the development of the taxonomy. These catalogs were published between 1983 and 2016. Examples of this literature sample are presented in chapters 7.4 and 7.5. We started our literature research on major IT business value (and the German equivalent) literature. Due to the lack of a common generic term, a search string query was difficult; therefore, the forward and backward search was much better and resulted in a set of distinct value catalogs (Webster and Watson 2002; Vom Brocke et al. 2009).

For the taxonomy development, we apply the methodology proposed by Nickerson et al. (2013), using a hybrid approach that includes conceptually and empirically derived dimensions. The taxonomy should describe and be used to classify existing value catalogs. As a meta-characteristic, we applied the following: support the IT business value assessment by proposing appropriate IT business value catalogs. To determine the ending of the iterative development process, we apply the ten objective and five subjective ending conditions, as proposed by Nickerson et al. (2013). Although we have defined mutually exclusive as an objective ending condition, it is possible that several characteristics are simultaneously fulfilled in the dimensions by one IT value catalog, as shown in figure 7.2. These combinations form a distinct characteristic in the formal taxonomy tuples that are not represented in figure 7.2 for reasons of graphical simplification (Wulfert et al. 2021). Before each iteration, in the third step, the researchers can choose between an inductive empirical-to-conceptual approach and a deductive conceptual-to-empirical approach for the development of the taxonomy. The dimensions and characteristics were derived independently by three researchers knowledgeable in the context of IT business value and IS impacts and discussed after-

97 For a detailed overview of the value catalogs, see appendix 7.7.1. This overview was not included in the accepted paper due to page limitations, but should be added to this thesis for completeness.

wards via electronic communication media.[98] The majority of dimensions are derived deductively within the first three iterations using samples from the 32 previously identified value catalogs. For these empirical-to-conceptual iterations, we randomly selected eight value catalogs and derived dimensions and characteristics accordingly.[99] The Overall Objective (8) dimension and the Methods to Supplement the Procedures Under Certainty characteristics of the Method Recommendation (10) dimension were inductively derived from the literature in the fourth iteration. After each iteration, the taxonomy is checked for the fulfillment of the defined ending conditions. Our development process stops after the fourth iteration.[100]

7.4 First Research Results: Taxonomy for Value Catalogs

The developed taxonomy for value catalogs has 10 dimensions, with a total of 33 characteristics. In the following, we present the determined dimensions and characteristics (Figure 7.2).

Dimensions	Characteristics				
Structure (1)	list	hierarchical			
		less than or equal to 3 main categories	more than 3 main categories		
Scope (2)	rudimentary (up to 9 values)	more detailed (10-26 values)	very detailed (more than 26 values)		
IT system (3)	system-independent	system-dependent			
		ERP systems	systems for e-commerce		
Industry (4)	industry-independent	industry-dependent			
		retail	construction	production	credit institute
Application (5)	abstract	specific			
Evaluation of the catalog (6)	no evaluation	evaluation through			
		interviews	surveys	case studies	
Methodical foundation of the catalog (7)	method besides literature analysis				
	no additional method	interviews	surveys	case studies	
Overall objective of the catalog (8)	not mentioned	performance	financial	product and market	social
Method recommendation for the identification of values (9)	no recommendations	empirical analysis of the companies	use of value chains	catalog as checklist	
Method recommendation for the quantification of values (10)	no recommendations	under certainty			methods to supplement the procedures under certainty
		static methods	dynamic methods	qualitative methods	

Figure 7.2: Final Taxonomy of Value Catalogs

A catalog can be structured as a simple *list* of impacts. Another possibility is a **structure (1)** in the form of a hierarchy. This has the advantage that the relationships between the individual impacts become clear, and the target defect can be avoided. Thus, the authors believe that in the end all values should be summarized to a final category that represents the root node to allow for a comparison of different IT investments. However, this ideal form does not exist in any catalog of values examined. For this reason, hierarchical structures of *up to three main categories* (e.g., Kurniawan et al. (2016); Samulat (2015)) and *over three main categories* (e.g.,

98 For a detailed overview of the detailed iterations, see appendix 7.7.2. This overview was not included in the accepted paper due to page limitations, but should be added to this thesis for completeness.

99 For a detailed overview of how many characteristics and dimensions were derived in which iteration, see appendix 7.7.3. This overview was not included in the accepted paper due to page limitations, but should be added to this thesis for completeness.

100 For a detailed overview of the fulfillment of the ending conditions, see appendix 7.7.4 This overview was not included in the accepted paper, but should be added to this thesis for completeness.

Schubert and Williams (2009b); Schulze (2009)) were developed to be able to make an approximate statement. The main categories differ per catalog. Mirani and Lederer (1998), for example, name three main categories: strategic benefits, informational benefits, and transactional benefits. A slightly different classification was made by DeLone and McLean (2003): system quality, information quality, service quality, usage, user satisfaction, and net benefits. The mentioned main categories are then further divided into lower values.

The **scope (2)** includes the number of impacts at the lowest level of the catalog called leaf nodes. This dimension already allows a statement to be made about the precision of the catalog. While some catalogs are very *rudimentary (up to nine values)* (e.g., Bartsch (2015)), there are some other catalogs that are *more detailed (10-26 values)* (e.g., Gregor (2006)). There are also catalogs that are *very detailed (more than 26 values)* (e.g., O'Leary (2004)). The classification was based on the average of the results in this dimension of the value catalogs considered, which are 18 values.

Regarding the type of **IT system (3)**, the IT value catalogs can be differentiated between *system-independent* (e.g., Lucas (1999)) and system-dependent. If system-dependent impacts are distinguished, they can be divided into *ERP systems* (e.g., Shang and Seddon (2000)) or *systems for e-commerce* (e.g., Riggins (1999)). It should be noted that this is not an exhaustive list of IT system types, but only these two variants were found in the examined sample of catalogs.

Analogous to the type of IT system, the type of **industry (4)** can also be distinguished between *industry-independent* (e.g., Vanlommel and De Brabander (1975)) and industry-dependent. Four industries were identified in the analyzed sample of IT value catalogs, which then considered the effects in this context: *retail* (e.g., DeLone and McLean (2003)), *construction* (e.g., Andresen et al. (2002)), *production* (e.g., O'Leary (2004)), and *credit institute* (e.g., Anselstetter (1984)).

The **application (5)** describes whether the catalogs examined are rather *abstract* (e.g., Mooney et al. (1996)) or *specific* (e.g., Schumann (1992)). Specific here means that the impacts can be applied practically and directly. The assignment is based on the statements of the authors of the catalogs. Nevertheless, it should be noted that the authors have not necessarily classified all the specific catalogs marked here in the same way. Specific catalogs of impacts should be directly measurable.

In addition to the development of the catalog, the **evaluation (6)** can also be considered to determine whether the catalog is applicable in practice. In the literature, either *no evaluations* (e.g., Weill and Broadbent (1998)) were made or *interviews* (e.g., Vanlommel and De Brabander (1975)), *surveys* (e.g., Gable et al. (2008)), or *case studies* (e.g., Parsons (1983)) were used.

The **methodical foundation of the catalogs (7)** was done in different ways. However, all authors use existing literature as the basis for their catalogs. The review of the literature did not necessarily follow a literature review method, such as that of Webster and Watson (2002). Rather, it followed selective processing and was therefore not structured. Furthermore, *no additional methods* (e.g., Hammer and Mangurian (1987)) were applied, and no additional information from *interviews* (e.g., Andresen et al. (2002)), *surveys* (e.g., Kesten et al. (2007)), or *case studies* (e.g., Porter and Millar (1985)) from practice was used. The understanding of what a value is may differ significantly, as described in the previous chapters, because the focus can be set differently, for example, internal or external processes.

Thus, the understanding already provides a direction that reflects the **overall objective of the catalog (8)**. While some catalogs have *no mentioned understanding* (e.g., Dos Santos (1991)) of the impacts, others focus on different objectives. In line with corporate objectives, these are *performance* (e.g., Kütz (2013)), *financial* (e.g., Baumöl and Ickler (2008)), *product and market* (e.g., Porter (2001a)), and *social* (e.g., Gable et al. (2008)) aspects. The catalogs list a wide range of different impacts, but these must then be specifically identified for a company and a particular IT investment.

For this reason, it is examined whether there are **methodological recommendations for the identification of values (9)**. While many catalogs make *no recommendations* (e.g., Gammelgård et al. (2006)), some authors recommend using the catalog as a *checklist* (e.g., Shang and Seddon (2000)). Further possibilities include an *empirical analysis of the company* (e.g., Petrovic (1994)) and the use of *chains of impacts* (e.g., Kesten et al. (2007)). After the impacts have been identified, they must be quantified to calculate an IT business value.

For this purpose, we analyzed whether **method recommendations for the quantification of values (10)** have been made. Either there were *no recommendations* (e.g., Melville et al. (2004)) or methods of investment calculation under certainty were used, for example, *static methods* (e.g., Farbey et al. (1995b)) (e.g., profitability calculation), *dynamic methods* (e.g., Andresen et al. (2002)) (e.g., net present value method), or *qualitative methods* (e.g., Kütz (2013)) (e.g., cost–benefit analysis). Some catalogs also mention methods to *supplement the procedures under certainty* (e.g., Dos Santos (1991)) (e.g., risk analysis).

7.5 Towards a Reference Value Catalog

The process for the development of a company-specific value catalog can be divided into four steps based on the findings of the related literature (Figure 7.3). The steps are briefly described in general terms below, and then the findings from the taxonomy are applied to the individual steps.

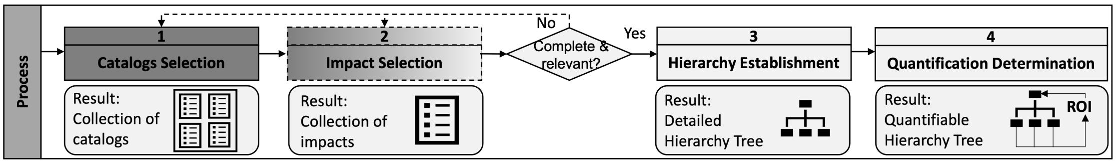

Figure 7.3: Process for Developing a Company-Specific Value Catalog

Step 1 – Catalogs Selection (almost completed): At the very beginning, catalogs selection has to be conducted to develop a value catalog that is both suited for the context to which the IT system is applied and sufficiently complete. We argue that an initial assessment of the context in which an IT system is to be used is required, that is, an identifying industry (e.g., O'Leary (2004)) or IT system-specific (e.g., Andresen et al. (2002)) review. Based on the context, the appropriate existing value catalogs can then be selected. Therefore, the taxonomy contains a selection of different manifestations of the two contexts mentioned, providing corresponding IT value catalogs. The step is almost completed with the development of the taxonomy, as only the evaluation of the taxonomy is still pending. FINDINGS: The IT business value depends on both the type of IT implemented or introduced and the specifics of the company introducing it (Brynjolfsson and Hitt 2003). With 81 %[101] of the catalogs in our sample being system-independent (*IT system*) and 84 % being industry-independent (*industry*), the catalogs focus on higher levels of abstraction in which the IT business value tends to be equal for various types of IT and different industries (Kütz 2013). However, these values at higher levels of abstraction cannot be directly assessed for the IT investment decision. They need to be further detailed for step 4. Only 28 % of the IT value catalogs of our sample were empirically evaluated using surveys, case studies, or interviews (*evaluation*). Thus, the applicability of the analyzed IT value catalogs, in general, and their benefit for the companies, in particular, is often not evaluated. An evaluation after the release of a contribution would have led to a new iteration of the catalog. Although we have scanned the literature for these iterations, they do not exist, at least, in scientific contributions, except for Schubert and Williams (2009a). Nevertheless, there are catalogs that build on each other and thus represent further iterations by other authors. While 22 % of the catalogs analyzed do not mention the overall objective of the identification of values, the majority of authors (41 %) focus on a performance perspective when assessing the IT business value (*objective*). Justifying IT investments using highly regarded and evaluated IT business catalogs may support decision-makers in considering a huge set of relevant impacts possible by future IT investment.

Step 2 – Impact Selection (ongoing): Based on the impacts identified within the existing literature, a customized assessment of IT impacts must also identify the

101 For a detailed overview of the cross-tabulator analysis on clustering results see appendix 7.7.5. This overview was not included in the accepted paper due to page limitations, but should be added to this thesis for completeness.

impacts that apply to the specific company (Brynjolfsson and Hitt 2003) to allow for a goal-oriented IT management (Seufert et al. 2021b). Those cannot be derived from external sources but by analyzing previous projects or benchmarking existing processes. To support this step, we are currently conducting interviews with decision-makers and IT staff regarding the strategies, structures, culture, and processes of their organization to understand the various impacts that are not yet reflected in the literature but greatly affect the overall IT business value. Within an interview with the Chief Operating Officer (COO) of a large discounter in Germany, the specific expectations of an IT system became clearer (e.g., guaranteed availability of goods in the shop and procurement more in line with demand). Steps 1 and 2 should result in a collection of impacts, which must be checked in terms of its completeness and the relevance of each impact it contains. FINDINGS: It should be discussed that 60 % of the value catalogs are only based on literature research (*Methodical foundation*) and thus do not cover possible impact from current practice. To add further aspects to the existing catalogs of impacts, a further analysis is necessary.

Step 3 – Hierarchy Establishment (pending): As mentioned before, the assessment of the IT business value requires a hierarchization of impacts to map relationships and resolve target defects. The goal is to create a detailed hierarchy consisting of different levels of abstractions from the leaf impacts towards a single root impact (Schütte et al. 2019). FINDINGS: None of the analyzed IT value catalogs aggregates the IT business value to a one-dimensional root value that is properly monetarily quantified. Our sample of IT value catalogs varies between two (e.g., Gable et al. (2008)) and six nodes (e.g., DeLone and McLean (2003); Schulze (2009)) on the highest level of aggregation (*structure*), with another six catalogs proposing a plain list instead of a hierarchical aggregation of values (e.g., Bartsch (2015); Lucas (1999); Weill and Olson (1989)). Nevertheless, it can be noted that over 50 % of the value catalogs specify a maximum of three main categories. Hence, these value catalogs can support decision-makers with possible IT business values for an IT investment but do not result in single objectively comparable root values. Although decision-makers must pay attention when attributing IT system impacts to the categories proposed within IT value catalogs, a specific IT business value should only be included in one impact category. Otherwise, a possible double accounting would distort the IT business value assessment. This assessment defect can only be avoided by mutually exclusive and well-described impacts in the IT value catalogs.

Step 4 – Quantification Determination (pending): This structure of aggregated impacts allows the defining of one overarching target dimension, such as the Return on Investment (ROI), by which the overall benefit of the IT system can be determined. To determine the overall business value of the IT system, each leaf impact must be quantifiable and converted to monetized values. If this is the case, the process of developing a company-specific reference value catalog is complete. FINDINGS: For

38 % of the IT value catalogs, the authors claim that they are specific enough to be directly applicable for IT business value assessments (*application*). For this dimension, we have extracted the authors' opinions as written within their contributions. We would question their claim, as on the one hand, 72 % of the IT value catalogs do not suggest a method for the identification of business impacts caused by IT systems. Only 12.5 % of the IT value catalogs provide methods for the quantification of impacts under uncertainty (*quantification*). As IT investment decisions are characterized as situations of uncertainty, most of the analyzed catalogs do not provide methodological support.

7.6 Conclusion

In this paper, we highlighted that an IT reference value catalog should be used as heuristics to cope with impact defect IT investment decisions. As the circumstances are totally different in companies, we recommend developing a reference value catalog for a company-specific assessment of IT business value. This development includes four steps: catalogs selection, impact selection, hierarchy establishment, and quantification determination. The developed taxonomy (result of step 1) for an IT value catalog selection has implications for both practitioners and researchers. Our sample of IT value catalogs provides an overview of potential catalogs that can be applied in a company based on the process towards a company-specific catalog of values. For practitioners, the taxonomy should further simplify the selection of an appropriate IT value catalog for the IT business value assessment, or it can be used for classifying an existing catalog for reasons of comparability. However, the developed taxonomy has its limitations. First, the identified sample (32 catalogs in total) of IT value catalogs does not raise a claim for completeness. Because we focused on scientific literature, we excluded practitioner contributions to IT value catalogs, which may be more industry-specific. Second, the proposed evaluation of the quality of the taxonomy developed by Nickerson et al. (2013) is pending. In addition to the development of a company-specific value catalog to evaluate IT investments, it is also important to take a holistic approach to controlling the values. Future research may include IT value catalogs into more holistic approaches to IT business value assessment. It may also include even the transfer of IT business value assessment from a snapshot of the investment decision to a continuous control that reaches in the productive operation. This controlling should be integrated into existing procedure models.

7.7 Appendix - Paper III

7.7.1 Overview of the Value Catalogs Considered

Table 7.1 contains an overview of the value catalogs that we could identify in the existing literature[102]. The list is sorted by author(s) in ascending order. In addition, the value catalogs were assigned to the archetypes we identified.

ID	Authors	Year	Archetype
1	Andresen et al.	2002	specialized
2	Anselstetter	1984	specialized
3	Bartsch	2015	holistic
4	Baumöl and Ickler	2008	holistic
5	DeLone and McLean	2003	specialized
6	Dos Santos	1991	holistic
7	Farbey et al.	1995	holistic
8	Gable et al.	2008	abstract
9	Gammelgård et al.	2006	holistic
10	Gregor	2006	abstract
11	Hammer and Mangurian	1987	abstract
12	Kesten et al.	2007	holistic
13	Kurniawan et al.	2016	abstract
14	Kütz	2013	holistic
15	Lucas	1999	abstract
16	Melville et al.	2004	abstract
17	Mirani and Lederer	1998	holistic
18	Mooney et al.	1996	abstract
19	O'Leary	2004	specialized
20	Parsons	1983	abstract
21	Petrovic	1994	holistic
22	Porter	2001	abstract
23	Porter and Millar	1985	abstract
24	Riggins	1999	specialized
25	Samulat	2015	holistic
26	Schubert and Williams	2009	specialized
27	Schulze	2009	holistic
28	Schumann	1992	specialized
29	Shang and Seddon	2000	specialized
30	Vanlommel and De Brabander	1975	abstract
31	Weill and Broadbent	1998	abstract
32	Weill and Olson	1989	abstract

Table 7.1: Value Catalogs Considered Ascending by Author(s)

7.7.2 Detailed Iterations

Detailed information on the five iterations can be found below (Tables 7.2 - 7.39). For each iteration, the same value catalogs were used and examined for the different

102 In comparison to paper II, only 32 value catalogs are examined in paper III. This is due to the distribution of the catalogs among the iterations. Since we performed 4 iterations with 8 value catalogs each, we only considered 32 value catalogs in this paper. The catalogs were randomly selected.

dimensions. The light grayed out characteristics were found in later iterations, but were also shown in the earlier iterations for reasons of clarity.

Iteration 1 - E2C

Structure	list	hierarchical	
		less than or equal to 3 main categories	more than 3 main categories
Mirani and Lederer (1998)		3	
Shang and Seddon (2000)			5
Schubert and Williams (2009)			4 (5)[103]
Melville et al. (2004)		3	
Kurniawan et al. (2016)		3	
Gregor et al. (2006)			4
Kütz (2013)		2	
Gable et al. (2008)		2	

Table 7.2: Iteration 1 - Structure

Scope	rudimentary (up to 9 impacts)	more detailed (10-27 impacts)	very detailed (more than 27 impacts)
Mirani and Lederer (1998)		25	
Shang and Seddon (2000)		25	
Schubert and Williams (2009)			72
Melville et al. (2004)	9		
Kurniawan et al. (2016)		12	
Gregor et al. (2006)		22	
Kütz (2013)	8		
Gabel et al. (2008)	4		

Table 7.3: Iteration 1 - Scope

IT system	system-independent	system-dependent	
		ERP	E-Commerce
Mirani and Lederer (1998)	x		
Shang and Seddon (2000)		x	
Schubert and Williams (2009)		x	
Melville et al. (2004)	x		
Kurniawan et al. (2016)	x		
Gregor et al. (2006)	x		
Kütz (2013)	x		
Gabel et al. (2008)	x		

Table 7.4: Iteration 1 - IT System

103 Early papers by Schubert and Williams (2009a) identified five categories (business design, company management, business function, supply chain, and information technology). However, the supply chain category was eliminated in later papers (Schubert and Williams 2009b).

Industry	sector-independent	sector-dependent			
		retail	construction	production	credit institutions
Mirani and Lederer (1998)	x				
Shang and Seddon (2000)	x				
Schubert and Williams (2009)	x				
Melville et al. (2004)	x				
Kurniawan et al. (2016)	x				
Gregor et al. (2006)	x				
Kütz (2013)	x				
Gabel et al. (2008)	x				

Table 7.5: Iteration 1 - Industry

Application	abstract	specific (measurable)
Mirani and Lederer (1998)	x	
Shang and Seddon (2000)	x	
Schubert and Williams (2009)		x
Melville et al. (2004)	x	
Kurniawan et al. (2016)	x	
Gregor et al. (2006)	x	
Kütz (2013)		x
Gabel et al. (2008)	x	

Table 7.6: Iteration 1 - Application

Evaluation of the catalog	no evaluation	evaluation through		
		surveys	case studies	interviews
Mirani and Lederer (1998)		x		
Shang and Seddon (2000)	x			
Schubert and Williams (2009)	x			
Melville et al. (2004)	x			
Kurniawan et al. (2016)	x			
Gregor et al. (2006)		x		
Kütz (2013)	x			
Gabel et al. (2008)		x		

Table 7.7: Iteration 1 - Evaluation of the Catalog

Methodical foundation of the catalog	method besides literature analysis			
	no additional method	interviews	surveys	case studies
Mirani and Lederer (1998)			x	
Shang and Seddon (2000)				x
Schubert and Williams (2009)	x			
Melville et al. (2004)	x			
Kurniawan et al. (2016)	x			
Gregor et al. (2006)	x			
Kütz (2013)	x			
Gabel et al. (2008)			x	

Table 7.8: Iteration 1 - Methodical Foundation of the Catalog

Method recommendation for the identification of values	no recom-mendations	empirical analysis of the companies	use of value chains	catalog as checklist
Mirani and Lederer (1998)				x
Shang and Seddon (2000)				x
Schubert and Williams (2009)			x	x
Melville et al. (2004)	x			
Kurniawan et al. (2016)	x			
Gregor et al. (2006)	x			
Kütz (2013)	x			
Gabel et al. (2008)	x			

Table 7.9: Iteration 1 - Method Recommendation for the Identification of Values

Method recommendation for the quantification of values	no recom-menda-tions	under certainty			methods to supple-ment the proce-dures under certainty
		static methods	dynamic methods	qualitative methods	
Mirani and Lederer (1998)	x				
Shang and Seddon (2000)	x				
Schubert and Williams (2009)	x				
Melville et al. (2004)	x				
Kurniawan et al. (2016)	x				
Gregor et al. (2006)	x				
Kütz (2013)				x	
Gabel et al. (2008)	x				

Table 7.10: Iteration 1 - Method Recommendation for the Quantification of Values

Iteration 2 - E2C

Structure	list	hierarchical	
		less than or equal to 3 main categories	more than 3 main categories
O'Leary (2004)		3	
Bartsch (2015)	x		
Porter and Millar (1985)		3	
Baumöl and Ickler (2008)	x		
Anselstetter (1984)			4
Mooney et al. (1996)		3	
Lucas (1999)	x		
Schumann (1992)			5

Table 7.11: Iteration 2 - Structure

Scope	rudimentary (up to 9 impacts)	more detailed (10-27 impacts)	very detailed (more than 27 impacts)
O'Leary (2004)			35
Bartsch (2015)	5		

Scope	rudimentary (up to 9 impacts)	more detailed (10-27 impacts)	very detailed (more than 27 impacts)
Porter and Millar (1985)		10	
Baumöl and Ickler (2008)	3		
Anselstetter (1984)			41
Mooney et al. (1996)		25	
Lucas (1999)	5		
Schumann (1992)	9		

Table 7.12: Iteration 2 - Scope

IT system	system-independent	system-dependent	
		ERP	E-Commerce
O'Leary (2004)		x	
Bartsch (2015)	x		
Porter and Millar (1985)	x		
Baumöl and Ickler (2008)	x		
Anselstetter (1984)	x		
Mooney et al. (1996)	x		
Lucas (1999)	x		
Schumann (1992)		x	

Table 7.13: Iteration 2 - IT System

Industry	sector-independent	sector-dependent			
		retail	construction	production	credit institutions
O'Leary (2004)				x	
Bartsch (2015)	x				
Porter and Millar (1985)	x				
Baumöl and Ickler (2008)	x				
Anselstetter (1984)		x		x	x
Mooney et al. (1996)	x				
Lucas (1999)	x				
Schumann (1992)	x				

Table 7.14: Iteration 2 - Industry

Application	abstract	specific (measurable)
O'Leary (2004)		x
Bartsch (2015)		x
Porter and Millar (1985)	x	
Baumöl and Ickler (2008)	x	
Anselstetter (1984)		x
Mooney et al. (1996)	x	
Lucas (1999)	x	
Schumann (1992)		x

Table 7.15: Iteration 2 - Application

Evaluation of the catalog	no evaluation	evaluation through		
		surveys	case studies	interviews
O'Leary (2004)	x			
Bartsch (2015)			x	
Porter and Millar (1985)	x			
Baumöl and Ickler (2008)	x			
Anselstetter (1984)	x			
Mooney et al. (1996)	x			
Lucas (1999)	x			
Schumann (1992)	x			

Table 7.16: Iteration 2 - Evaluation of the Catalog

Methodical foundation of the catalog	method besides literature analysis			
	no additional method	interviews	surveys	case studies
O'Leary (2004)				x
Bartsch (2015)	x			
Porter and Millar (1985)				x
Baumöl and Ickler (2008)	x			
Anselstetter (1984)		x		
Mooney et al. (1996)	x			
Lucas (1999)				x
Schumann (1992)				x

Table 7.17: Iteration 2 - Methodical Foundation of the Catalog

Method recommendation for the identification of values	no recom-mendations	empirical analysis of the companies	use of value chains	catalog as checklist
O'Leary (2004)	x			
Bartsch (2015)	x			
Porter and Millar (1985)	x			
Baumöl and Ickler (2008)				x
Anselstetter (1984)	x			
Mooney et al. (1996)	x			
Lucas (1999)	x			
Schumann (1992)	x			

Table 7.18: Iteration 2 - Method Recommendation for the Identification of Values

Method recommendation for the quantification of values	no recommendations	under certainty			methods to supplement the procedures under certainty
		static methods	dynamic methods	qualitative methods	
O'Leary (2004)	x				
Bartsch (2015)		x	x		
Porter and Millar (1985)	x				
Baumöl and Ickler (2008)	x				
Anselstetter (1984)	x				
Mooney et al. (1996)	x				
Lucas (1999)	x				
Schumann (1992)	x				

Table 7.19: Iteration 2 - Method Recommendation for the Quantification of Values

Iteration 3 - E2C

Structure	list	hierarchical	
		less than or equal to 3 main categories	more than 3 main categories
Riggins (1999)		3	
DeLone and McLean (2003)			6
Weil and Olson (1989)	x		
Vanlommel and De Brabander (1975)		3	
Petrovic (1994)	x		
Hammer and Mangurian (1987)		3	
Weill and Broadbent (1998)			4
Gammelgard et al. (2006)		3	

Table 7.20: Iteration 3 - Structure

Scope	rudimentary (up to 9 impacts)	more detailed (10-27 impacts)	very detailed (more than 27 impacts)
Riggins (1999)		15	
DeLone and McLean (2003)		25	
Weil and Olson (1989)	3		
Vanlommel and De Brabander (1975)		15	
Petrovic (1994)	5		
Hammer and Mangurian (1987)	9		
Weill and Broadbent (1998)		16	
Gammelgard et al. (2006)		25	

Table 7.21: Iteration 3 - Scope

IT system	system-independent	system-dependent	
		ERP	E-Commerce
Riggins (1999)			x
DeLone and McLean (2003)			x
Weil and Olson (1989)	x		
Vanlommel and De Brabander (1975)	x		
Petrovic (1994)	x		
Hammer and Mangurian (1987)	x		
Weill and Broadbent (1998)	x		
Gammelgard et al. (2006)	x		

Table 7.22: Iteration 3 - IT System

Industry	sector-independent	sector-dependent			
		retail	construction	production	credit institutions
Riggins (1999)		x			
DeLone and McLean (2003)		x			
Weil and Olson (1989)	x				
Vanlommel and De Brabander (1975)	x				
Petrovic (1994)	x				
Hammer and Mangurian (1987)	x				
Weill and Broadbent (1998)	x				
Gammelgard et al. (2006)	x				

Table 7.23: Iteration 3 - Industry

Application	abstract	specific (measurable)
Riggins (1999)		x
DeLone and McLean (2003)	x	
Weil and Olson (1989)	x	
Vanlommel and De Brabander (1975)	x	
Petrovic (1994)	x	
Hammer and Mangurian (1987)	x	
Weill and Broadbent (1998)	x	
Gammelgard et al. (2006)		x

Table 7.24: Iteration 3 - Application

Evaluation of the catalog	no evaluation	evaluation through		
		surveys	case studies	interviews
Riggins (1999)	x			
DeLone and McLean (2003)	x			
Weil and Olson (1989)	x			
Vanlommel and De Brabander (1975)				x
Petrovic (1994)	x			
Hammer and Mangurian (1987)	x			
Weill and Broadbent (1998)	x			
Gammelgard et al. (2006)		x		

Table 7.25: Iteration 3 - Evaluation of the Catalog

Methodical foundation of the catalog	method besides literature analysis			
	no additional method	interviews	surveys	case studies
Riggins (1999)	x			
DeLone and McLean (2003)	x			
Weil and Olson (1989)	x			
Vanlommel and De Brabander (1975)		x		
Petrovic (1994)	x			
Hammer and Mangurian (1987)	x			
Weill and Broadbent (1998)				x
Gammelgard et al. (2006)	x			

Table 7.26: Iteration 3 - Methodical Foundation of the Catalog

Method recommendation for the identification of values	no recommendations	empirical analysis of the companies	use of value chains	catalog as checklist
Riggins (1999)		x		
DeLone and McLean (2003)	x			
Weil and Olson (1989)	x			
Vanlommel and De Brabander (1975)	x			
Petrovic (1994)		x		
Hammer and Mangurian (1987)	x			
Weill and Broadbent (1998)	x			
Gammelgard et al. (2006)	x			

Table 7.27: Iteration 3 - Method Recommendation for the Identification of Values

Method recommendation for the quantification of values	no recommendations	under certainty			methods to supplement the procedures under certainty
		static methods	dynamic methods	qualitative methods	
Riggins (1999)	x				
DeLone and McLean (2003)	x				
Weil and Olson (1989)	x				
Vanlommel and De Brabander (1975)	x				
Petrovic (1994)	x				
Hammer and Mangurian (1987)	x				
Weill and Broadbent (1998)	x				
Gammelgard et al. (2006)	x				

Table 7.28: Iteration 3 - Method Recommendation for the Quantification of Values

Iteration 4 - C2E

Overall objective of the catalog	not mentioned	performance	financial	product and market	social

Table 7.29: Iteration 4 - Overall Objective of the Catalog

Iteration 5 - E2C

Structure	list	hierarchical	
		less than or equal to 3 main categories	more than 3 main categories
Samulat (2015)		3	
Schulze (2009)			6
Farbey et al. (1995)	x		
Porter (2001)		2	
Parson (1983)		3	
Dos Santos (1991)		3	
Andresen et al. (2002)		3	
Kesten et al. (2007)			4

Table 7.30: Iteration 5 - Structure

Scope	rudimentary (up to 9 impacts)	more detailed (10-27 impacts)	very detailed (more than 27 impacts)
Samulat (2015)		12	
Schulze (2009)		18	
Farbey et al. (1995)	8		
Porter (2001)	9		
Parson (1983)		11	
Dos Santos (1991)	2		
Andresen et al. (2002)			85
Kesten et al. (2007)		12	

Table 7.31: Iteration 5 - Scope

IT system	system-independent	system-dependent	
		ERP	E-Commerce
Samulat (2015)	x		
Schulze (2009)	x		
Farbey et al. (1995)	x		
Porter (2001)	x		
Parson (1983)	x		
Dos Santos (1991)	x		
Andresen et al. (2002)	x		
Kesten et al. (2007)	x		

Table 7.32: Iteration 5 - IT System

Industry	sector-independent	sector-dependent			
		retail	construction	production	credit institutions
Samulat (2015)	x				
Schulze (2009)	x				
Farbey et al. (1995)	x				
Porter (2001)	x				
Parson (1983)	x				
Dos Santos (1991)	x				
Andresen et al. (2002)			x		
Kesten et al. (2007)	x				

Table 7.33: Iteration 5 - Industry

Application	abstract	specific (measurable)
Samulat (2015)		x
Schulze (2009)		x
Farbey et al. (1995)		x
Porter (2001)	x	
Parson (1983)	x	
Dos Santos (1991)	x	
Andresen et al. (2002)		x
Kesten et al. (2007)	x	

Table 7.34: Iteration 5 - Application

Evaluation of the catalog	no evaluation	evaluation through		
		surveys	case studies	interviews
Samulat (2015)	x			
Schulze (2009)		x		
Farbey et al. (1995)	x			
Porter (2001)	x			
Parson (1983)			x	
Dos Santos (1991)	x			
Andresen et al. (2002)			x	
Kesten et al. (2007)	x			

Table 7.35: Iteration 5 - Evaluation of the Catalog

Methodical foundation of the catalog	method besides literature analysis			
	no additional method	interviews	surveys	case studies
Samulat (2015)	x			
Schulze (2009)	x			
Farbey et al. (1995)				x
Porter (2001)	x			
Parson (1983)	x			
Dos Santos (1991)	x			
Andresen et al. (2002)		x		
Kesten et al. (2007)			x	

Table 7.36: Iteration 5 - Methodical Foundation of the Catalog

Overall objective of the catalog	not mentioned	performance	financial	product and market	social
Samulat (2015)		x			
Schulze (2009)		x			
Farbey et al. (1995)			x		
Porter (2001)				x	
Parson (1983)				x	
Dos Santos (1991)	x				
Andresen et al. (2002)		x			
Kesten et al. (2007)	x				

Table 7.37: Iteration 5 - Overall Objective of the Catalog

Method recommendation for the identification of values	no recommendations	empirical analysis of the companies	use of value chains	catalog as checklist
Samulat (2015)			x	
Schulze (2009)	x			
Farbey et al. (1995)	x			
Porter (2001)	x			
Parson (1983)	x			
Dos Santos (1991)	x			
Andresen et al. (2002)				x
Kesten et al. (2007)			x	x

Table 7.38: Iteration 5 - Method Recommendation for the Identification of Values

Method recommendation for the quantification of values	no recommendations	under certainty			methods to supplement the procedures under certainty
		static methods	dynamic methods	qualitative methods	
Samulat (2015)		x	x	x	x
Schulze (2009)		x	x	x	x
Farbey et al. (1995)		x	x	x	x
Porter (2001)	x				
Parson (1983)	x				
Dos Santos (1991)					x
Andresen et al. (2002)		x	x	x	x
Kesten et al. (2007)		x	x	x	x

Table 7.39: Iteration 5 - Method Recommendation for the Quantification of Values

7.7.3 Overview of Iterations

Table 7.40 shows in which iteration how many characteristics were identified for a dimension of the taxonomy. The "dark grey" fields mark the number of characteristics that led to the dimension. The "light grey" fields then mark the number of characteristics that were found in further iterations. In case of a "-", no further characteristics of the dimension were found in the examined value catalogs. In addition, it was noted whether empirical-to-conceptual (E2C) or conceptual-to-empirical (C2E) was proceeded.

		Structure	**Scope**	**Type of IT system**	**Type of business sector**	**Level of utility**	**Overall objective of the identification of impacts**	**Creation of the catalog**	**Evaluation of the catalog**	**Method recommendation for the identification of impacts**	**Method recommendation for the quantification of the impact**
Iteration 1	E2C	2	3	2	-	2	-	3	2	3	2
Iteration 2	E2C	1	-	-	4	-	-	1	1	-	2
Iteration 3	E2C	-	-	2	1	-	-	-	1	1	-
Iteration 4	C2E	-	-	-	-	-	5	-	-	-	1
Iteration 5	E2C	-	-	-	-	-	-	-	-	-	-

Table 7.40: Overview of Iterations

7.7.4 Ending Conditions

Table 7.41 lists the objective and subjective ending conditions and marks the iteration after which they are fulfilled.

	Iteration				
	1	2	3	4	5
Objective condition					
All relevant objects were analyzed					x
No merge or split of object					x
Each characteristic was assigned at least once	x	x	x	x	x
No new dimension or characteristic was added					x
No dimension or characteristics was merged or split					x
Every dimension is unique	x	x	x	x	x
Every characteristic per dimension is unique	x	x	x	x	x
No duplicate combinations of characteristics	x	x	x	x	x
Mutually exclusive: All objects have no more than one characteristic per dimension	x	x	x	x	x
Collectively exhaustive: For all objects, a characteristic can be assigned to each dimension	x	x	x	x	x
Subjective conditions					
Concise: Dimensions and characteristics are limited	x	x	x	x	x
Robust: Sufficient number of dimensions and characteristics				x	x
Comprehensive: Identification of all (relevant) dimensions of an object				x	x
Extendable: Possibility to easily add dimensions and characteristics in the future	x	x	x	x	x
Explanatory: Dimensions and characteristics sufficiently explain the object				x	x

Table 7.41: Ending Conditions

7.7.5 Cross-Tabulation Analysis on Clustering Results

Table 7.42 shows the allocation of the characteristics for all analyzed value catalogs and for each archetype separately. The dark grey fields show a 100% allocation, i.e., for example, all considered value catalogs that were assigned to the archetype "holistic" are industry independent. The light grey boxes indicate the highest value for an archetype at a dimension. In total, the light grey field shows the value that was highest in the dimension i.e. for example 81,25% of all analyzed value catalogs are system independent.

Dimension	Characteristic	In total	Archetype "holistic"	Archetype "specialized"	Archetyp "abstract"
Structure	List	18,75%	36,36%	0,00%	15,38%
	<= 3 categories	53,13%	45,45%	37,50%	69,23%
	>3 categoriers	28,13%	18,18%	62,50%	15,38%
Scope	Rudimentary	40,63%	54,55%	12,50%	46,15%
	More detailed	46,88%	45,45%	37,50%	53,85%
	Very Detailed	12,50%	0,00%	50,00%	0,00%
IT system	Independent	81,25%	100,00%	25,00%	100,00%
	ERP	12,50%	0,00%	50,00%	0,00%
	Ecommerce	6,25%	0,00%	25,00%	0,00%
Industry	Independent	84,38%	100,00%	37,50%	100,00%
	Retail	9,38%	0,00%	37,50%	0,00%
	Construction	3,13%	0,00%	12,50%	0,00%
	Production	6,25%	0,00%	25,00%	0,00%
	Credit institute	3,13%	0,00%	12,50%	0,00%
Application	Abstract	62,50%	45,45%	25,00%	100,00%
	Specific	37,50%	54,55%	75,00%	0,00%
Evaluation	No evaluation mentioned	71,88%	63,64%	87,50%	69,23%
	Surveys	15,63%	27,27%	0,00%	15,38%
	Case studies	9,38%	9,09%	12,50%	7,69%
	Interviews	3,13%	0,00%	0,00%	7,69%
Foundation	Literature	59,38%	72,73%	37,50%	61,54%
	Interviews	9,38%	0,00%	25,00%	7,69%
	Survey	9,38%	18,18%	0,00%	7,69%
	Case studies	21,88%	9,09%	37,50%	23,08%
Objective	Not mentioned	21,88%	18,18%	37,50%	15,38%
	Performance	40,63%	54,55%	37,50%	30,77%
	Financial	15,63%	18,18%	12,50%	15,38%
	Product & market	18,75%	9,09%	12,50%	30,77%
	Social	3,13%	0,00%	0,00%	7,69%
Identification	Not mentioned	71,88%	54,55%	50%	100%
	Empirical analysis	6,25%	9,09%	12,5%	0%
	Value chain	9,38%	18,2%	12,5%	0%
	Checklist	18,75%	27,27%	37,5%	0%
Quantification	Not mentioned	75%	36,36%	87,5%	100%
	Static methods	18,75%	45,45%	12,5%	0,00%
	Dynamic methods	18,75%	45,45%	12,5%	0,00%
	Qualitative method	18,75%	45,45%	12,5%	0,00%
	Uncertainty	18,75%	45,45%	12,5%	0,00%

Table 7.42: Cross-tabulation Analysis on Clustering Results

Archetype "holistic": Bartsch (2015); Baumöl and Ickler (2008); Dos Santos (1991); Farbey et al. (1995a); Gable et al. (2008); Kesten et al. (2007); Kütz (2013); Mirani and Lederer (1998); Petrovic (1994); Samulat (2015); Schulze (2009)

Archetype "specialized": Andresen et al. (2002); Anselstetter (1984); DeLone and McLean (2003); O'Leary (2004); Riggins (1999); Schubert and Williams (2009a);

Schumann (1992); Shang and Seddon (2000)

Archetype "abstract": Gregor (2006); Hammer and Mangurian (1987); Kurniawan et al. (2016); Lucas (1999); Melville et al. (2004); Mooney et al. (1996); Parsons (1983); Porter (2001b); Porter and Millar (1985); Vanlommel and De Brabander (1975); Weill and Broadbent (1998); Weill and Olson (1989)

Part IV

Integration of Identified Impacts of an IT Investments into an Approach for Managing IT Business Value

8 Paper IV: Das Wertbeitragscontrolling als Anreicherung bestehender Vorgehensmodelle des Software Engineering

Abstract

Häufig in der Praxis genutzte Vorgehensmodelle des Software Engineering fokussieren zwar die Erfüllung der Zeit-, Budget- und inhaltlichen Anforderungen, vernachlässigen aber die angestrebten Wertbeiträge der IT-Investition. Somit werden die eigentlichen Wirkungen der Informationssysteme häufig weder für die ex-ante zu treffende Investitionsentscheidung berücksichtigt, wo sie methodisch nur schwer zu identifizieren und quantifizieren sind, noch konsequent über den gesamten Projektverlauf überwacht. Angesichts der viefältigen methodischen Probleme, denen sich die Wirtschaftlichkeitsanalyse von IT-Systemen ausgesetzt sieht, wird ein holistisches Vorgehen vorgestellt, das die Identifikation von Wirkungen bei einem spezifischen IT-Investitionsvorhaben, die Bewertung der Wirkungen, die Abstimmung in einer Organisation über diese Bewertung und die Realisierung der Wirkungen umfasst. Dieser Prozess wird als Wertbeitragscontrolling bezeichnet und sollte in einem Unternehmen nicht isoliert als Teilbereich des Unternehmenscontrolling etabliert werden, sondern ist vor allem im Rahmen von IT-Projekten von Bedeutung. Denn die Anreicherung von Vorgehensmodellen um Wertbeitragsrealisierungsüberlegungen ist die Voraussetzung, um IT-Projekte wirtschaftlich erfolgreich umzusetzen.

Keywords: Vorgehensmodelle, Software Engineering, Wirkungen der IT, Wertbeitrag der IT, Wirtschaftlichkeitsanalyse, Wertbeitragscontrolling

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8.1 Einleitung

Die Wirkung der Informationstechnologie (IT) in Institutionen im Allgemeinen und Unternehmen im Speziellen ist ein wenig betrachteter Themenbereich, obwohl ohne ein Verständnis der Wirkungen kein zielführendes IT-Management möglich ist. In der Wissenschaft hat sich, geprägt durch die Diskussion des Produktivitätsparadoxons der IT (Brynjolfsson and Hitt 1998; Brynjolfsson 1993), die Meinung durchgesetzt, dass die IT einen positiven Einfluss auf die Unternehmensproduktivität hat (Brynjolfsson and Hitt 2003). Es existieren jedoch bis heute kaum Erkenntnisse darüber, welche organisatorischen Kontextfaktoren den Erfolg beeinflussen, welche zeitlich-vertikalen Interdependenzen bei der Wirkungsanalyse zu beachten sowie zu bewerten sind und wie die ex-ante im Zuge der Investitionsentscheidung angenommenen Wertbeiträge auch über die Einführung der Systeme hinweg realisiert und einem Controlling unterzogen werden können. Dieses Problem wird mit einem zunehmenden Einsatz von IT-Systemen in Unternehmen immer bedeutender.

Existierende Vorgehensmodelle des Software Engineering (SE) sowie zur Einführung von Standardsystemen berücksichtigen die Frage der Wirkungs- und Wertbeitragsproblematik von Informationssystemen nicht (Termer et al. 2014). Auch im IT-Projektmanagement werden besonders die Dimensionen Zeit, Kosten und Qualität berücksichtigt, die Wertbeitragsproblematik hingegen kaum (Atkinson 1999). In der Regel verbirgt sich diese Fragestellung im SE bzw. im Projektmanagement hinter einzelnen Anforderungen nur mittelbar (Anwar 2014; Beynon-Davies et al. 1999). Jedoch ist auch beim Anforderungsmanagement die diesbezügliche methodische Unterstützung zuweilen wenig bis gar nicht ausgeprägt (Balaji and Murugaiyan 2012). Es existieren Adaptionen von Vorgehensmodellen in Institutionen, die die Wirtschaftlichkeit einer IT-Investition betrachten. Allerdings wird dabei die Wirkungsproblematik ausgeblendet und lediglich die Wirtschaftlichkeitsrechnungsproblematik, die in Unternehmen aus dem Controlling stammt, in die Vorgehensmodelle übertragen.[104]

Im Gegensatz zum Fokus der Vorgehensmodelle des SE auf die Erstellung eines technischen Artefakts, die Software, gibt es aus der angelsächsischen Information Systems Community den Forschungsstrang des Benefits Management (BM), der vor allem die Veränderung der Organisation im Zuge des Change Management thematisiert (Badewi 2016; Bradley 2010; Ward and Daniel 2012). Es geht dabei vor allem um die Realisierung eines Wertes aus dem technischen Artefakt, nicht um die Maßnahmen zur Realisierung desgleichen. Das in diesem Beitrag vorgestellte Wertbeitragscontrolling (WBC) stellt einen holistischen Ansatz dar, der anders als das SE im Allgemeinen

104 Beispielhaft sei hier auf das (unternehmens-) wertorientierte Controlling bei der BMW Group verwiesen, dass aus investitionsrechnerischem Kalkül die Projektentscheidung im Sinne der Shareholder trifft, aber keine strukturierte Wirkungsbetrachtung anstrebt (Sommerfeld and Steurer 2008; Krause and Schmidbauer 2003).

und das Requirements Engineering (RE) im Speziellen nicht nur die Anforderungen an das technische Artefakt betrachtet, sondern einerseits in die Vorgehensmodelle Aspekte der Wirkungs- und Wirtschaftlichkeitsanalyse integriert und andererseits aus dem BM bekannte Aspekte der Planung, Kontrolle und Unterstützung der Veränderung der Organisation integriert. Daher wird hier die mangelnde Integration eines WBC in Vorgehensmodellen des SE problematisiert, indem auf Interdependenzen zwischen den Prozessmodellen des SE und des WBC hingewiesen wird. Vor diesem Hintergrund widmet sich der Beitrag der Forschungsfrage, welche Aspekte des WBC - von der Identifikation, Bewertung bis zu deren Realisierung - besonders bedeutend sind und wo eine Integration in Vorgehensmodelle des SE geboten erscheint. Mit der Auswahl der Technologie und der Entwicklung von Systemen ist an sich noch kein Mehrwert im Unternehmen entstanden. Es bedarf der frühzeitigen Fokussierung auf die möglichen Wertbeiträge von IT-Systemen, damit Implementierungsprojekte erfolgreich werden. Es genügt nicht ausschließlich auf Anforderungen zu fokussieren, ohne den ökonomischen Rahmen dieser Anforderungen zu problematisieren.

Der Beitrag skizziert zunächst in der hier gebotenen Kürze Vorgehensmodellen des SE, wobei fokussiert wird, dass in diesen die Identifikation von Wirkungen von IT-Systemen selten bis gar nicht thematisiert werden. Es ist vielmehr zu beobachten, dass die implizite Annahme besteht, dass die Anforderungen aufgrund der Kenntnis desjenigen, der sie stellt, eine wirtschaftlich hinreichende Begründung vorliegt – ggf. durch ein Entscheidungsgremium unterstützt. Auf dieser Erkenntnis basierend wird ein Vorgehen vorgestellt, wie eine holistische und in Implementierungsprojekten integrierte Bestimmung des Wertbeitrages der IT vorgenommen werden kann. Die Integrationsmöglichkeiten eines WBC in Vorgehensmodelle des SE werden in einer phasenorientierten Gegenüberstellung angedeutet.

8.2 Vorgehensmodelle des Software Engineering

Das SE umfasst die systematische und ingenieurmäßige Entwicklung von Software unter Einsatz verschiedener Prinzipien, Methoden sowie Werkzeugen (Balzert 2009). Innerhalb des SE dienen Vorgehensmodelle als Referenzmodell für SE-Prozesse, die spezifische Soll-Vorstellungen bei der Bearbeitung der für die Softwareerstellung erforderlichen Aufgaben repräsentieren (Sommerville 2012): es werden die mit einer Entwicklung eines technischen Systems verbunden Aufgaben nach Mustern strukturiert modelliert (Bremer 1998), so dass sequentielle, iterative, versionsorientierte und andere Prototypenansätze entstehen. Die Vorgehensmodelle stellen Strategien dar, die Ziele verfolgen (mit unterschiedlichen Prioritäten) und einzelne Schritte, die im Projektkontext durch Vorgehensmodelle effektiv und effizient verfolgt werden sollen (Schatten et al. 2010).

Vorgehensmodelle geben damit die Ablauforganisation von Projekten wieder, da die Aufgaben innerhalb der einzelnen Phasen – je nach verfolgtem Vorgehensmodelltyp –

im Sinne des Vorgehensmodells als Referenzmodell Schablonen sind, die für die Ausgestaltung einzelner Projekte verwendet werden können. Die Definition der Aufgaben, deren Reihenfolge und auch die Zuordnung der Aufgaben zu den einzelnen Aufgabenträgern in einem Projekt werden damit erheblich vereinfacht (Kuhrmann and Linssen 2014). Ungeachtet der Ablauflogik der Aufgaben können als essenzielle Aufgaben im SE die (Anforderungs-) Analyse, das Design (Entwurf), die Implementierung und der Systemtest sowie die Produktivnahme des Softwareproduktes (Einsatz) genannt werden (Abbildung 8.1).

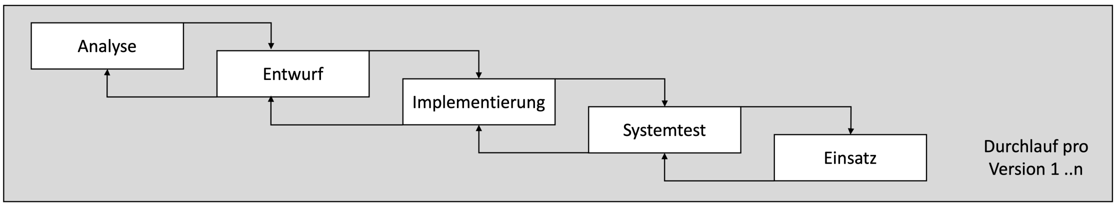

Fig. 8.1: Exemplarisches SE-Vorgehensmodell

Die Wirkungs- und Wertbeitragsbetrachtung der zu entwickelnden Softwareartefakte wird innerhalb dieser essentiellen Aufgaben weder in klassischen noch in agilen Vorgehensmodellen des SE hinreichend operational betrachtet. Bei den älteren Vorgehensmodelle wie dem Wasserfallmodell (Osorio et al. 2011) und dem Spiralmodell (Boehm and Sullivan 2000) ist eine Betrachtung der Wirkung des zu entwickelnden Systems auf die Organisation im Sinne einer Wirkungsanalyse nicht vorhanden. Auch andere traditionelle Vorgehensmodelle wie das V-Modell (Bröhl and Dröschel 1995) und das Rapid Application Development (RAD)-Modell (Martin 1991) betrachten zwar die umzusetzenden Anforderungen, leiten daraus jedoch weder eine dedizierte Wirkungsanalyse ab, noch wird die tatsächliche Erfüllung dieser überwacht (Balaji and Murugaiyan 2012; Beynon-Davies et al. 1999). In Weiterentwicklungen dieser Modelle, wie dem WinWin-Spiral-Modell (Boehm 2003) und dem V-Modell-XT (Broy and Rausch 2005), soll die Anforderungsanalyse durch das frühzeitige und kontinuierliche Einbinden der Stakeholder, im Besonderen des Kunden, verbessert werden. Dieser Gedanke findet sich auch in den umfassenden Arbeiten zum RE (Pohl 2010) wieder, allerdings ist grundsätzlich keine methodisch fundierte Wirkungs- und Wertbeitragsanalyse vorhanden (Biffl et al. 2006; Sullivan et al. 1999).

Gegenwärtig sind im Besonderen agile Vorgehensmodelle wie Scrum, Extreme Programming (XP), Rational Unified Process (RUP), Crystal, Feature Driven Development (FDD) und Dynamic Systems Development Method (DSDM) in der unternehmerischen Praxis weit verbreitet (Hamed and Abushama 2013; Mahanti et al. 2012). Die bereits bei den klassischen Vorgehensmodellen beschriebene Integration des Kunden als Stakeholder in den Entwicklungsprozess stellt bei agilen Vorgehensmodellen eines der grundlegenden Prinzipien dar (Sommerville 2012). Lediglich Scrum und XP sehen einen Versuch einer Wirkungsanalyse in sogenannten „Estimation Meetings“ zu Beginn eines jeden Entwicklungszyklus vor, in denen mögliche Wirkungen der IT-Investition geschätzt werden (Gloger 2016). Angesichts der hier gebotenen Kürze seien diese Schätzungen zunächst positiv bewertet, da sie zumindest den Versuch unternehmen, Wirkungsaspekte im SE zu berücksichtigen. Allerdings handelt es sich bei dieser Aufgabe in agilen Modellen nicht um eine strukturierte Wertbeitragsbetrachtung und noch weniger um ein methodisch korrektes Vorgehen, so dass auch diese Vorgehensmodelle nicht hinreichend einen wesentlichen Zweck von Softwaresystemen beachten: welche Wirkungen sind mit der Software in Organisationen verbunden. Da sich andere agile Vorgehensmodelle, wie RUP, Crystal, DSDM und FDD (Abrahamsson et al. 2002; Anwar 2014; Chang 2010; Paetsch et al. 2003), in diesem Aspekt nicht fundamental von den skizzierten agilen Vorgehensmodellen unterscheiden, lässt sich konstatieren, dass auch bei den agilen Vorgehensmodellen keine hinreichende Betrachtung der Wirkungs- und Wertbeitragsproblematik erfolgt, die eine wissenschaftliche Auseinandersetzung mit der Wirkungs- und Wertbeitragsproblematik und dessen Integrationsanalyse in tradierte Vorgehensmodelle legitimiert.

8.3 Wirkungsidentifikation und Wertbeitragscontrolling

Aus einer ganzheitlichen Perspektive eines Software-Lifecycle-Managements können für die Wirkung dieser in einer Organisation oder auch in einem übergeordneten System aus Sicht des SE vier Phasen unterschieden werden, die Identifikation von Wirkungen, die ökonomische Bewertung dieser, die Abstimmung der Bewertungsergebnisse in der Organisation, damit anschließend mit der letzten Phase auch die Realisierung von Wertbeiträgen erfolgen kann. Der gesamte Prozess wird hier als WBC bezeichnet (Abbildung 8.2) und begleitet die Phasen des SE.[105]

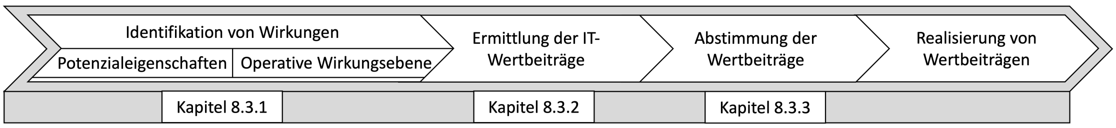

Fig. 8.2: Prozess des IT-Wertbeitragscontrollings

8.3.1 Identifikation der Potentialeigenschaften und operative Wirkungsidentifikation

Die Phase der Wirkungsidentifikation kann anhand der Art der Wirkung von IT-Systemen – sofern beide Wirkungen von dem betrachteten System ausgehen – in die Subphasen der Ermittlung der Potenzialeigenschaften des Systems und der operativen Wirkungsermittlung unterteilt werden.

Die Subphase der Potenzialbetrachtung dient der Bewertung von Potenzialeigenschaften der IT, die sich nicht in einer einzelnen Wirkung materialisieren. Es gilt zu prüfen, ob die IT-Investition im Sinne eines Business-IT-Alignment relevant ist. Dies wäre der

105 Aufgrund der gebotenen Kürze des Beitrags und dem Fokus der Integration in Vorgehensmodelle des SE wird die letzte Phase der Realisierung von Wertbeiträgen nicht näher untersucht.

Fall, sofern eine Strategieanpassung vorgenommen wird, die ohne das neue, technische System nicht umzusetzen wäre (Luftman 2004; Luftman and Brier 1999) oder eine Systementscheidung getroffen wird, die ohne Strategieanpassung nicht möglich wird. Diese grundsätzlichen Wirkungsinterdepedenzen zwischen der strategischen Ebene einerseits und der IT-Ebene andererseits sollen nicht weiter untersucht werden, da diese in der Literatur weithin diskutiert wurden. Für die Wirkungsidentifikation erscheint es wichtiger zu sein, einen Aspekt in die Wirkungsanalyse einzubringen, der bisher nach Auffassung der Autoren eine zu geringe Beachtung gefunden hat: IT als Potenzialeigenschaft, die die strategische Fähigkeitsbasis des Unternehmens betrifft. Diese Potenzialeigenschaften finden in der Verfügbarkeit von Daten, Informationen oder Fähigkeiten durch IT ihren Ausdruck. So sind die Informationen in einem Data Warehouse, ein strategisch konzipiertes Business Intelligence (BI)-System oder eine Plattformlösung zur Verbindung zwei- und mehrseitiger Märkte zu evaluieren.[106]

Einen methodischen Ansatz zur Bewertung von Potenzialeigenschaften bieten Realoptionsansätze (Schulze 2009; Ullrich 2013) an, die in der wirtschaftswissenschaftlichen Literatur seit längerem für Investitionsentscheidungen vorgeschlagen wurden, im Bereich der IT-Investitionen allerdings noch keine Verbreitung erfahren haben. Für analytische Informationssysteme sind andere Wirkungsidentifikationsanalysen erforderlich als bei der die Prozesse und Ressourcen fokussierenden Analysen auf einer operativen Ebene. In der Literatur wird die Identifikation der Wirkung von BI-Systemen nicht sehr intensiv gewürdigt. Die mittlerweile verfügbaren Datenmengen aus Unternehmen und auch über den Wettbewerb eröffnen allerdings neue Wirkungsfelder, die es zu beachten gilt. Welche Wirkung aus der Verfügbarkeit von Informationen über den Wettbewerb, die strategische Position des Unternehmens, das faktische Wettbewerbsverhalten der Wettbewerber bei der Preissetzung des Unternehmens – im Oligopolfall – gefolgert werden können. Diese Aspekte sind neuartig und sollten zukünftig viel umfassender analysiert werden. Es gilt eine Wirkung, insbesondere für den dispositiven Faktor des Unternehmens, zu ermitteln. Dieser Wirkungsaspekt ist im Zuge einer zunehmenden Digitalisierung besonders weitreichend, er dürfte die operative Wirkungsebene zukünftig überlagern. Sofern das IT-Investitionsvorhaben keine strategischen Implikationen hat, so wäre der Mehrwert aus einer Potenzialeigenschaft nicht zu beachten und diese Phase der Wirkungsidentifikation könnte entfallen.

Die Subphase der Wirkungsanalyse auf einer operativen Ebene dient dazu, Wirkungen zu identifiziert und zu dokumentieren. Eine Wirkung beschreibt eine – je nach eingesetztem Verfahren – Beobachtung, Messung der Auswirkungen oder ein Interview mit Mitarbeitern - tatsächliche oder erwartete Veränderung durch ein neues oder verändertes Softwaresystem im Vergleich zur Ausgangssituation. Damit etwas beob-

106Vgl. zu Plattformen in dem hier verstanden Sinne die ökonomischen Überlegungen von Rochet und Tirole (2003).

achtet werden kann, bedarf es vorher der Konzeptualisierung dessen, was Gegenstand der Beobachtung sein soll. Es wird hier die Auffassung vertreten, dass Wirkungskataloge[107] einen ersten wichtigen Ausgangspunkt für einen solchen konzeptionellen Rahmen darstellen. Die in der Literatur propagierten, allgemeinen Wirkungskataloge sind ein Ansatzpunkt, um in Ergänzung von Domänen- und Unternehmensaspekten eine faktische Bewertung vornehmen zu können.

Dabei stellen die Wirkungskataloge in der Regel einen Zusammenhang von beobachtbaren Wirkungen und den entsprechenden Beiträgen zu betriebswirtschaftlichen Zielen dar. Analog zum diffusen Wertbeitragsverständnis gibt es keinen Konsens in der Literatur bezüglich der Anzahl, Definition und Granularität von Wirkungskategorien. Beispielsweise ist die Hierarchie innerhalb existierender Wirkungskataloge wie bei Anselstetter (1984), Shang und Seddon 2002 sowie Kütz (2013) nicht hinreichend auf eine messbare Zieldimension ausgerichtet. Dabei sollten die Wirkungen auf der untersten Ebene messbar sein und auf den obersten Ebenen auf eine Zielgröße hin verdichtet werden können. Der Wirkungskatalog sollte daher dem schematischen Aufbau eines Baumes folgend auf eine quantitative Wirkung als Wurzel konzentriert sein. Unternehmen und IT-Systeme bilden den spezifischen Rahmen für den Wirkungskatalog, die unreflektierte Anwendung eines allgemeinen, aus der Literatur vorgegebenen Wirkungskataloges ist nicht hinreichend für die Identifikation der Wirkungen des IT-Einsatzes. Nach Kesten et al. (2007) lassen sich die Wirkungen von verschiedenen IT-Investitionsobjekten erst auf höheren Abstraktionsebenen auf die gleichen Wirkungskategorien verdichten. Somit ist eine Spezifizierung nach IT-Investitionsobjekt nur auf granularen Ebenen eines hierarchischen Wirkungskataloges notwendig.

Bei der Identifikation der Wirkungen können unterschiedliche Arten von Messungen vorgenommen werden: direkte Messungen wie bei Prozessdurchlaufzeiten oder indirekte Messungen, indem aus den Systemdaten und Logs die Werte – beispielsweise im Rahmen des Process Mining – ermittelt werden (van der Aalst et al. 2007). Die Messwerte setzen dabei immer einen bereits existierenden Prozess oder ein lauffähiges System voraus, während die zu entwickelnden Systeme hinsichtlich ihrer Auswirkungen noch nicht bekannt sind. Daher gilt es auf unternehmensexterne Vergleichsdaten zurückzugreifen (Tallon and Kraemer 2003), so dass vergleichbare Situationen verwendet werden können, um Anhaltspunkte für die Auswirkungsbewertung zu erhalten. Neben der Frage, was wirkt (Wirkungskataloge) und wie diese erfasst werden können (Messungen, Beobachtungen, Interviews) ist auch die Frage zu stellen, wo in einem Unternehmen die Wirkung zu beobachten ist. Es werden hierzu in der Literatur vier

107 Unter einem Wirkungskatalog wird eine referenzartige Auflistung von Wirkungen verstanden, die mit dem Einsatz von IT-Systemen einhergehen können. Wirkungskataloge können beispielsweise den Arbeiten von Gregor et al. (2006) oder Kütz (2013) entnommen werden. Eine Generalisierung von Wertbeiträgen ist nur auf höheren Abstraktionsebenen möglich, die jedoch dann immer mit der Konsequenz einhergehen, dass die Wertbeiträge nicht direkt quantifizierbar sind (Bartsch 2015).

Ebenen differenziert: Arbeitsplatz-, Abteilungs-, Unternehmens- sowie unternehmensübergreifende Ebene.

8.3.2 Ermittlung der IT-Wertbeiträge

Der Wertbeitrag[108] bezeichnet die monetäre Bewertung der in einer Beobachtung erfassten Wirkung. Somit kann der IT-Wertbeitrag nur vollständig ermittelt werden, wenn die Wirkungen zuvor zumindest größtenteils identifiziert wurden. Für Ermittlung der spezifischen Wertbeiträge des untersuchten SE-Vorhabens müssen die zuvor erfassten Wirkungen einer monetären Bewertung unterzogen werden. Dazu werden die beobachteten Wirkungen und ermittelten Potentiale mit möglichen Umsatzeffekten bewertet. In der betrieblichen Praxis werden dazu Methoden der statischen und dynamischen Investitionsrechnung, auch aufgrund ihrer verhältnismäßig einfachen Anwendung, für die Bewertung von IT-Investitionen herangezogen (Heidtmann und Däumler 1997). Die statischen Methoden der Investitionsrechnung wie Kosten-, Gewinn- oder Rentabilitätsvergleichsrechnung sollten für eine umfassende Bewertung jedoch nicht genutzt werden, da sie das Entscheidungsproblem auf zu wenige Entscheidungsparameter reduzieren. Als dynamische Methoden der Investitionsrechnung stehen unter anderem Kapitalwert- oder Annuitätenmethode (Blohm et al. 2012; Götze 2010; 2014; Wöhe et al. 2016) sowie der vollständige Finanzplan zur Verfügung (Grob 1989). Diese Methoden sind jedoch speziell für die beschriebene Entscheidungssituation einer IT-Investition unter Unsicherheit im weiten Sinne und Programmentscheidungen mit einem multikriteriellen Zielumfang ungeeignet (Blohm et al. 2012). Für IT-Investitionsentscheidungen sollten daher die dynamischen Methoden der Investitionsrechnung um weitere Verfahren wie der Szenario-Technik, Sensitivitätsanalyse oder Entscheidungsbaumverfahren ergänzt werden oder Verfahren wie Portfolio Selection, Capital Asset Pricing Model und flexible Investitionsprogrammplanung eingesetzt werden, die diese Entscheidungssituationen abbilden können (Becker and Schütte 2004).

Das idealtypische Ergebnis dieser Phase stellt die Verdichtung aller zuvor ermittelten Wertbeiträge des SE-Vorhabens auf einen Zielbeitrag in einem hierarchischen Wertbeitragsbaum, analog zu den Schilderungen zu einem hierarchischen Wirkungskatalog, dar. In Abbildung 8.3 ist das angesprochene Vorgehen der Wertbeitragshierarchie beispielhaft für die Einführung eines Systems zur automatischen Disposition in einem Handelsunternehmen ausschnitthaft illustriert. Die zuvor bestimmten IT-Wertbeiträge sind in den Blättern dieses Wertbeitragsbaumes enthalten und sind unmittelbar auf eine Zieldimension konvergiert, die in der Wurzel des Baumes situiert ist. In diesem Beispiel ist die Rendite der Investition (Return on Investment) gemessen in Prozent

108 In der Literatur existiert bislang noch kein einheitliches Begriffs- und Definitionsverständnis über den Wertbeitrag der IT (Bannister und Remenyi 2000; Bartsch und Schlagwein 2010; Krcmar 2015; Strecker 2009). Dies liegt vor allem daran, dass der Wertbeitrag vielfach als selbsterklärend angenommen und axiomatisch vorausgesetzt wird (Bartsch und Schlagwein 2010) sowie aus unterschiedlichen Untersuchungsperspektiven betrachtet wird (Neumann 2011).

vom Umsatz als Zielbeitrag in der Hierarchie formuliert worden. So lässt sich der Wertbeitrag des SE-Vorhabens mit einer Kennzahl, dem formulierten Zielbeitrag, kommunizieren.

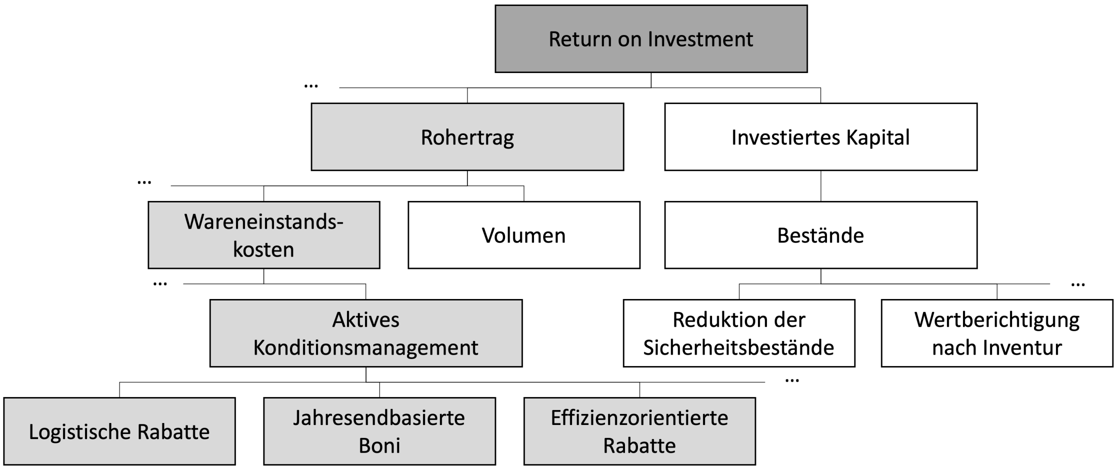

Fig. 8.3: Ausschnitt eines domänenspezifischen Wertbeitragsbaums

Angesichts der Hierarchie der Wertbeiträge, die von einem Softwaresystem ausgehen, könnte der Eindruck entstehen, dass es sich um eine aus dem RE bekannte Hierarchie von Zielen handelt und damit im Kontext der Vorgehensmodelle bereits verwendet wird. Im RE sind Zielhierarchien aus Ansätzen wie dem BMM, i*, KAOS, sowie REF bekannt (Edirisuriya and Zdravkovic 2008; Donzelli 2004), die sowohl qualitative als auch quantitative Ziele des zu erstellenden technischen Artefakts auf ein Oberziel in der Wurzel des Baumes aggregieren (Balzert 2009). Dabei werden Eigenschaften und Anforderungen an das zu erstellende technische Artefakt abgebildet. Beim WBC werden hingegen die betriebswirtschaftlichen Wirkungen, die mit dem technischen Artefakt in einer Organisation angestrebt werden, dargestellt. Somit unterscheiden sich die beiden Instrumente fundamental von dem mit ihnen verfolgten Zweck und dem abgebildeten Inhalt.

8.3.3 Abstimmung der Wertbeiträge

Nach der erfolgten Wirkungsidentifikation und Quantifizierung der IT-Wertbeiträge ist eine projektübergreifende Abstimmung über die zu erzielenden Wertbeiträge sinnvoll. Dazu wird eine weitere Interpersonalisierung über einen Abstimmungsprozess erwogen (Zelewski 2008). In diesen werden sowohl das Management, die IT-Abteilung als auch die beteiligten Fachbereiche involviert. Durch die gemeinsame Abstimmung entsteht im Fachbereich eine hohe Sensibilisierung für das SE-Vorhaben, die damit intendierten Wertbeiträge und mit dem Projektvorgehen einhergehende organisatorischen Veränderungen. Die Detaillierung gibt dem Fachbereich verstärkt Transparenz über die möglichen betriebswirtschaftlichen Wertbeiträge, die auch zum Teil nicht direkt auf das entstehende IT-Artefakt zurückzuführen sind. Die Abstimmung führt ebenfalls zu einer interdisziplinären Analyse der Wertbeiträge aus den Perspektiven der verschiedenen Prozessteilnehmer. Über eine so erfolgte weitere Spezifizierung der Wertbeiträge können präzisere Aussagen zu den zu erwarteten Wertbeiträgen getroffen werden und einzelne Projektaktivitäten weiter priorisiert werden. Die Fachbereiche haben überdies die Möglichkeit Bedenken hinsichtlich des Vorhabens zu artikulieren. Innerhalb des Abstimmungsprozesses werden konkrete Verantwortlichkeiten für die einzelnen Wertbeitragskategorien bestimmt. So liegt die Realisierung einzelner IT-Wertbeiträge im Verantwortungsbereich einzelner, konkret definierter Personen, die als Ansprechpartner fungieren und die Erreichung der Wertbeiträge überwachen und dokumentieren. Es gilt die Wirkungen eines SE-Projektes umzusetzen und für diese Realisierung sind die Profit-Center- oder Budgetverantwortlichen zuständig, die daher den Wertbeiträgen zustimmen müssten, denn andernfalls besteht die Gefahr, dass die Wertbeiträge nicht realisiert werden.

Für eine projektinterne und -übergreifende Abstimmung der Wirkungseffekte und IT-Wertbeiträge ist eine möglichst vollständige und konsistente Dokumentation erforderlich, in der auch die Verantwortlichkeiten für die jeweilige Wertbeitragsrealisierung festgelegt sind. Dazu werden in der Literatur diverse „Methoden“ empfohlen. Beispielhaft sei an dieser Stelle auf Wirkungssteckbriefe zur ausführlichen Beschreibung einer einzelnen Wirkung und Wirkungsketten zur Dokumentation der Zusammenhänge zwischen mehreren Wirkungen eines IT-Systems verwiesen. Wirkungssteckbriefe fassen dabei die Informationen über zum Beispiel Wirkungsort, -richtung, -intensität und Voraussetzungen für den Eintritt der Wirkungen einer einzelnen Wirkung zusammen (Kesten et al. 2007). Diese Steckbriefe lassen sich um die ermittelten Wertbeiträge ergänzen. Abbildung 8.4 illustriert einen Ausschnitt eines Wirkungssteckbriefes für die Wirkung „Reduktion des Zweitverräumungsaufwandes (W08)“ durch die Einführung eines Autodispositionssystems im Einzelhandel.[109]

Autodisposition: Reduktion Aufwand Zweitverräumung (W08)			
Wirkungsort	Fachbereich (Markt)	**Wiederholungscharakter**	Laufend
Voraussetzung für den Eintritt der Wirkungen	Mitarbeiter behalten Verräumungsgeschwindigkeit gleich	**Messung der Wirkung**	Personalaufwand (in h)
	Sortiment bleibt unverändert	**Wirkungshöhe**	Noch zu bewerten
Wirkungsrichtung	Positiv	**Fristigkeit der Wirkung**	Nach Einführung, Verbesserung durch lernfähige Dispositionsalgorithmen
Wirkungsintensität	Stark	**…**	…

Fig. 8.4: Beispielhafter Wirkungssteckbrief zur Zweitverräumung

Die erstellte Dokumentation im Allgemeinen und die Wirkungssteckbriefe im Speziellen stellen die Basis für ein kontinuierliches Controlling der Wertbeiträge innerhalb des

109 Während die Erstverräumung das Verräumen der Ware nach der Anlieferung bezeichnet, ist die Zweitverräumung das Nachräumen aus dem Lager in die Regale (Becker and Schütte 2004).

Einführungsprojektes und darüber hinaus dar. Für die Nachverfolgung der Wirkungen ist es auch wichtig, dass die Umgebungsbedingungen für die Entstehung der Wirkung mitdokumentiert werden, damit diese im Zuge der Wertbeitragsrealisierung auch vorliegen.

8.4 Wertbeitragscontrolling als Prozess und Integration in Vorgehensmodelle des Software Engineering

Das WBC in einem Unternehmen ist nicht isoliert als Teilbereich des Unternehmens-controllings zu etablieren, sondern vor allem im Rahmen von Projekten von Bedeutung. Bei der Investition in IT stellen sich Investitionsentscheidungen als ex-ante-Entscheidungsproblem dar. Dabei ist aber die Realisierung der Schätzungen im Bereich der Entwicklung neuer Systeme und deren Einsatz möglicherweise relevanter für den faktisch in einem Unternehmen entstehenden Softwarenutzen. Die Realisierung der Wertbeiträge setzt damit eine Integration der Überlegungen eines WBC in bestehende SE-Vorgehensmodelle voraus. Im Gegensatz zu der Integrationsüberlegung in der Literatur, die sich auf das Ergebnis einer Fachkonzeptphase fokussiert, wird hier ein WBC über den gesamten Lebenszyklus eines Projektes präferiert. Erst bei einer laufenden Integration kann sichergestellt werden, dass der erwartete Wertbeitrag (aus der erstmaligen Bewertung) und der tatsächlich realisierte Wertbeitrag übereinstimmen (PMI 2008) beziehungsweise Abweichungsfälle begründet werden können. In Abweichungsfällen können zudem geeignete Gegenmaßnahmen initiiert werden oder das SE-Vorhaben gegebenenfalls gänzlich gestoppt werden bevor weitere Investitionen getätigt werden. Die vorrangige Fokussierung auf die Erfüllung der Zeit- und Budgetziele sollte zwingend um die angestrebten Wertbeiträge ergänzt werden (Zwikael and Meredith 2018). In Abbildung 8.5 werden die wesentlichen Phasen eines WBC denen eines exemplarischen Vorgehensmodells – ein versionsorientiertes Modell – gegenübergestellt, um die Integrationsproblematik zu entfalten.[110]

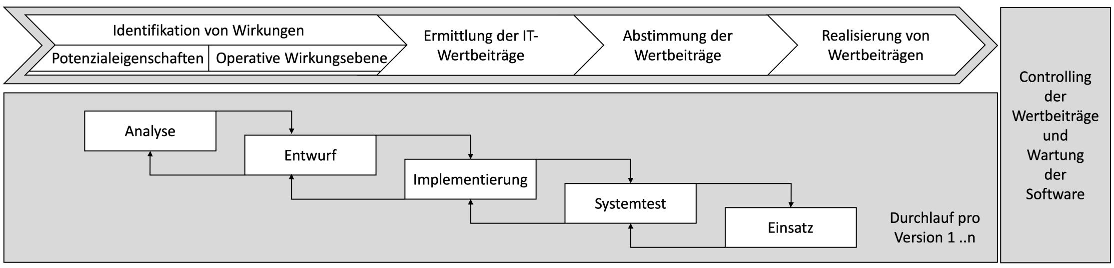

Fig. 8.5: Exemplarische Gegenüberstellung eines Wertbeitragscontrollingprozesses und eines SE-Vorgehensmodells

In der ersten Phase eines jeden Vorgehensmodells werden Anforderungen fokussiert, die als Ergebnis der Analysephase beispielsweise in Anforderungsdokumentationen

110 Es wurde in Abbildung 8.5 ein versionsorientiertes Vorgehensmodell unterstellt, die Integrationsfragen zwischen dem WBC und den Vorgehensmodellen wären auch bei anderen Modellen in ähnlicher Art vorhanden.

münden. Die Anforderungen im Allgemeinen und deren Dokumentation im Speziellen bilden die Koordinationspunkte zum WBC, denn die Wirkungen der Anforderungen, deren Bewertung und deren Voraussetzungen im Zuge einer organisatorischen Implementierung bieten Ansatzpunkte, das WBC in die Vorgehensmodelle zu integrieren. Schließlich kann die Abstimmung der Wertbeiträge auch bei der Diskussion der Anforderungen erfolgen, denn letztlich sollten sich Anforderungen immer an den ökonomischen Wirkungen bemessen lassen, so dass die Methoden der ersten drei Phasen des WBC mit der Analysephase (dem RE) besonders eng verwoben sein sollten.

In den weiteren Phasen werden der Entwurf, die Implementierung und der Einsatz der Software im Unternehmen weitere Aspekte beinhalten, bei denen Wechselwirkungen zwischen einer Wertbeitragsbetrachtung und der Erstellung des technischen Artefakts zu analysieren und zu beachten sind.[111] Besonders evident wird dies in der Phase des „Einsatzes" der Software, denn ohne den Einsatz der Software kann eine Wirkung nicht eintreten und in welchem Umfang die Wirkung zu welchem Zeitpunkt eintritt wird erst nach dem Einsatz des technischen Artefakts final bewertbar. Spätestens ab dem Einsatz wird eine Zusammenführung der Wartungsphase der Software und eines Controllings der Wertbeitragsrealisierung erforderlich, denn mit der Übergabe der Software in den produktiven Betrieb nach Erfüllung der Abnahmekriterien geht das Projekt in ein Produkt über.

Für das IT-Management ist es erforderlich, die empirischen Daten über die Projekte und Produkte zu erfassen, so dass das Projektmanagement, die betroffenen Fachbereiche, die eingeführten Softwareprodukte, der Lebenszyklus der Produkte, et cetera zukünftig aufgrund von Wirkungszusammenhängen gesteuert werden können und nicht auf Basis von subjektiven Einschätzungen. Durch eine solche Entwicklung, die ohne eine Integration des WBC mit Vorgehensmodellen des SE nicht möglich erscheint, würde die Organisation neben dem technischen System Software symbiotisch betrachtet, was für die Wirkung und letztlich auch die Entwicklung der Systeme zwingend ist.

8.5 Zusammenfassung und Ausblick

In klassischen Vorgehensmodellen werden die mit der Software intendierten Wirkungen in einer Organisation nicht als gesonderter Analysegegenstand betrachtet und auch in agilen SE-Vorgehensmodellen wird nur ansatzweise in der Anforderungsanalyse der Aspekt der Wirtschaftlichkeit von Anforderungen postuliert. Daher ist in Zeiten der Digitalisierung, in denen die IT-Systeme für die Organisationen bedeutender werden, eine Bewertung der Systeme ohne Organisationsbezug kaum möglich. Es sollte daher

111 Dieser Umstand wird hier auch als kritisch bewertet. Aufgrund der vielfältigen Ursachen für dieses Phänomen, was nicht zuletzt auch an den involvierten Personen, deren Rollen und Kompetenzen liegt, kann dieser Aspekt hier nicht weiter untersucht werden.

eine Integration des WBC in Vorgehensmodelle des SE erfolgen, denn die Wirkung von Systemen ist mitunter wichtiger als die davon unabhängige Entwicklung von Features im technischen Artefakt Software. Besondere Bedeutung kommt dem RE als Kristallisationspunkt von WBC und SE zu. Daher sollten Anforderungsdokumente des SE um zusätzliche Informationen aus der Wirkungs- und Wertbeitragsdokumentation ergänzt werden. Auch während der Implementierung des technischen Artefaktes sollten die Wertbeiträge überwacht werden, da die Anforderungen und der Unternehmenskontext einer stetigen Veränderung unterliegen sowie die technologische Entwicklung weitere Potentiale heben kann.

Die Realisierung der Wertbeiträge erfolgt erst mit dem produktiven Einsatz des technischen Artefaktes, weil eine Wirkung vor der Inbetriebnahme nicht beobachtet werden kann und auch der spezifische Eintrittszeitpunkt unbekannt ist. Die damit einhergehenden methodischen Probleme werden in der Regel im Softwareproduktmangement in den Unternehmen zu lösen sein. Eine Überleitung der Wertbeiträge aus dem SE-Vorhaben in eine Produktorganisation wird heute nicht praktiziert, obgleich aufgrund von Verschiebungen viele ehemalige Wertbeitragspotentiale erst im Zuge der Produktbetreuung realisiert werden (Termer et al. 2014).

Zukünftige Forschungsbeiträge sollten sich einer weitergehenden Integration und Implementierung des WBC in bestehende SE- und Projektmanagementvorgehensmodelle widmen. Da sich das WBC in diesem Beitrag an einem Phasenmodell orientiert hat, ist die Integration in agile Vorgehensmodelle zu problematisieren. Agile Vorgehensmodelle mit ihren Prinzipien nach einer in der Regel sehr kleinen „Paketierung" von Entwicklungsaufgaben, die in der Regel von einer Kapselung und Serviceorientierung geprägt sind, nehmen eine „Stückelung" des SE-Gesamtvorhabens vor, so dass eine beschleunigte Entwicklung möglich wird. Die Analyse der Wirkung und Wirtschaftlichkeit erscheint beispielsweise bei einem Sprint nur erschwert möglich zu sein. Dies ergibt sich aus einer zeitlichen und einer inhaltlichen Perspektive. Zeitlich dürfte bei der Kurzfristigkeit des Sprints eine längere Analyse zumindest erschwert werden. Inhaltlich besteht das Problem in der Gefahr, dass aus einer betriebswirtschaftlichen Perspektive Interdependenzen „zerschnitten" werden, so dass die Wirkung des im Sprint bereitgestellten Aufgabenumfangs nicht möglich ist. Es ist damit zukünftig zu untersuchen, ob und wie die Wirkungs- und Wertbeitragsbetrachtung in agile Vorgehensmodelle integriert werden können.

Part V

Discussion and Concluding Remarks

9 Critical Reflection

In this chapter, the key findings of the four research papers are summarized and, in particular, the design artifacts of this thesis are presented. The contribution of the research papers to the previously identified research areas in chapter 2 is shown and the practical contribution as well. In addition, the approach of the design science research in this thesis is reviewed to ensure scientific quality. The limitations of this thesis and implications for future research are finally discussed.

9.1 Summary of Key Findings

The overarching research problem was that, due to a lack of theoretical foundations, many companies struggle to identify and assess the business benefits of IT needed to address the phenomenon of digitization. To solve the research problem, the thesis answered the research questions through the design artifacts of the four research papers (Figure 9.1). In Paper IV we derived the value contribution controlling, in which the other IT artifacts of the thesis can be sorted. Papers I, II and III dealt in particular with the phase of identifying the impacts of IT, which was in particular the focus of the thesis. On a strategic level, we use the meta-model of dynamic capabilities profiles (Paper I) and the dynamic capability profiles template (Paper I) to indicate how the potential of IT can be taken into account. We have created the appropriate procedure to derive and to use dynamic capability profiles (Paper I). On the operational level, we recommend the development of a company-specific value catalog (Paper III), which can be supported by our taxonomy of value catalogs (Paper III) and our IT value framework (Paper II). The identification phase is followed by further phases in the holistic process to ensure that the identified IT business value is also monitored. The value contribution controlling can then still be integrated into SE process models (Paper IV) in order to be embedded in IT project management. The key findings of the individual papers are summarized below.

Research paper I considers the IT business value at a strategic level. As a complement to the current IT business value discussion, dynamic capabilities are mentioned in the literature. However, the concept of dynamic capabilities is inconsistent in the literature, as it is also referred to as "patterns" (Zollo and Winter 2002), "potentials" (Barreto 2010), "capacity" (Wolf et al. 2012), "routines" (Daniel et al. 2014), "portfolio" (Soluk and Kammerlander 2021) or "capability" (Helfat et al. 2007). To create a clear understanding of dynamic capabilities and the role of IT in dynamic capabilities, 30 definitions from 1997 to 2022 were identified. It becomes clear that most of the definitions go back to the original definitions of Teece et al. (1997) and Eisenhardt and Martin (2000). To capture the multidimensional concept of dynamic capabilities, we have taken up the idea of dynamic capability profiles from the literature. We then created a meta-model to specify the concept of dynamic capabilities profiles. We

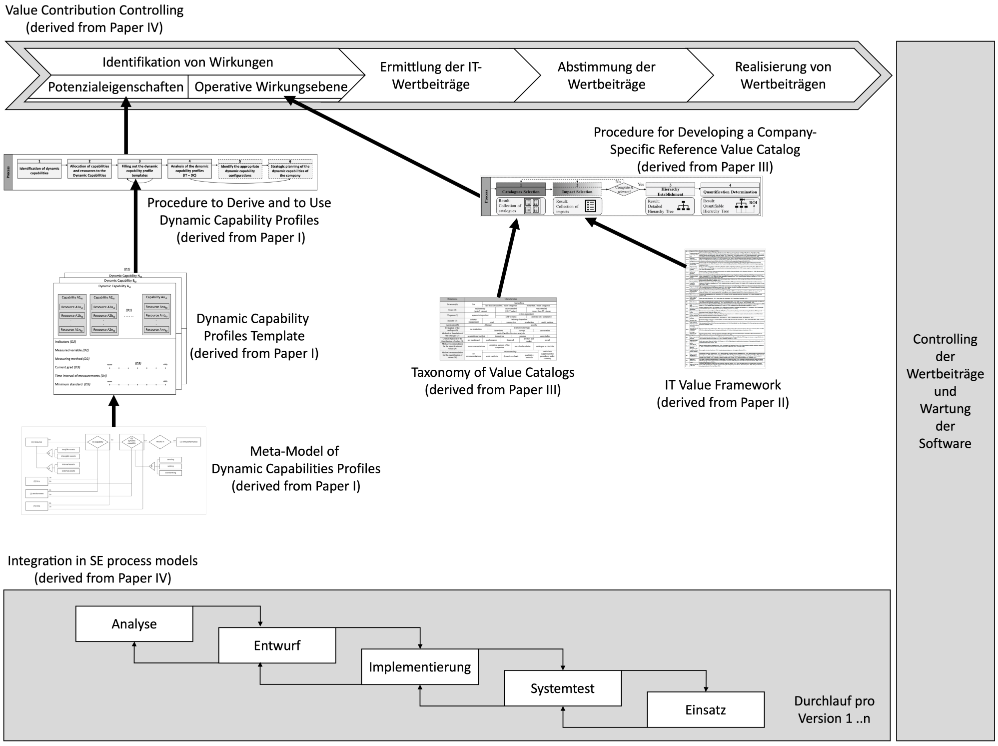

Figure 9.1: Design Artifacts of This Thesis

identified the following entities (1) resources (with can be further differentiated into tangible vs intangible assets, internal vs external assets, and IT vs non-IT assets), (2) firm, (3) environment, (4) time, (5) capability, (6) dynamic capability, (7) firm performance, (8) dynamic capability types, (9) indicators, (10) measured variable, (11) measuring method, (12) current grad, (13) time intervals of measurement, and (14) minimum standard. The part of the meta-model with entities 1-7 also represents the meta-model of dynamic capabilities. Dynamic capabilities concern the existing capabilities of a firm. These capabilities can vary over time and according to different environmental conditions. We would like to emphasize the time period consideration, because this consideration is very neglected in the existing literature on dynamic capabilities. Dynamic capabilities need at least two points in time in which they can be measured. The dynamic nature is characterized in particular by the fact that a capability has changed from time t_0 to at least time t_1. The delta between the points in time represents exactly the way in which the company reacts to environmental changes, which can then become a competitive advantage. Otherwise, only a capability of a firm at a time in a current environment is explained. Entities 1-7 with the entities 8-14 needed to operationalize capabilities, then represents the meta-model of dynamic capability profiles. A dynamic capability profile can be understood as a set of multiple capabilities and their measurement characteristics in a particular organization in a a particular time in a particular environment. The relationships of the entities are mapped in our meta-model. Once the concept of dynamic capability profiles became clear at the strategic level, we were able to develop guidelines that should be followed when assessing dynamic capabilities in companies at the operational level: (D1) Dynamic capabilities should be identified on a company-specific and relevant basis, (D2) indicators and their metrics should be defined for each dynamic capability to make them operationalizable, (D3) dynamic capabilities should be measured by a scale to capture not only the presence but also the quality, (D4) time intervals at which dynamic capabilities are reviewed should be specified, and (D5) a minimum standard should be set for each dynamic capability. From the design guidelines we have created a dynamic capability template, which can be used in practice in order to better capture dynamic capabilities and thus make them manageable. With the help of the dynamic capability profiles, we can also answer the question of how IT influences dynamic capabilities and vice versa. From this, strategic management can also derive the extent to which dynamic capabilities should be further developed in the future and can draw up a corresponding plan. If the dynamic capability profiles are to be implemented in practice, there are a number of steps to be taken. It was important to us that the artifacts we developed could also be used in practice, so we created a procedure for how to proceed.

Overall, paper I answered the first research question, "*How can strategic impact of IT investments be made accessible for IT business value identification?*".

In the second research paper, it becomes clear that although IT business value is already widely discussed in the literature, its decomposition and assessment at a more detailed level is ambiguous in literature and practice. Therefore we suggest a hierarchical decomposition of the IT business value. Optimally, the IT business value (Level 1) should be hierarchically decomposed into aggregated values (Level 2), and observable, atomic impacts (Level 3). IT impacts can be characterized in six dimensions. First, IT impacts can be assigned to a business unit of the company. We followed the business units of Porter (1985a)'s value chain (Logistics, Operations, Marketing & Sales, Service, Procurement, Technology Development and Human Resources). We added Cross-Organizational-Activities, which includes activities which usually supports the entire value chain and not the previously mentioned activities. Second, IT impacts can be divided into tangible and intangible impacts. Compared to tangible impacts, intangible impacts are more difficult to capture in economic evaluations. Third, a distinction can be made as to whether an impact can be attributed to an individual level, a firm level, or an industry level. Fourth, an impact can be distinguished as to whether it can be assigned to an operational process performance or a management process performance. Fifth, IT impacts can occur at different times. For this reason, a distinction can be made between immediate and anticipated impacts. Lastly, a distinction can be made between positive and negative impacts. In order to better understand the impacts mentioned in the literature, we conducted a structured literature review following Webster and Watson (2002) to identify value catalogs including atomic IT impacts. In total, we were able to identify 682 IT impacts on level 3 from the literature, which we subjected to a qualitative content analysis in a further step. The individual impacts were then independently assigned to the different characteristics of the dimensions by five pre-trained coders. We then applied hierarchical clustering to the coded impacts and obtained 29 clusters that can be classified as archetypical IT impacts at level 3 in the decomposition of IT business values. We have used an aggregated term to describe the clusters and assigned them to the respective business sectors, as this can be seen as a key differentiation in our cluster. We provide an IT value framework in which exemplary impacts for all aggregated values are listed. For each exemplary impact, we have listed additional literature. We choose the perspective of key business areas to guide practitioners in identifying potential impacts and provide insights on individual impacts.

After clarifying in the second research paper what can be understood by IT business value in terms of concrete impacts, the third research paper is addressing the development of a reference value catalog for a company-specific assessment of the IT business value. To develop a company-specific value catalog, several steps are necessary: (1) catalog selection, (2) impact selection, (3) hierarchy establishment, and (4) quantification determination. In our paper we focused on the first step. To do this, we first identified the requirements for value catalogs. First, value catalogs should contain the possible impacts of an IT investment that can be observed in reality. An IT reference value catalog is an option to avoid having to determine the impacts again in every new IT investment situation. Second, it is necessary that value catalogs can be adapted to the individual context of a company. Third, the impacts to be observed at the bottom of the value catalog must be included, which in turn can be aggregated at higher levels. The value catalog should then end in an one-dimensional target dimension representing IT business value. Fourth, impacts must be quantifiable. Within the framework of the design science research methodology, we then developed a taxonomy following Nickerson et al. (2013) for the development of the reference value catalog. We identified 32 value catalogs from related literature. The taxonomy should describe and be used to classify existing value catalogs. The dimensions and characteristics were derived independently by three researcher knowledgeable in the context of IT business value and IT impacts. Our developed taxonomy has 10 dimensions (structure, scope, IT system, industry, application, evaluation of the catalog, methodical foundation of the catalog, overall objective of the identification of values, method recommendation for the identification of values, method recommendations for the quantification of values) with a total of 33 characteristics. We found that 91 % of our analyzed value catalogs are system-independent and 84 % are industry-independent, which indicates that most value catalogs are rather abstract and thus have to be applied in a broad sense, but still have to be concretized for a specific company. For step 2 in the development of a company-specific catalog of values, we observed that 60 % of the catalogs of values are based only on literature research and thus do not capture possible impacts from current practice. To add further aspects to the existing catalogs, further analyses, e.g., of practice-oriented literature or interviews with IT managers, are necessary. For step 3, we found out that none of the analyzed IT value catalogs aggregates the IT business value to an one-dimensional root value. Over 50 % of the catalogs specify a maximum of three main categories. Hence, these value catalogs can support decision-makers with possible IT business value for an IT investment but do not result in single objective comparable root values. For step 4 we analyzed, that only 12,5 % of the value catalogs provide methods for the quantification of impacts under uncertainty. Although value catalogs are a good starting point for developing a company-specific catalog, the aspects mentioned above still need to be taken into account.

Overall, papers II and III answered the second research question, "*How can impacts of an IT investment be identified on an operational level in a company?*".

The fourth research paper presents a holistic approach for the IT project management to handle the impact identification and controlling the IT business value that includes the (1) identification of impacts in a specific investment project, (2) the evaluation of the impacts, (3) the coordination in an organization about the evaluation, and (4) the realization. We called this process value contribution controlling (VCC). In the identification of impacts, a distinction can be made between the identification of potential properties, e.g., by means of dynamic capability profiles, and the operational identification of impacts, e.g., by means of value catalogs. In case of the potential properties, it is important to check whether the IT investment is relevant in the sense of an IT business alignment, as this could entail a strategy adjustment of the company. Analytical information systems require different analyses than process or resource-focused analyses at the operational level. Value catalogs can play a relevant role in the operational identification of impacts, since they represent a connection between observable impacts and business objectives. When assessing impacts, the identified impacts must be valued in monetary terms. For this purpose, procedures from investment appraisal are typically used. The ideal result of this phase is the condensation of all previously determined value contributions to a target value in a hierarchical value contribution tree. This then allows the value contribution of an IT investment project to be expressed in a key figure. The key performance indicator can then be discussed with the business units in the phase of coordinating the value contributions. This coordination then creates an awareness in the business unit for the SE project and the value contributions intended with it and the organizational changes associated with the project. Impact profiles are a way to record the agreed-upon information about the direction of impact, the location of impact, the intensity of impact, and the preconditions for impact. After implementation, the realized value contributions can then be recorded. The VCC process should not be viewed in isolation as a subarea of corporate controlling, but should be taken into account in IT projects in particular. Software development process models focus on meeting time, budget, and content requirements, but neglect the intended value proposition of the IT investment. Some process models consider the requirements to be implemented, but do not derive a dedicated impact analysis. However, it is only when integration is ongoing that it can be ensured that the effects expected beforehand and the effects that are actually realized actually match. If there is no match, countermeasures can be initiated or the investment project can be stopped before further investments follow. For this reason, we have compared the VCC process and a SE process model as examples. The identification of the impacts can be carried out in the "analysis" and "design" phases. The requirements and their documentation are the links to the VCC, which can then be added to the effects of the requirements, their evaluation and their prerequisites. This enrichment of the analysis documents of requirements engineering is relevant to integrate the process with each other. But even during the implementation of the technical artifact, the value contributions should be monitored, since the requirements and the corporate context are subject to constant change, and technological development can leverage further potential. The realization of the value contributions then only takes place with the productive use of the technical artifact.

Overall, paper IV answered the third research question, "*How can companies achieve targeted management of the IT business value, which includes the identification of impacts?*".

9.2 Contribution to Research and Practice

The contributions of the thesis are to develop a better understanding and identification of the strategic (Research Question 1) and operational (Research Question 2) impacts of IT investments and to provide a concrete procedure for the identification and assessment of the IT business value (Research Question 3), which can then be implemented in practice. These objectives were achieved through the four research papers. The specific contributions to research of the individual papers will be discussed in more detail below, based on the research areas of IT business value research from chapter 2. The contributions to the research areas are complemented by the practical contributions.

In the research area "*Ambiguity and Fuzziness of the IT Business Value Construct*", the state-of-the-art analysis in the chapter 2 has shown that the construct of IT business value has received little attention in the last years, and if it has, it has been focused primarily on assessment and more precisely on measurement methods. The explicit consideration of the impacts of an IT investment was neglected, which, however, are important in order to be able to assess the IT business value. This is because it is important to know what impacts are to be assessed, otherwise they will not be captured by the measurement methods at all. This gap was overcome by this thesis through research papers II and III. Our IT value framework provides an overview of the impacts already known from the literature and summarizes them into archetypal impacts, which can serve as an orientation for operational impact identification in companies (Paper II). For the operational impact identification, we provided a procedure in which companies can develop their own reference value catalog, which can then be reused for a new IT investments (Paper III). This catalog contains the IT project and company-specific impacts in a hierarchical structure. In addition to the development of a precise approach for the identification of IT business value impacts, clarity was also achieved with regard to (existing) value catalogs. The identification of value catalogs is difficult due to the lack of a uniform use of terms. To this purpose, we have established requirements for a value catalog and worked out the characteristics (Paper III). The taxonomy developed from this in turn helps in the selection of an appropriate value catalogs in relation to the process for the creation of a company-specific catalog. The artifacts of Paper II and III allow an operational IT impact identification to be performed in any practical context, which was not possible with previous frameworks.

In the research area "*Neglected Disaggregation of IT investments*", the input factors of an IT investment are discussed. Dynamic capabilities as a complement to previous IT business value research are difficult to break down at the strategic level. Through our meta-model, we have contributed to breaking down dynamic capabilities and thereby also making them measurable and manageable (Paper I). This has made it clear that dynamic capabilities are a multidimensional construct which are influenced by IT, but which can also themselves influence IT in companies. The relationship is mapped in the meta-model via the connections of the entities and should be considered in an IT business value analysis.

The research area "*Creation Process as a Grey Box*", has so far investigated which assets, capabilities and their relationships have a direct or indirect influence on the performance of the company. In this research area, we were able to contribute with our dynamic capability profile template (Paper I) so that the effects of new IT investments can also be tracked using indicators. The automatic (e.g., through process mining) or manual (e.g., through interviews) recording of indicators makes the creation process more transparent.

In the newly added research area "*Holistic Procedure to Identify and Evaluate IT Business Value*", which calls for a holistic perspective on IT business value, there are individual papers that take a more overarching view of individual parts of the impact process. For the first time, we presented a procedure that takes into account the impact consideration over the entire IT investment project lifecycle, which includes the actions for IT business value identification and assessment (Paper IV). In addition, we were able to demonstrate an initial approach to integrating value contribution controlling into SE process models, which represents a holistic management process for IT investments in organizations (Paper IV).

Overall, the thesis can be a valuable guide for managers who would like to capture the identification of impacts of IT investments in their company in a more structured way. We were able to create an overarching process that can serve as an orientation for holistic value contribution controlling (Paper IV). The above-mentioned phases can be further differentiated by the managers and adapted to their own company. Paper IV indicates which tasks are relevant in the phases and should be taken into account, so that recommendations for action are given for the identification and assessment of the IT business value (such as the use of impact profiles to document preconditions for the occurrence of impacts). For the identification phase in particular, we can offer further assistance with additional artifacts that have been developed. Through our taxonomy of value catalogs, we support the selection of a suitable value catalog (Paper II). Managers can select more suitable catalogs, for example, by the characteristics of the industry or by the type of IT system. An overview of all the catalogs we have identified can also be found in the appendix 6.7.1. Our IT value framework also provides further guidance on the impacts that can be expected in a company, since not all impacts in particular are covered in one value catalog. We also recommend the creation of a company-specific value catalog, so that the process does not have to be started anew with every new IT investment, because the industry in which the company operates remains the same (Paper III). However, this company-specific catalog should be regarded as dynamic and supplemented as necessary in the case of new IT investments, e.g., if a new type of IT system is introduced that did not exist previously. This can prevent relevant impacts from being overlooked and not being recorded. This also applies in particular to the strategic capabilities. Up to now, these have been given too little consideration in IT business value assessment. Paper I is intended to raise awareness of this and initial approaches have been mentioned as to how these can be operationalized, which is relevant for management. All in all, the thesis is a helpful starting point to drive the consideration of IT business value in companies and also highlights the relevance of the analysis of the IT business value.

After the contribution of the individual papers and the entire thesis for researcher and manager has been made clear, the evaluation of the design science research of this thesis will be shown below in order to illustrate that the thesis has fulfilled the criteria of design science research.

9.3 Evaluation of the Design Science Research

According to Hevner et al. (2004), seven guidelines should be met in order for the design science research to meet the scientific recognition as in behavioral science research (Zelewski 2007). These seven guidelines are often used as evaluation criteria[112] (Venable 2010) and are applied to this thesis.

112 Nevertheless, there is some debate in the literature as to whether the guidelines should be used as criteria for evaluating DSR (Venable et al. 2012). In the study by Venable et al. (2012), survey

The first criteria describes that "Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation" (Hevner et al. 2004, p. 83). An overview of the artifacts of this thesis and their interrelationships can be found in figure 9.1. In paper I we produced a construct[113] (meta-model of dynamic capabilities profiles), a model (dynamic capability profiles template), and a method (procedure to derive and to use dynamic capability profiles), in paper II we developed a model (IT value framework), in paper III we derived a model (taxonomy of value catalogs) and a method (process for developing a company-specific value catalog), and in paper IV we developed a method (value contribution controlling) and a model (integration in SE process models). The artifacts should serve to fulfill a task that solves an important problem in reality (Zelewski 2007). The innovation of the new artifacts should become clear. To the best of our knowledge, no or only insufficient procedure exists to date for creating a company-specific value catalog or a holistic approach to controlling IT business value. With the artifacts we have developed, it is possible to capture the identification of impacts of IT investments in a company in a structured way. In addition, the thesis provides indications of what should be taken into account when considering IT business value over an entire IT investment project. The thesis is a helpful starting point to drive the consideration of IT business value in companies and also highlights the relevance of the analysis of the IT business value. We have thus taken a major step forward in IT business value research, as the targeted use of the constructed artifacts can solve an important business problem, more specifically, the identification of IT impacts in order to be able to evaluate an IT

respondents alerts that the guidelines are used as a checklist (Hevner and Chatterjee (2010) provide a checklist with 8 questions) to judge whether DSR publications meet all criteria and should be published. One respondent points out that it would not be possible to cover all the guidelines in one paper or thesis. This is due to the complex build/evaluation cycle of DSR on the one hand and the fact that research papers are also page-limited on the other. He suggests a differentiation into "construction papers" and "evaluation papers". In the sense of this differentiation, the four papers of this thesis can all be assigned to the "construction papers", which thus have weaknesses in the evaluation (more on this in the third evaluation criterion below). The annotation of Venable et al. (2012) is consistent with the findings of Indulska and Recker (2010), which found that 22.8 % of the DSR papers studied focus on only one guideline, 7 % focus on some, and 19.3 % focus on all. However, 36.8 % simply stated that they follow the DSR guidelines, but did not elaborate on how the seven guidelines apply to their work or how they implement and/or execute the guidelines. Further weaknesses of the individual guidelines as criteria can be taken from e.g., Arnott and Pervan (2008). Despite the criticism, the guidelines characterize the DSR and should be used as an orientation for this thesis. In particular, guideline 1 (create innovative artifacts) and 6 (construct artifacts in a search process) are indicative of the construction-oriented research paradigm (Zelewski 2007). The other guidelines can also be applied to other paradigms and are more generic (Zelewski 2007).

113 "IT artifacts are broadly defined as constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), and instantiations (implemented and prototype systems)" (Hevner et al. 2004, p. 77). Offermann et al. (2010) expands the view to include other IT artifacts that can be found in the DSR literature. Based on the findings of Hevner et al. (2004) and Offermann et al. (2010), Prat et al. (2015) assigns, for example, a taxonomy, a framework, an architecture, and a requirements to the model. A meta-model, on the other hand, can be assigned to the construct. This thesis follows this classification, although it should be mentioned that in Vaishnavi and Kuechler (2004), for example, a framework is evaluated as a separate IT artifact. Instead of four, they then have 8 outputs of design science research. Since the more detailed classification is not required for this thesis, we will stick to the aforementioned classification of Prat et al. (2015) as defined in chapter 4.1.

investment based on the IT business value. The first evaluation criterion according to Hevner et al. (2004) is therefore fulfilled.

The second evaluation criterion states that the objective of the research is "to develop technology-based solutions to important and relevant business problems" (Hevner et al. 2004, p. 83). Through the motivation in chapter 1 it became clear that the thesis deals with a real problem in business. The penetration of companies with digitalization affects all companies, regardless of industry. The right way to deal with the associated IT investments is at a more strategic level in top management and at a more operational level in IT project management. Managers are increasingly emphasizing the importance of the benefit of IT. Methods are also adapted to the IT business value perspective. In scrum, for example, the product goal was added to make the overall goal clearer to the team (Schwaber and Sutherland 2020), which highlights the significance. This shows an interest from the practice to clarify the benefit of IT systems. But the relevance of IT business value research is also emphasized in science: "We propose that IT value research represents an important stream of work that deals with business value" (Kohli and Grover 2008, p. 24), "Despite the importance to researchers, managers, and policy makers of how information technology (IT) contributes to organizational performance, there is uncertainty and debate about what we know and don't know" (Melville et al. 2004, p. 283), "Business and information systems (IS) executives continue to struggle with a host of complex issues involved in determining payoffs from investments in information technology" (Tallon et al. 2000, p. 146), "The role of IT in organizational performance is an important subject in the field of information systems research, especially as regards their potential to create value" (Wamba-Taguimdje et al. 2020, p. 1899), and "Our study highlights the importance of understanding both enablers and inhibitors in IT business value research" (Perdana et al. 2022, p. 1). Melville et al. (2004) also emphasizes the importance for policy makers[114] as a further perspective in addition to researchers and managers. The second evaluation criterion is also fulfilled by the relevance judgments of the managers as well as the researcher.

The third criterion is that "[t]he utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods" (Hevner et al. 2004, p. 83). March and Smith (1995) suggest differentiated evaluation criteria for DSR artifacts, which depend on the type of artifact.[115] For a construct the criteria "completeness, simplicity, elegance, understandability, and ease of use" (March and Smith 1995, p. 261) can be applied, for a model "fidelity with real world phenomena, completeness, level of detail, robustness, and internal consistency" (March and Smith

114 The focus of the work is on companies, so the political perspective is neglected.

115 The IS community is intensely concerned with evaluation criteria, as they are inadequately and inconsistently used (Venable et al. 2012). Venable et al. (2012) describes a pre-hevner phase, the hevner phase and a post-hevner phase. For further evaluation approaches, refer to Venable et al. (2012).

1995, p. 261), for a method "operationality[116] [...], efficiency, generality, and ease of use" (March and Smith 1995, p. 261), and for an instantitions "efficiency and effectiveness o the artifact and its impacts on the environment and its users" (March and Smith 1995, p. 261). The evaluation of the artifacts is for Hevner et al. (2004, p. 85) a "crucial component of the research process". We use the informed arguments[117], which use information from the knowledge base to justify the utility of the artifact (Hevner et al. 2004). This is a descriptive evaluation method (Venable et al. 2012) that can be applied to DSR artifacts (Peffers et al. 2012). Thus the third criterion is fulfilled.

The fourth criterion serves to advance knowledge (Zelewski 2007), because "Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies" (Hevner et al. 2004, p. 83). The progress in knowledge can be achieved through generally three ways: novelty, generality, and significance (Zelewski 2007). When creating, for example, the procedure for developing a company-specific value catalog, we drew on the existing value catalogs and made them manageable through our taxonomy for selecting a appropriate value catalog. In this way, we were able to apply existing knowledge in a novel way, thus creating a new contribution. The contribution for research and for practice was shown in chapter 9.2 for the individual papers and the thesis as a whole. For research, IT business value research was expanded, particularly in the field of identifying the impact of IT investments. For practice, the thesis can be a valuable guide for managers who would like to capture the identification of impacts of IT investments in their company in a more structured way. Through the new progress in knowledge, the fourth criterion is met.

The fifth criterion concerns the methods used, because "Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact" (Hevner et al. 2004, p. 83). It is particularly important that there is scientific rigor, which means consistent definitions, internal consistency, and a formal language representation of the issues addressed (Zelewski 2007). The methods used in the individual papers are described in chapter 4 and in detail in the individual papers. In each case, reasons were also given as to why the selected method appeared to be suitable for dealing with the respective research question. For example serves the development of a taxonomy the description objective from a research perspective by providing transparency about one important aspect of IS research (Gregor 2006) and

116 Operationality is "the the ability to perform the intended task or the ability of humans to effectively use the method if it is not algorithmic" (March and Smith 1995, p. 261).

117 Alternatives are observational methods such as a case study and a field study, analytical methods such as static analysis, architecture analysis, optimization, and dynamic analysis, experimental methods such as a controlled experiment and a simulation, testing methods such as functional testing and structural testing, and descriptive methods such as scenarios (Hevner et al. 2004). However, it should be noted that the evaluation method should also always fit the constructed artifact (Hevner et al. 2004).

a structured literature review is useful at the beginning of a research project (Okoli and Schabram 2010; Rowe 2014). The definitions of the central terms of this thesis have been used consistently throughout the thesis. This is particularly relevant in the context of IT business value, as many different terms are used in the literature for one construct, some of which are also used as synonyms, and some of which are not (e.g., digitization vs. digitalization, benefits vs. value, dynamic capabilities vs. capabilities). This also leads to the fact that the existing literature must always be critically reflected in order to capture the understanding of the respective authors. In particular, in the paper on dynamic capabilities, we have strived for a clear understanding of the terms and therefore also established the meta-model for dynamic capabilities. The consistency is given across all four papers of this thesis, so that the fifth criterion is met.

The sixth criterion describes "The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment" (Hevner et al. 2004, p. 83). In this thesis, for example, the IT value framework was used as a satisfactory problem solution. Because there are a myriad of types and business sectors, the impacts of IT investments can also be correspondingly diverse. However, the impacts on level 2 are intended to provide an orientation with which managers can approach the IT business value identification. The characterization of IT impacts in the taxonomy of IT impacts to set up the framework, for example, was also not always clear. While it was relatively clear whether the IT impact was a positive or negative impact, the time of occurrence was not always obvious. Through discussions among the coders, it was then possible to settle on a characteristic (results see table 6.4). Through the further appendix of the papers, the results of the papers can be followed. The process leading to the results is thus presented transparently. So that with this thesis we also satisfy the sixth criterion.

The seventh and final criterion describes the target group to which design science research is directed. "Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences" (Hevner et al. 2004, p. 83). By considering IT business value highly within the context of a socio-technical system, both target groups are addressed. The research results are especially appropriate for the management of the company and the IT project management, who have been given a procedure on how to proceed in identifying IT impacts. This has enabled us to ensure adequate communication of our research findings. In addition, three of the four papers were published and presented at information systems conferences (International Conference on Enterprise Information Systems 2021, European Conference on Information Systems 2021, and Tagung der Fachgruppen Vorgehensmodelle und Projektmanagement im Fachgebiet der Wirtschaftsinformatik der Gesellschaft für Informatik e.V. 2019), which also led to an exchange with the IS community. The latter conference, which is also more practice-oriented than the other two conferences, also confirmed the relevance for practice, as they highly appreciated our scientific results. Thus the seventh criterion is also fulfilled, which leads to the statement that this thesis meets the requirements of a scientific work[118] from Hevner et al. (2004)'s perspective.

Nevertheless the results of this thesis must be viewed critically, as the papers also have some limitations, which then lead to further research.

9.4 Limitations and Implications for Future Research

Despite the contribution to research and practice there are some limitation of the thesis, which should be overcome by further research. The limitations and the resulting implications for future work from the individual papers are mentioned, followed by the limitations and implications overarching the IT Business Value. For each identified limitation, a follow-up research endeavor is formulated and a research path is suggested. One research path is highlighted and further thoughts are mentioned.

9.4.1 Future Research based on the IT Business Value Research Areas

A brief summary of future research based on the IT business value research areas can be found in table 9.1. The table contains the research gaps (which were derived from the paper's limitations) and the corresponding research endeavor, each assigned to the areas of IT business value research from chapter 2. It also shows research paths for future work.

Research Gaps	**Research Endeavor**	**Research Paths**
Research Area: Ambiguity and Fuzziness of the IT Business Value Construct		
Analysis of the entire IT business value spectrum in the literature (derived from the state-of-the-art analysis)	Which papers (also from other scientific disciplines) and synonyms of IT business value need to be included in an analysis to get an entire overview?	Inclusion of other research strings in the literature review such as productivity, benefit, impact, benefits, potential, and value of IT. Inclusion of other scientific disciplines in the literature review such as business administration, computer science, psychology, and economics.
Evaluation of the IT value framework in practice (derived from paper II)	How can the IT value framework be adapted or expanded based on feedback from the field in order to improve its applicability?	Inclusion of also practice-oriented literature in order to further enrich previous scientific results. Addition of further impacts to the IT value framework. Conducting expert interviews and incorporating feedback into the IT value framework.

118 However, we did not evaluate the extent to which the individual criteria were met. While the thesis can be rated as strong on the second criterion, for example, evaluation, the third criterion, using other methods is still necessary for the future in order to also obtain direct feedback from the field and to further improve the research results.

Table 9.1 continued from previous page

Research Gaps	Research Endeavor	Research Paths
Application of existing value catalogs (derived from paper II and III)	To what extent is the application of value catalogs still valid in today's world, or how would value catalogs have to be adapted in order to holistically cover today's IT investments?	Distinction between the more abstract and the more concrete value catalogs. Exemplary investigation of the impacts of a current technology such as cloud computing and analysis of the extent to which the selected value catalog covers the impacts, which can be evaluated by expert interviews.
Making the value catalogs configurable for specific IT investments decisions and industries (derived from paper III)	How can value catalogs be customized even more specifically for IT systems and/or industries?	Formulation of guiding questions to better identify the typical impacts for a system-specific and industry-specific IT investment.
Research Area: Creation Process as a Grey Box		
Process Mining as support for IT business value measurements (derived from paper I)	How can process mining help to better understand the creation process and what opportunities does it offer for measurement?	Conducting a case study in a company to collect qualitative data and test applicability.
Research Area: Neglected Disaggregation of IT Investments		
Relevance of dynamic capabilities (derived from paper I)	Do dynamic capabilities exist that are more relevant than other dynamic capabilities?	Identification of necessary and sufficient capabilities through the analysis of dynamic capability combinations in different companies.
Research Area: Holistic Procedure to Identify and Evaluate the IT Business Value		
Detailing the holistic approach (derived from paper IV)	How must the holistic approach be further developed in order to be applicable in practice?	Development of a structured process model with the individual steps (e.g., with BPMN) that are run through in the identification and evaluation of the IT business value with the assignment of which effects can be realized under which conditions at which point in time.
Integration of the VCC in agile process models (derived from paper IV)	How can the key aspects of IT business values be integrated into existing process models?	Application of the VCC to a selected agile process model and creation of a universal process, which can also be applied to other process models, or a specific process for exactly that process model.
All Research Areas		
Development of IT applications for supporting identification of the IT Business Value (derived from paper I, II, III, IV)	How should an IT application (either isolated or integrated into existing IT project management tools) be designed to support the value contribution controlling process?	Development of a prototype that covers the individual steps of IT business value controlling and implementation in a case study.

Table 9.1: Further Research Fields Derived from the Papers of This Thesis

The results of the literature review in the state of the art analysis are based on the identified research areas from the literature review by Schryen (2013), which have been adopted and expanded. Research currently focuses primarily on the creation process in firms, while this thesis is more related to the other research areas. From a methodological point of view, the literature review is limited to the search string "IT Business Value" and the journals and conferences included. However, it became clear that IT business value is considered and analyzed under many different terms in the literature. This makes it difficult to get a complete picture of the research areas.

For this reason, the literature reviews for the state-of-the-art of the IT business value are helpful as a basis, but do not cover the entire spectrum of it. The aim was to be able to assign the research area and the papers written in the IS discipline to the different research areas in order to get an overview of the key issues in the topic area, which was achieved. For a complete state of the art analysis, further search strings must be included and other scientific disciplines must also be considered. It is also advisable to update the results in the near future through the many publications on the topic and the rapid developments in the internal and external environment. In line with the challenges that no consistent term is used in the literature, the paper on the IT value framework is limited to the identified impacts of an IT investment and to the classification by the key business functions. Other classification possibilities would also be conceivable. In addition to considering a different perspective in the IT Value Framework, future papers should also consider its applicability in practice. Due to rapid technological developments, new impacts may arise that have not yet been taken into account. For this reason, the IT value framework should be regularly updated and expanded. In addition, the paper mainly focused on scientific literature. However, IT business value is also a very practice-oriented topic, which means that further practice-oriented literature will be included in further research work in order to also include findings from practice and to take them into account in the future design of tools / procedures. For example, it would be helpful to supplement the developed IT Business Value Framework with further impacts from practice. Conducting expert interviews and incorporating feedback into the IT Value Framework would help to further increase its application in practice.

In paper II and paper III, the limitation also became clear that some of the value catalogs were developed over 20 years ago (e.g., Anselstetter (1984); Dos Santos (1991); Mirani and Lederer (1998); Petrovic (1994); Shang and Seddon (2000); Weill and Broadbent (1998)) and the question arises as to whether they are still valid today. Due to the rapid technological changes, impacts can be added that were not previously taken into account. Due to the fact that most catalogs are only intended as orientation and describe the impacts only abstractly, the catalogs are actually suitable as a starting point. The more concrete catalogs, on the other hand, should not be seen as something static, but can be added to at any time. Reference value catalogs should be seen as something dynamic and should be reviewed after and before each IT investment project.

In paper III the procedure for compiling a company-specific reference value catalog is presented. The approach is limited in the sense that it should be configurable for specific IT investment decisions and industries. Future Research might be formulate guiding questions to better identify the typical impacts for a system- and industry-specific IT investment could be a solution approach. This can make the procedure even more useful in practice.

In paper I it was concluded that process mining could be an interesting approach to make IT even more measurable and thus manageable. Process mining uses data from the event logs of IT systems to enable a variety of analyses such as "(automated) process discovery (i.e., extracting process models from an event log), conformance checking (i.e., monitoring deviations by comparing model and log), social network/organizational mining, automated construction of simulation models, model extension, model repair, case prediction, and history-based recommendations" (Van Der Aalst et al. 2012, p. 172). From this it can be concluded that the impacts of IT systems can be recorded by means of process mining for the old system in order to determine the current status. After the introduction of the new system, the event logs of the new system could be recorded in order to compare the impacts of the two systems (Schütte et al. 2022b). For example, a positive effect would be a time saving due to the new IT investment. Furthermore, potentials for new IT investments could be identified that could have new impacts (Schütte et al. 2022b). Nevertheless, this procedure can only automatically take into account the process information that is already mapped in the company's IT systems (Van Der Aalst et al. 2012). Manual activities are not captured, but this could still be a step towards further operationalizing IT impacts. To explore this, a case study is a suitable option to clarify to what extent process mining can be used in IT business value identification and assessment. For the case study design, for example, the steps of Yin (2009) can be followed.

Paper I lays the foundation for operationalizing and managing dynamic capabilities. In order to be able to develop dynamic capabilities strategically in the future, the question arises as to which dynamic capabilities a company should focus on. The assumption here is that certain dynamic capabilities appear to be more important than others. Since there are still no statements on this in IS research, it would be interesting to identify the necessary capabilities by analyzing dynamic capability combinations in different companies. Necessary condition analysis (NCA) and qualitative comparative analysis (QCA) can be used for this.

Paper IV presents the phases of value contribution controlling. These need to be further detailed in order to be able to apply them in practice. For this purpose, a detailed process model (e.g., with Business Process Model and Notation (BPMN)) should be created, which contains the individual steps. It seems to be necessary to record the identified impacts in detail and to relate them to the prerequisites and the current landscape in order to be able to make a reliable statement. Schütte et al. (2022b) have already taken the results of the thesis into account before this thesis was published and, building on this, have described value contribution controlling in detail and used a case study to illustrate the procedure developed, which is a further research evaluation (see the DSR evaluation criterion 3). For further research, the next step is to apply the VCC procedure in firms.

The approach developed for value contribution controlling in paper IV has so far only been integrated into traditional software engineering process models in an exemplary manner. The possibilities should also be shown for other traditional process models (including IT project management frameworks such as Prince2, IPMA, HERMES, or PMBok) as well as for agile process models. Agile process models are assumed to pose a particular challenge in this respect, as the value contribution controlling phases cannot simply be adopted due to the characteristics of agility. Agility[119] is the ability of an organization to act both flexibly (in the sense of reactively) and proactively, as well as to anticipate the ever faster changing conditions in the business environment and to take the initiative to introduce necessary changes and adapt to changing markets (REFA 2021). For this reason, further research is needed on how the results of the VCC can be adapted to agile process models. Further thoughts on this can be found in chapter 9.4.2.

When IT investments exceed a certain level, it becomes difficult to manage the impacts without an IT-based application. The interactions between impacts or the fulfillment of impact prerequisites, for example, can then only be determined with difficulty. Schubert and Williams (2013) announce the development of a web application in their research, which has not yet been published. However, it becomes clear in that thesis that tools are needed. The tools should then cover the individual steps of IT business value controlling and also take into account the specifics of the company. In the context of a master study project at the university of Duisburg-Essen we were able to develop a first prototype. However, the prototype still needs to be detailed and adapted to the new findings from Schütte et al. (2022b).

The overarching limitation of the work can be the acceptance of the created artifacts in practice. As it became clear, some artifacts (e.g., value catalogs) have already been developed, but due to their applicability they have not been established in practice. In our artifacts, we have endeavored to ensure that they can be directly applied in practice and provide added value for practitioners. Since we have only conducted a qualitative evaluation of the artifacts so far, this should be supplemented by further empirical evaluations to then also determine implications for future research.

In addition to the research gaps identified in the research papers I-IV (Table 9.1), the identified research areas from chapter 2 offer many clues as to how the topic of IT business value should be considered in the future. The studies on IT business value in literature focus primarily on firm level, just like this thesis. The focus is on private companies interested in financial gain. So further research in this area should also be done at a different level or type of organization, especially since these are also underrepresented in current research. It also became clear from the state-of-the-art

119 In computer science, agility is an umbrella term associated with specific software development methods, the basis of which is the agile manifest with the four values and 12 principles (Termer et al. 2014).

and the implications from this chapter that the topic of IT business values cannot be dealt with in a single thesis.

Overall, there are still some open research gaps in the area of IT business value, which should be closed by further research in the future, since the topic of IT business value is central to IS as a discipline and in practice for companies. Companies will continue to be confronted with the phenomena of globalization, IT penetration and increasing IT investments in the future. Despite the limitations of this thesis, it contributes significantly to IT business value research in general and to the design of procedures for identifying and assessing IT business values in particular.

9.4.2 Further Thoughts on the Integration of the Value Contribution Controlling into Agile Process Models

As already mentioned in chapter 9.4.1, the approach developed for value contribution controlling in paper IV has so far only been integrated into traditional software engineering process models in an exemplary manner. In practice, however, more and more companies are turning to agile methods because they promise to be more successful (Bitkom 2018). Half of German companies had already implemented agile methods in project management and the trend is rising (Bitkom 2018). In retail, 9 out of 10 companies that use agile methods use scrum, according to the study by Bitkom (2018). It is assumed that software development is an unpredictable activity that requires correspondingly adaptive development processes to be able to handle the existing uncertainty (Abbas et al. 2008). There is thus a conflict of objectives between agility and structured value contribution controlling. The objectives of agile process models and a parallelization of development work in teams tend to make value management more difficult, because the agile process models may stand in the way of rational value management (Schütte et al. 2022b). The special features of agile projects are the (1) iterative approach (i.e. selected features of the software are implemented in each sprint), the (2) incremental approach (i.e. an executable result is created in each sprint) and the (3) self-organized teams (i.e. the teams orchestrate and coordinate the creation of the increment themselves). The value contribution controlling process presented here would have to be run through in its entirety once in a sprint, which would require a great amount of time and effort. The question here is whether the effort then outweighs the benefit or not. It would also be necessary to check which actions are really required in a sprint, in order to then possibly split up the value contribution controlling. Due to the incremental approach, there is a risk that impacts are "cut up" and thus the impact cannot be captured properly from a business perspective. For this reason, it is not helpful to record an isolated impact of individual increments, as interdependencies are not taken into account. The question here is at what management level the IT business value should be considered if a sprint seems too isolated. So far it is unclear who is responsible for generating the impact. In traditional process models, it is still conceivable that the project manager can take on this task, but in agile process models this role does not exist. Hilger (2014) mentions the creation of a business value team as one possible solution. This team is supposed to support the product owner and is responsible for prioritizing the business needs, answering questions about the required functionalities, creating new stories as necessary and for deciding whether the project is complete (Hilger 2014). It can be seen as a counterpart to the development team and their scrum events. However, the product owner always speaks alone with the business value team, so the teams have no direct points of contact. Similar to the development team, the business value team consists of key stakeholders from business units as well as experts in specific areas and has its own frameworks to evaluate new functionalities. It is clear from this proposal that responsibility for controlling the value contributions lies with the IT business value team. This proposal is not yet being discussed in the scientific literature. Focusing on Scrum as a process model, the product goal was introduced in 2020 in the scrum guide to align the team with the overall valuable goal (Schwaber and Sutherland 2020). Each sprint should bring the product closer to the overall product goal. For each product goal, the Scrum team defines several sprint goals which, if fulfilled, achieve the product goal. The sprint goals also make clear why the product is helpful for the stakeholders (Schwaber and Sutherland 2020). The introduction of the product goal shows that there is a growing awareness that IT should deliver value, and this is increasingly being taken into account. However, it remains to be seen to what extent the introduction of an additional goal in scrum will lead to a better consideration of IT business values in practice. In further research, the value contribution controlling can be applied to Scrum as an example. The findings can then be transferred to other agile process models. Two approaches are conceivable. On the one hand, a universal approach can be developed. This approach can then be flexibly adapted to the different process models. On the other hand, several process models are conceivable, which are always specifically designed for one process model. The universal model or the specific models can then be evaluated through expert interviews and lead to further adaptation of the models. These can then be applied in the companies. However, it is also conceivable that due to the time and material restrictions in agile models no plausibility of the IT business value is possible at all. If this is confirmed in further research, it must be considered how a statement about the IT business value of an IT investment can nevertheless be made.

10 Conclusion

In this thesis, the impact of IT investments on a strategic and operational level of a company was examined in order to be able to make a statement about the IT business value of IT investments. Since management in general and IT project management in particular currently lack a methodological approach and an integrated perspective for identifying and assessing the business value of IT investments, the objective of this thesis was to expand the theoretical foundation in IT business value research and to go a step forward in providing management with procedures to better support the identification and assessment of IT business value for their specific firms. This could be achieved through four research papers, which build on the state-of-the-art of IT business value research.

On a strategic level, our first research paper addressed the question of the extent to which dynamic capabilities, which are intangible but nevertheless have a high strategic relevance, are operationalized in order to take them into account in IT business value assessment. In order to make dynamic capability operationalizable and thus manageable, we have created dynamic capability profiles. These also help to provide information about the impact of IT on dynamic capabilities and vice versa. Based on the novel information, decisions can be made at a strategic level on the target-oriented further development of dynamic capabilities (e.g., support of manual processes with new IT systems or specific IT training of employees), which should then lead to a higher firm performance.

On an operational level, the second research paper used a literature review to provide an overview of the possible impact of an IT investment. Thereby the IT value framework as an artifact was developed, which aggregates the impacts of an IT investment on the basis of a company's business units. The aggregated impacts then lead to the IT business value. In addition to the aggregated impacts of the business units, the IT value framework also contains examples of impacts and additional literature to enable even more detailed analysis of individual impacts, if required in practice. The results made it possible to obtain clarity about the decomposition of the IT business value and about the concrete output of an IT investment. Using the findings from the second paper, a procedure for the development of a company-specific reference value catalog was then developed in the third paper. The reference value catalog overcomes the challenge of having to go through the determination of possible impacts all over again for new IT investments, as the impacts depend on the type of IT investment (e.g., for similar IT systems already identified impacts can be assumed) as well as on the company (e.g., the company-specific impacts will not change rudimentarily). We have identified the requirements that a reference value catalog should fulfill: reference value catalogs must contain possible impacts, take into account the individual context of the IT investment, be hierarchically structured, and the impacts should be quantifiable.

For step 1 in the procedure of the development of a company-specific reference value catalog, we have created a taxonomy for value catalogs so that existing value catalogs can be selected more easily according to the company's requirements. We have identified 33 value catalogs in the literature that can be used. Using the selected value catalogs, the possible impacts can then be determined in step 2, before these are sorted into a hierarchy tree in step 3, and then it is determined in step 4 how the impacts can be quantified. On an operational level, it was thus possible to work out a concrete procedure of the identification of impacts of an IT investment and the actions of the respective steps.

The fourth paper developed an overarching process for identifying and assessing IT business value. The artifacts from the previous papers can be assigned to the steps there. We call this procedure "Value Contribution Controlling" and it consists of four steps: identification of the impacts, determination of the IT value contributions, reconciliation of the value contributions, and realization of the value contributions. Examples are given of how the procedure can be integrated into software engineering process models in order to increase the applicability in practice.

The results of this thesis have contributed to the IT business value research areas "Ambiguity and Fuzziness of the IT Business Value Construct" (Paper II, III), "Neglected disaggregation of IS Investments" (Paper I), "Creation Process as a Grey Box" (Paper I), and "Holistic Procedure to Identify and Evaluate the IT Business Value" (Paper IV). Nevertheless, the IT business value research is still not complete and needs further work in the future. Specifically related to the research results of this thesis, the value contribution controlling needs to be further developed. Schütte et al. (2022b) have already published a further publication of the procedure, explaining the individual steps in more detail and applying the procedure to a case study as an example. In a next step, it should be possible to integrate the developed procedure into agile procedure models in order to be able to take the dynamic environment into account even better. Finally, an IT-based tool is to be developed that can then be used in companies for the value contribution controlling.

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