Strategic planning framework for ICT-based Information Service Systems

Doctoral Thesis

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Declaration

I hereby declare that this doctoral thesis is my own work. It is based on my original research and expressed in my own words. Any use made within it of works of others in any form (e.g. ideas, figures, text, and tables) is properly acknowledged at the point of use.

I have not submitted this thesis for any other course or degree.

Graz, May 2012 *Wolfgang Vorraber*

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Graz, May 2012 *Wolfgang Vorraber*

Abstract

ICT-based Information Service Systems (ISS) are growing rapidly with the broad adoption of mobile devices such as smart phones. Although a lot of effort is put into conventional strategic ISS network planning, many of these systems do not meet expectations. One reason is that conventional value network analysis within strategic planning frameworks does not cover dynamic network effects. In this thesis a framework is introduced that includes a new enhanced visual notation and analysis concepts for value networks to be used for strategic analysis and planning.

The concepts of endogenous motivation and exogenous forces which model the subjective behaviour of agents interacting in a value network are included. In contrast to existing frameworks for ISS, this approach enables the analysis of multi party network constellations and the explanations of a variety of motivation related network effects being observed in practice. Validation of the approach was done using multiple real world case studies from industry.

Contents

CHAPTER

1 Introduction

This chapter provides a brief overview on the content of this thesis. It starts with a general introduction and the motivation behind this thesis. Furthermore the relevance of the topic and the focus of research are described.

1.1 Introduction and Motivation

With the broad adoption of mobile devices such as smartphones ICT-based ISS were growing rapidly and can now be seen as almost ubiquitous to people's everyday life in highly developed countries. Although a lot of effort is put into the planning of ICT-based ISS, many of theses systems do not meet expectations. The reasons therefore can be attributed to different aspects of the planning and development process. Often ICT-based ISS are developed from a very technical point of view. Here the main focus is laid on technical components and details of the service. Other areas such as cost-benefit analysis for end customers are not paid attention in an appropriate degree. As a consequence these services are often technically brilliant, but are not able to attract customers.

Furthermore ICT-based ISS often cover several areas that appeal to users like usabilty and price, but fail to meet the ultimate goal of providing an added value to the end customers. ICT-based ISS, where the planning and development process has not been aimed at added-value generation for the customer, often result in services that fail to distribute this value. This leads to low acceptance rate at the end customer and therefore often to economically unsuccessfull services. Currently there exist planning frameworks (see chapter 3) that deal to some extent with aspects of the problems identified so far.

A further reason for failed ICT-based ISS can be found within the network of actors that contribute to the generation of an ISS. Since there are hardly any actors that are able to cover the full value chain that is needed to create and provide an ICT-based ISS, different actors have to collaborate. This collaboration forms a network of actors

exchanging different values between each other to finally provide an ISS to the end customers. Although some of the existing frameworks mentioned above are already quite mature, there are some aspects that are not covered by them. Negative as well as positive dynamics may arise within to such a network. As a consequence it is crucial to setup a value network with adequate partners and to analyze and control value exchange dynamics between these partners. This thesis deals beside other aspects with exactly this problem and provides an analysis and planning framework that enables the analysis of multi party network constellations and the explanations of a variety of motivation related network effects being observed in practice.
The following section provides an overview on the economic context of ICT-based ISS to emphasize the relevance of this thesis.

1.2 Economic and social relevance of ICT-based ISS

ICT-based ISS have become a serious economic factor. This section provides an overview on the past and expected development of ICT-based ISS.

The development of ICT-based ISS is closely connected to the evolution of mobile communication networks and services. Due to the availiability of mobile communication networks, the number of subscribers increased at a high rate. Whereas the penetration rate of mobile communication technology, indicated by the number of activated SIM cards per inhabitant in selected european countries such as Austria, exceeded the 100% bound already in the year 2005 (RTR-GmbH 2007, p.18) and is now approaching the value of 150% (see Figure 1), fast emerging markets such as India are catching up with a tremendous speed.

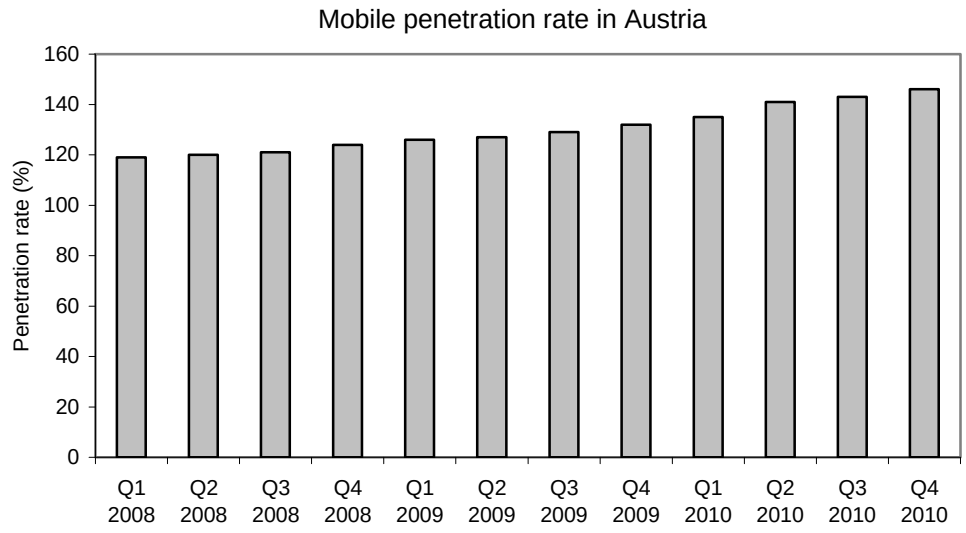


Figure 1 Mobile penetration rate in Austria is approaching 150% (figure modified from (RTR-GmbH 2011, p.30) numbers based on RTR, Statistics Austria)

As illustrated in Figure 2, mobile phone penetration in India is predicted to reach almost a full penetration rate in the year 2015 (Sondhi et al. 2011, p.13).

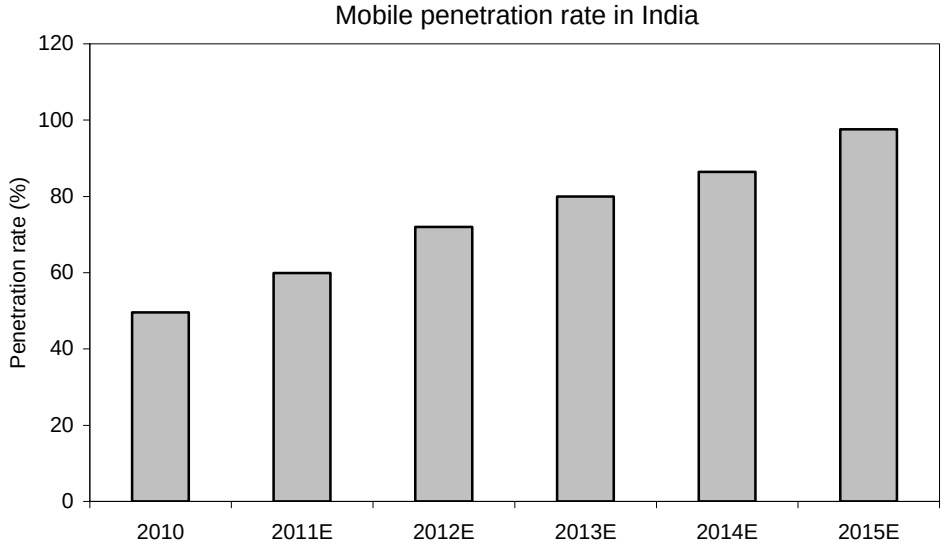


Figure 2 Mobile phone penetration in India is increasing tremendously (figure modified from (Sudha 2011, p.155) (Sondhi et al. 2011, p.13) (numbers based on TRAI)

Along with the broad adoption of mobile devices the economic impact of the mobile communication sector also increased. Figure 3 documents this development by

representing the increasing rates of mobile revenues as a portion of the Gross Domestic Product (GDP) in various markets. (Analysys Research 2008, p.7f)

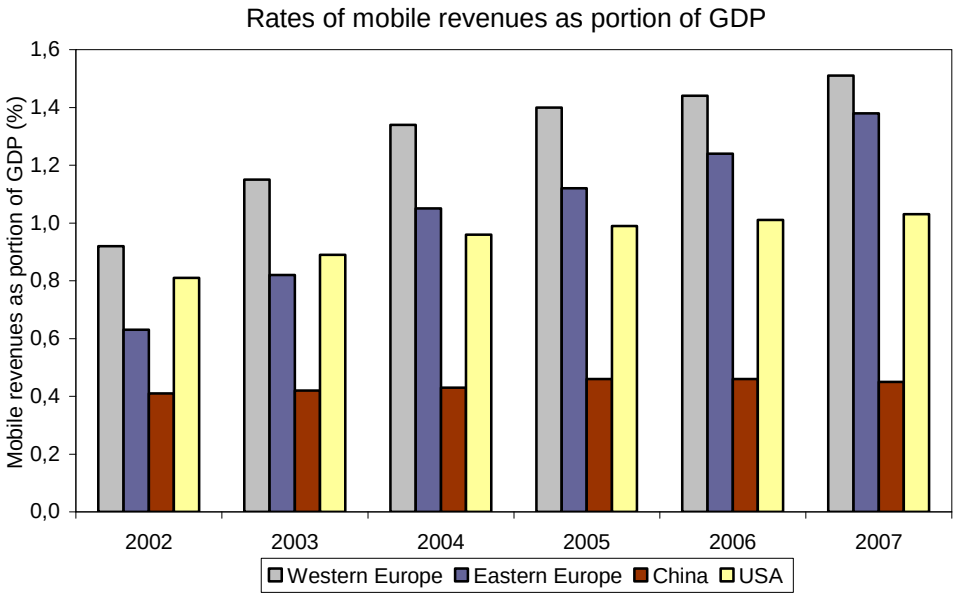


Figure 3 Rates of mobile revenues as a portion of the Gross Domestic Product (GDP) are increasing (Analysys Research 2008, p.8) (figure modified from (Analysys Research 2008, p.8))

A common phenomenon to all mobile telecommunication markets is that the "Average Revenue per User" (ARPU) in respect to the voice offer had been decreasing along with increasing market maturity ((Yan 2003) (Boston Analytics 2007) (Barnett, Hodges & Wilshire 2000)). Since different markets world wide have different maturity levels, this phenomenon increased at different time periods. Within early adopting markets like Western Europe, this effect already took place during the 1990's. For example, the ARPU of mobile phone users in UK had decreased by about 77% between 1990 and 2000 (Barnes 2002, p.16) based on Barnett, Hodges & Wilshire (Barnett, Hodges & Wilshire 2000, p.168).
Figure 4 provides an example for the decreasing ARPU for the telecommunication market in India during the years 2005 and 2006.

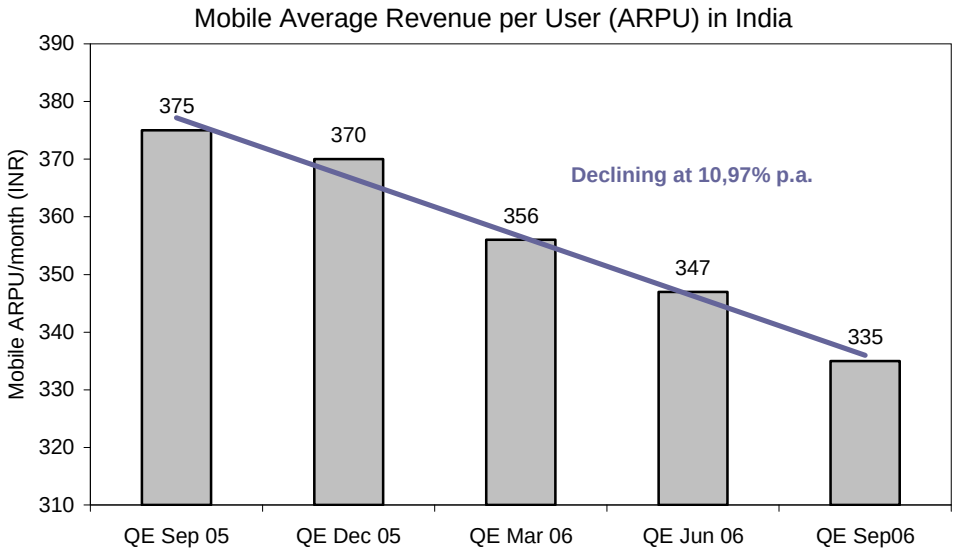


Figure 4 ARPU declines due to the commditisation of voice offers within the telecommunication inustry. (figure modified from (Boston Analytics 2007, p.10))

This phenomenon can be explained by the fact that the voice offers provided by the telecommunication providers increalingly became a commodity. Rivalry within the market forced telecommunication providers to lower their prices for voice offers.
As a consequence telecommunication providers quested for new revenue sources and found them within so called Mobile Value Added Services (MVAS). (Boston Analytics 2007, p.4ff)
MVAS are defined by Sudha (Sudha 2011) in the following way:

"Mobile Value Added Services are those services that are not part of the basic voice offer and are availed separately by the end user. They are used as a tool for differentiation and allow mobile operators to develop another stream of revenue[.]" (Sudha 2011, p.157)

MVAS can be regarded as a collective term subsuming different mobile service categories. There are different approaches of categorizing ICT-based services. Boston Analytics (Boston Analytics 2007, p.14) divides the market into three categories and describes each category in the following way:

- **Information:** This category contains services that provide the value "information" (e.g. new alerts, stock prices) to the end consumer (Boston Analytics 2007, p.14). The strategic analysis and planning framework for ICT-based ISS introduced within this thesis deals with services of this category.

- **M-commerce:** This service category is dealing with services that enable mainly financial transactions (e.g. ticket purchasing) on mobile devices (Boston Analytics 2007, p.14).
- **Entertainment:** This category subsumes services that primarily aim at entertaining the end customer. In the late 1990's and early years of the 21st century mainly ringtones and wallpaper services were dominant within this category. Now, with the rise of mobile platforms and mature end devices, also game apps take a big share of services attributed to this category.

Figure 5 provides an overview of revenues of MVAS categorized in the described categories. ICT-based ISS account for 25% of the total revenues within the regarded market.

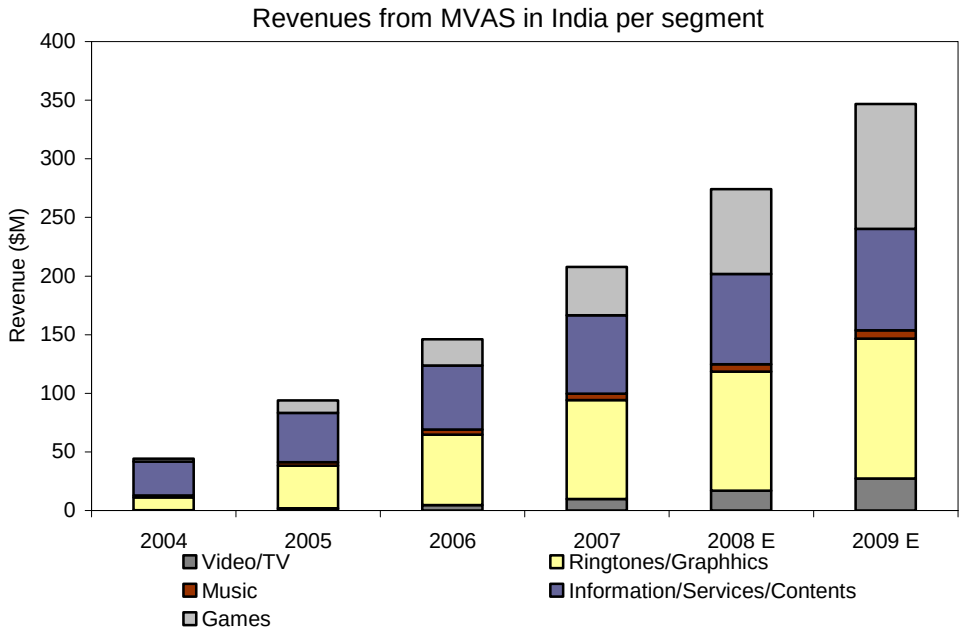


Figure 5 Revenues from Mobile Value Added Services in India during 2004-2009 per service category. Information Services account for 25% of total revenues. (figure modified from (Boston Analytics 2007, p.13))

One of the first technologies used to provide MVAS to end customers was the "Wireless Application Protocol (WAP)" (Carlsson et al. 2006, p.1f). Unfortunately services delivered with WAP were not successful. As stated by Van de Kar "*[t] the criticisms were aimed at speed, ease of use and the limited number of worthwhile services.*" (Van de Kar 2004, p.24)

While services based on WAP did not succeed as planned, NTT DoCoMo launched the iMode service successfully (Yan 2003, p.82).
According to Yan (Yan 2003, p.82f), the reasons for the success story of iMode may be found in a combination of different factors. In contrast to WAP, which is based on the Wireless Markup Language, iMode is based on cHTML, a subset of HTML. Since HTML is broadly adopted within the community, switching costs for providers were minimized. Furthermore NTT DoCoMo installed a business model similar to the currently very successful "App Store" business model of Apple. NTT DoCoMo shared traffic revenues connected to the third-party services with their providers. This policy facilitated the generation of third-party services and therefore led to a great variety of different useful services. The greate range of available services attracted end customers and consequently reinforced the generation of even more services. (Yan 2003, p.82ff) (Xu 2001, p.239f)
Exactly the same mechanism can be identified at Apple's iOS and Google's Android platform today. The broad availability of useful apps increases the attractivtiy of the application platform and the mobile devices connected to the platform. More and more end users are attracted to the platform, which reinforces the development of further services.

The current world wide success of MVAS represented by the overwhelming availability of apps based on different platforms (e.g. Android, iOS, Windows Phone7) can be explained by the development of the following important factors within the last years. Sharma explains it this way (Sharma 2010, p.5):

- The high maturity of end devices,
- the consistently high bandwidths of telecommunication networks
- and rich APIs for the service developers, enable MVAS that meet the users demand in a better way (e.g. better user experience).
- As already mentioned, the global business model of revenue sharing between service- and platform providers reinforces the generation of even more MVAS and therefore increase the attractivity of the entire MVAS platform to the end users.

According to estimates of (MarketsandMarkets 2010) the global mobile applications market is expected to be worth $25 billion in 2015. This implies a Compound Average Growth Rate (CAGR) of 29,6% from 2010 to 2015. (MarketsandMarkets 2010)

As stated above, one reason for the growth of mobile data traffic is the great diversity of mobile end devices available for end customers.

Figure 6 provides an overview on the device categories driving the growth of mobile data traffic in the upcoming years. The two main drivers are laptops, netbooks and smartphones. (Cisco Systems 2011, p.6ff)

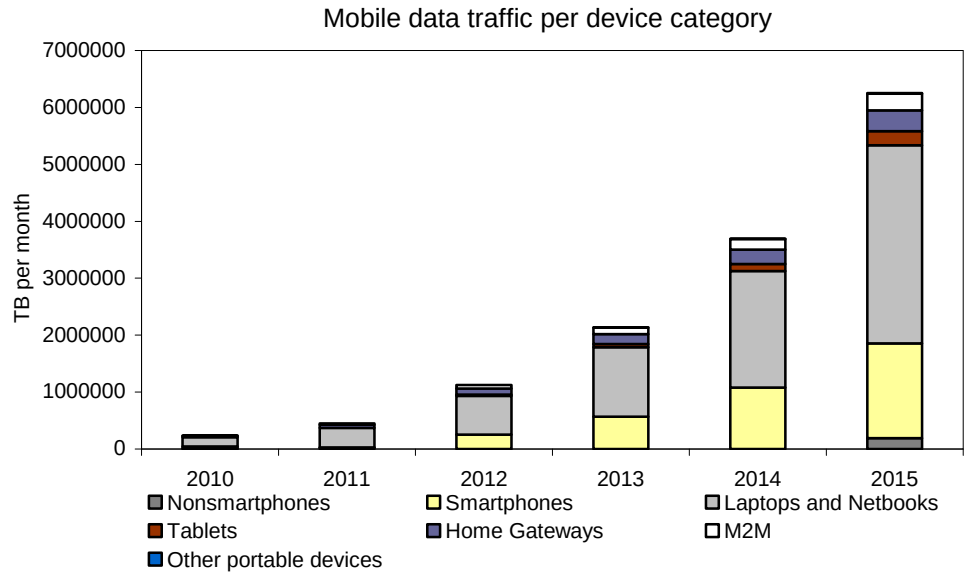


Figure 6 The upcoming mobile traffic growth is dominated by laptops, netbooks and smartphones (figure modified from (Cisco Systems 2011, p.19))

Forecasts for mobile phone penetration rates (see Figure 2) show that areas like Asia have a huge potential in respect to revenues in this area. The market for MVAS is expected to grow with an CAGR of 30,5% until 2015 (Sudha 2011, p.156). This development goes along with the global mobile applications market as indicated above.

A further reason for the increased reveneues of MVAS is a change in consumption habits of the end customers. This change can be captured by the frequency of use of ICT-based ISS. A recent report (comScore 2011) focusing on the frequency of use of applications divided into the three categories "email", "News and Information" and "Social networking" shows a tremendous increase of end customers using a service every day (see Figure 7). This report concludes that "*[f] for many people, mobile media consumption has rapidly moved from an occasional activity, perhaps even a novelty, to an essential service they depend on every day while at home, work or on the move.*" (comScore 2011, p.25)

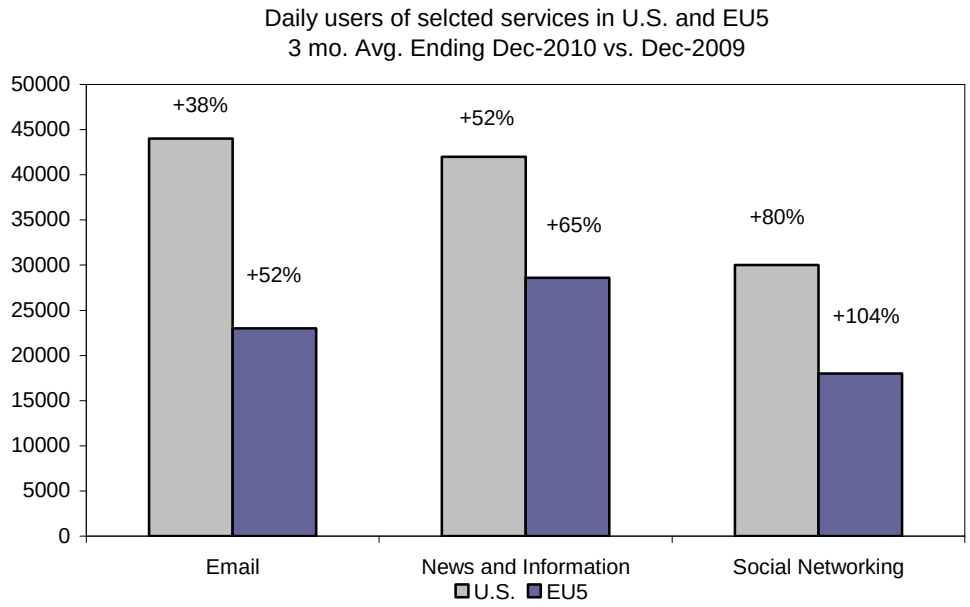


Figure 7 ISS are increasingly embedded in daily life (comScore 2011, p.25) - An overview on the increase of daily use of selected service categories (figure modified from (comScore 2011, p.25))

In general MVAS and therefore ICT-based ISS are increasingly important for revenue generation in the mobile telecommunication industry. As stated in a recent UMTS Report (UMTS Forum 2011) data traffic for MVAS over mobile networks has already exceeded the traffic of voice offers over mobile networks and "*[t] this trend is expected to continue into the future with data traffic representing 30 to 40 times the traffic used by voice services by 2014, and 100 times by 2020. Forecasts do vary somewhat from player to player, however.*"(UMTS Forum 2011, p.68ff).
Therefore the analysis of existing and the planning of new ICT-based ISS is a vital issue for companies that want to participate in this already huge market with its expected high growth rates. This thesis provides a framework to support service providers that either want to analyze their existing ICT-based ISS or are planning to create a new service.

1.3 Focus of Research

Since the business with ICT-based ISS is highly relevant as described within the previous section 1.2, there has also been a lot of research that deals with problems during the development process of these services. Several frameworks for planning and analyzing ICT-based ISS have already been developed (see chapter 3) and deal with aspects of the problems mentioned in the introduction.

Nevertheless there are aspects influencing the success of ICT-based ISS that are not covered by these frameworks. In order to be able to provide an ICT-based ISS various agents have to cooperate. As a result, a network of agents is created where different kind of values are exchanged between each other. Different positive as well as negative dynamics may arise within such a value network. The main focus of this thesis is layed on the development of a framework that provides a tool to deal with these aspects in the analysis or planning phase of an ICT-based ISS. The framework enables analysis of multi party network constellations and the explanation of a variety of motivation related network effects being observed in practice. This framework includes a new enhanced visual notation and analysis concepts for endogenous motivation and exogenous forces which model the subjective behaviour of agents interacting in a value network.

This thesis is guided by the following two research questions:

- No. 1: *Is it possible to create a framework for the structured planning of ICT-based ISS that enables the analysis of multi party network constellations and the explanation of motivation related network* effects?
- No. 2: *Can this framework be applied to analyze network effects in ICT-based ISS being observed in practice?*

The framework is based on a profound literature analysis about strategic planning frameworks for ICT-based ISS, value network theory and in depth analysis of several real world business models in the area of information service systems.
Validation of the approach was done separately using multiple real world case studies as part of research collaborations with industry.

1.4 Content and Structure

The thesis is structured as follows: Chapter 2 provides a basic introduction to the field of ICT-based ISS. This chapter contains a detailed description of the concept of ICT-based ISS. Furthermore crucial terms and concepts used throughout the thesis are defined.
Chapter 3 analyzes existing planning frameworks for ICT-based ISS and reveals areas not covered by these frameworks. These areas deal with the analysis of dynamics within value exchange relations in value networks.
As a consequence, the state of the art of value network notations is represented in chapter 4 to form the basis for the concepts introduced in this thesis. Based on the identified research gaps, an enhanced value network notation is introduced in chapter

5. This improved value network notation forms the basis for the analysis process of ICT-based ISS introduced in chapter 6. The research design and the validation results are presented in chapter 7. Finally, a conclusion is drawn and areas of further work are identified in chapter 8.

CHAPTER

2 ICT-based Information Service Systems

This chapter starts with a basic introduction to ICT-based ISS. First the different stakeholders and technical components of ICT-based ISS are categorized (section 2.1). Then these components are described in detail based on practical examples (section 2.2). Furthermore, crucial concepts and notions used throughout this thesis are defined (section 2.3).

2.1 An abstracted concept of ICT-based Information Service Systems

ICT-based Information Service Systems (ISS) are systems based on Information and Communication Technology (ICT) that provide an added value in form of information to end customers.

Figure 8 represents the basic components of an ICT-based Information Service System (ISS) in an abstract way. The figure is structured vertically into two main columns. While the left column represents the main categories of actors of an ISS, the right column visualizes the different building blocks of an ISS enhanced with generic process steps and typical communication flows. These building blocks and concepts will be described in detail in the following subsections.

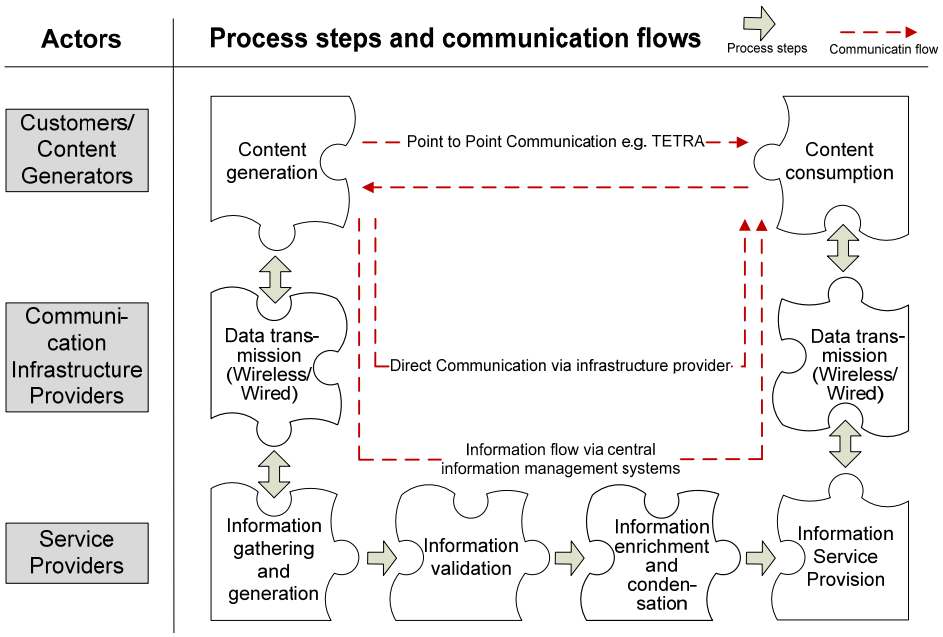


Figure 8 Basic building blocks of an ICT-based Information Service System (ISS) enhanced with generic process steps and communication flows.

2.1.1 The main actor categories of ICT-based ISS

The different actors of an ISS can be categorized as follows:

- **Service Providers:** The category "Service Providers" subsumes all actors that contribute to the generation of the ISS. As depicted in Figure 8 typical contributions can be the generation, aggregation, validation, condensation and enrichment of information. Due to this content preprocessing the ICT-based ISS can be created (e.g. in form of a web service or smartphone app).
- **Infrastructure providers:** This category represents all actors that provide communication infrastructure to actors of the other two categories.
- **Customers:** This category represents actors that consume the ICT-based ISS. Since customers often own end devices that are also able to generate content and in some cases content contribution by customers is desired, end customers can also act as content generators. This case is subsumed with the term "User generated content".

2.1.2 Typical processes within ICT-based ISS

As illustrated in Figure 8 a typical process within an ISS is as follows: Data and information is generated at an arbitrary place and gets transmitted to data- and information gatherers. These actors aggregate, enrich, condense and validate the

content on their own or redirect the content to other actors who execute these process steps. Furthermore, content may get stored and other content may be retrieved from repositories. Finally, an information service is generated based on the preprocessed information. This ISS is delivered to the end customers via the communication infrastructure.

2.1.3 The main information flow categories of ICT-based ISS

Figure 8 also contains three types of information flows that can be categorized according to their intermediate actors and technologies contributing to the communication flow. As indicated by the dotted lines between the actors these categories are as follows:

- Direct point to point communication
- Direct communication via a telecommunication provider
- Indirect communication via central information management systems

The differences between these three categories can be explained by using a practical example in the area of police information and communication systems. Police officers use 2-way radio sets to communicate directly with each other. In the case of handsets based on the TETRA standard, these handsets can communicate directly without any additional communication infrastructure. This case of communication without any infrastructure provided by a third party participant represents an example for the category “Direct point to point communication”.

In addition to their 2-way radio sets, police officers also use mobile phones to communicate directly with each other. In Western Europe these mobile phones are usually based on UMTS and use a terrestrial network infrastructure to transmit voice and data between each other. This network infrastructure is provided by a third-party network provider. This case represents an example for the category “Direct communication by way of telecommunication provider”.

The third category, “Indirect communication via central information management systems”, can be explained by a practical example for an ICT-based ISS used for mission control by the police. In the case of special events such as concerts or sports events, which attract a big audience, predefined organization structures are installed to manage the security of the audience. This organizational structure consists of commanders and field forces which execute predefined functions (e.g. observation). The commanders have to coordinate their teams in an appropriate way to achieve their

mission goals. The most crucial factor for the commanders to be able to coordinate their teams and to be able to make appropriate decisions is a good information base concerning the current mission situation. ICT-based ISSs for mission control are often used to support this task. These systems integrate various information sources such as video surveillance systems or status reports of on-site teams. Data gets transmitted by way of communication infrastructure to the central ICT-based ISS where the information gets processed according to the different processing steps explained above. Commanders use this processed and appropriately visualized information to make their decisions and communicate these decisions to their on-site teams. In addition, also the on-site teams may use filtered and individually prepared information from the ICT-based ISS to get additional information that supports their mission (e.g. maps of their mission area augmented with additional information like the current stream of visitors).

2.2 ICT-based Information Service Systems in detail

While Figure 8 represented the basic building blocks of an ICT-based ISS in an abstracted way, Figure 9 provides practical examples for these blocks. Figure 9 is again structured into three vertical actor categories consisting of “End Customers”, Communication infrastructure” and “Service Provider”.
As illustrated within the legend of Figure 9, actors are represented by transparent ovals, information flows by directed arcs between actors and the network infrastructure is highlighted with blue rectangles. Actors can execute processes, which are represented by pink ovals.
The great diversity of different end customers is represented in the topmost part of the figure. The figure provides examples of different types of end devices used by end customers like notebooks and smartphones. In addition to end customers who consume information provided by the ICT-based ISS, content generating device types are also illustrated. As described in section 2.1.1, end customers can also act as content generators and may use, for example, end devices such as smartphones with integrated cameras as content generating devices. Besides humans acting as content generators, specialized devices such as video surveillance systems may also act as content generators.

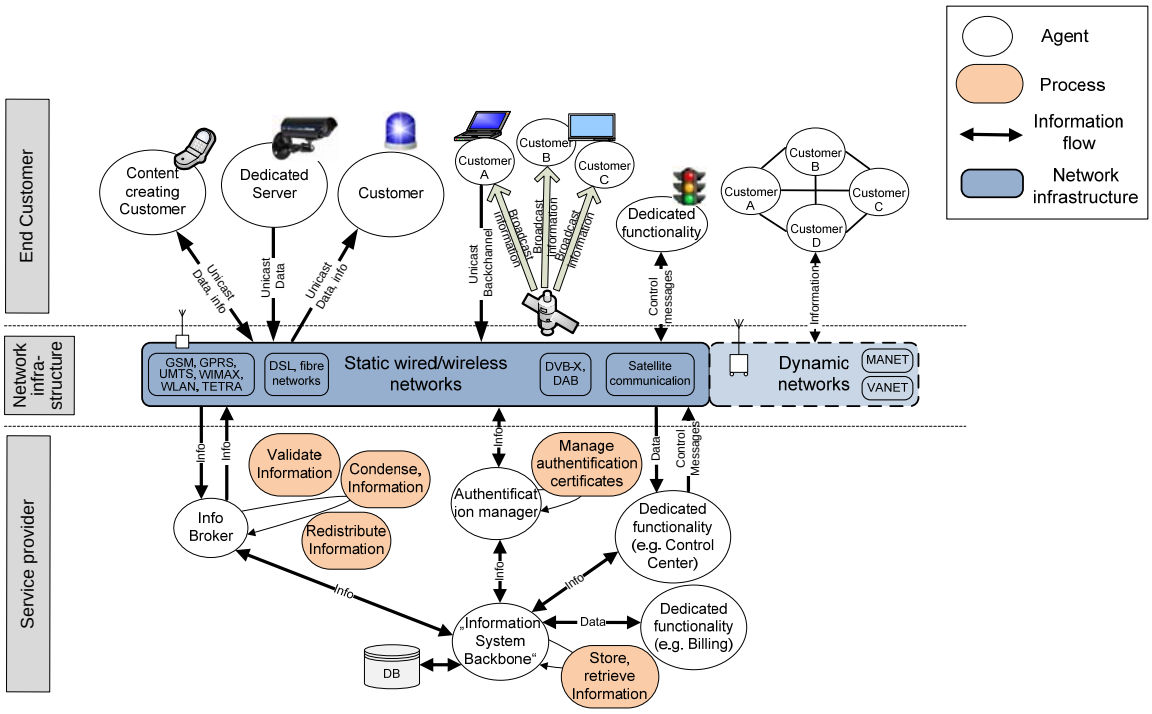


Figure 9 The main components of an Information Service System (ISS)

2.2.1 Classification of communication infrastructure technologies

Since the main goal of an ISS is the provision of information to end customers, information has to be transported between the service providers and the end customer. Transportation of information is realized with technical network infrastructure. The central layer of Figure 9 illustrates different communication technologies which are common to ICT-based ISS.

Table 1 provides a categorization of these communication infrastructure technologies. These technologies can be categorized according to their “Mode of connection” which can be wireless (e.g. WLAN IEEE 802.11x) or wired (e.g. DSL), according to their “Range of coverage” which can be limited to Personal Area Networks (e.g. Bluetooth), Local Area Networks (e.g. WiFi), Metropolitan Area Network (e.g. WiMAX), Wide Area Network (e.g. UMTS) and Global Area Network (e.g. THURAYA). (Katz, Fitzek 2005, p.5) (Sabat 2002, p.510)
What’s more, these communication technologies can also be categorized according to their type of transmission, whether Unicast, Broadcast (e.g. DVB) or Multicast (e.g. TETRA group call). In addition they can be categorized according to their mode of

network creation which can be dynamically with ad-hoc networks (e.g. Vehicular ad-hoc networks) or statically with preconfigured installed networks (e.g. UMTS networks).

Classifcation criteria	Properties
Mode of connection medium	• Wireless • Wired
Range of coverage	• Personal Area Network (PAN) • Local Area Network (LAN) • Metropolitan Area Network (MAN) • Wide Area Network (WAN) (Katz, Fitzek 2005, p.5) (Sabat 2002, p.510) • Global
Type of transmission	• Unicast • Broadcast • Multicast
Mode of network creation	• Dynamic ad-hoc networks: e.g. Mobile ad-hoc networks (MANET), Vehicular ad-hoc networks (VANET) • Static installed networks

Table 1 Classification of communication infrastructure technologies

A further crucial criterion for communication infrastructure is the amount of data that can be transported via the network within a certain timespan.
Figure 10 provides an overview on the data rate and the degree of mobility of different mobile communication technologies mentioned above.

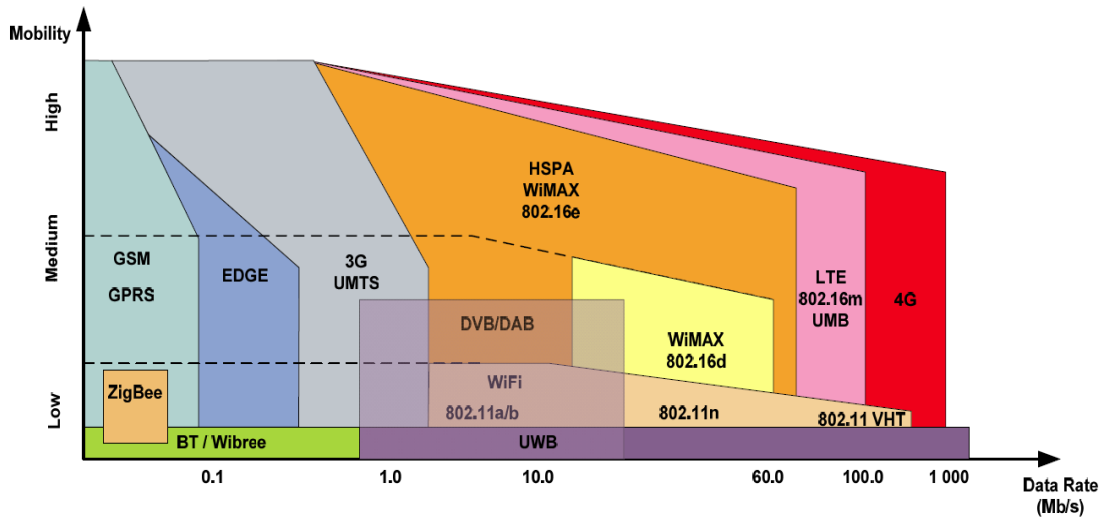


Figure 10 An overview on the data rates and the degrees of mobility of different mobile communication technologies (figure from (Bourse, Tafazolli 2007, p.15) based on WiSOA)

2.2.2 Conclusion

The abstraction and categorization schemes introduced in section 2.2 should aid in structuring the overwhelming range of services available and as such, are arranged according to certain criterias. The abstract view on ICT-based ISS introduced in section 2.1 is intended to provide a generic concept that includes the basic actors, components and processes within ICT-based ISS. The abstraction and categoritzation of ICT-based ISS can be seen as a first step in the analysis or planning process of a new service.

2.3 Definitions

Important concepts and terms that will be used throughout the thesis are defined in the following section in order to avoid ambiguities.

2.3.1 Data, Information, Knowledge

The Data-Information-Knowledge model (see Figure 11 of Aamodt and Nygard (Aamodt, Nygard 1995) provides an overview on the concepts and interrelationships of data, information and knowledge. They define the three notions the following way:

- **Data:** *„Data are syntactic entities – data are patterns with no meaning; they are input to an interpretation process, i.e. to the initial step of decision making.“* (Aamodt, Nygard 1995, p.6)
- **Information:** *„Information is interpreted data – information is data with meaning; it is the output from data interpretation as well as input to, and output from, the knowledge-based process of decision making.“* (Aamodt, Nygard 1995, p.6) *“A distinction between data and information is that data are uninterpreted characters, signals, patterns, sign, i.e. they have no meaning for the system concerned. Data becomes information after having been interpreted to give meaning. This is illustrated in the figure [Figure 11] by the Data Interpretation arrow.”* (Aamodt, Nygard 1995, p.8)
- **Knowledge:** *„Knowledge is learned information – knowledge is information incorporated in an agent‘s reasoning resources, and made ready for active use within a decision process; it is the output of a learning process.“* (Aamodt, Nygard 1995, p.6f) Knowledge is essential to the described concepts “Data”, “Information” and “Knowledge”, because it is required in the “Data Interpreta-

tion", "Information Elaboration" and "Learning" process. This fact is indicated by the green arrows in Figure 11. (Aamodt, Nygard 1995, p.7)

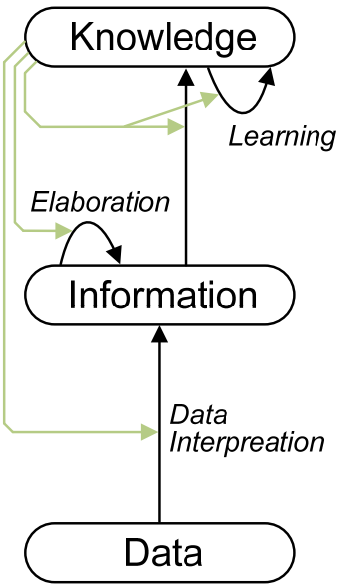


Figure 11 The Data-Information-Knowledge model according to (Aamodt, Nygard 1995, p.8)

2.3.2 Information System (IS)

Since information systems have become a part of our everyday life (see Figure 7), there has also been a lot of research in this area and, as a consequence, many different approaches to the definition of this term exist. Alter (Alter 2008, p.449ff) provides an overview of these definitions.
A clear and concise definition of the term "Information System" is provided by Ward et al. (Ward et al. 2002) who define it in the following way:
"Information systems are the means by which people and organisations, utilising technologies, gather, process, store, use and disseminate information." (Ward et al. 2002, p.3) cited from (UKAIS)

Ward & Peppard furthermore state that *"[i] it should be remembered that information systems existed in organizations long before the advent of information technology and, even today, there are still many information systems present in organizations with technology nowhere in sight."* (Ward et al. 2002, p.3)

Because Information and Communication Technology (ICT) is not an inherent part of information systems, the prefix "ICT-based" is added in front of "Information Service Systems" to indicate that only ISS, which are based on ICT, are investigated within this thesis.

2.3.3 Information Technology (IT) – Information and Communication Technology (ICT)

The terms "Information Technology (IT)" and "Information and Communication Technology (ICT)" can be differentiated in the following way according to Ward et al. (Ward et al. 2002):
„IT refers specifically to technology, essentially hardware, software and telecommunications networks. It is thus both tangible (e.g. with servers, PCs, routers and network cables) and intangible (e.g. with software of all types). IT facilitates the acquisition, processing, storing, delivery and sharing of information and other digital content. In the European Union, the term Information and Communication Technologies or ICT is generally used instead of IT to recognize the convergence of traditional information technology and telecommunications, which were once seen as distinct areas." (Ward et al. 2002, p.3)

2.3.4 ICT-based Information Service System

In order to accurately define the entire term "Information Service System (IS)", the subterm "service" contained can be explained by the following definition:
"Services are the portfolio of choices offered by services providers to a user." (Eylert, 2005, p. 32)
ICT-based Information Service Systems (ISS) are systems based on Information and Communication Technology (ICT) that provide an added value in form of information to end customers. A practical example for such a service is the Google Maps Navigation service. This service combines typicial google search functionality with a turn-by-turn navigation service enriched by street maps and satelite pictures (see Figure 12). This service provides an added value to the customers and can therefore be assigned to the category of ICT-based ISS.

Figure 12 Goolge Maps Navigation represents an example for ICT-based ISS and provides a turn-by-turn navigation system enhanced with street maps (left picture from (Google 2011b)) and satellite view (right picture from (Google 2011a)).

2.3.5 Strategy

Since this thesis deals with the strategic analysis and planning of ICT-based ISS, the term strategy should also be clearly defined in this introduction. Chandler (Chandler 1962, p.13) puts it this way:
"Strategy can be defined as the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals." (Chandler 1962, p.13)

A further definition specifies "strategy" in the following way:
"The eternal struggle of business is the struggle for advantage. The one with more advantages wins; the one with fewer advantages loses. Strategy is the ceaseless pursuit of advantage." (Boar 2001, p.4)

2.3.6 Planning

In order to complete the definition of crucial terms used within the title and, as a consequence, throughout the entire thesis, the term "planning" is defined as follows:
"Planning is a formalized procedure to produce an articulated result, in the form of an integrated system of decisions. What to us captures the notion of planning above all -- most clearly distinguishes its literature and differentiates its practice from other

processes -- is its emphasis on formalization, the systemization of the phenomenon to which planning is meant to apply." (Mintzberg 2000, p.12)

2.3.7 Business Model

The term "business model" is an ubiquitous term in the area of planning frameworks of ICT-based ISS. Therefore an overview on different definitions and a conclusion on the concepts inherent to business models are provided within this section.

An early definition, which is also referenced by other important publications in this field (see (Bouwman 2003, p.11)), is provided by Timmers who defines a business model as *"[a] an architecture for the product, service and information flows, including a description of the various business actors and their roles; and [a] description of the potential benefits for the various business actors; and [a] description of the sources of revenues."* (Timmers 1998, p.2)

"A business model describes the rationale of how an organization creates, delivers, and captures value[.]" (Osterwalder, Pigneur 2010, p. 14)

"A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams." (Osterwalder, Pigneur & Tucci 2005, p.17f)

In general all definitions of the term "business model" provided include a description of the value delivered to the customer and how this value is created. A further component of business model definitions, which has been also noted by Petrovic, Kittl & Teksten (Petrovic, Kittl & Teksten 2001, p.2), is the description of the revenue generation for service providers.

2.4 Conclusion and outlook

As already mentioned in the introduction ICT-based ISS have become a serious economic factor and therefore became also very relevant for research. Nevertheless many ICT-based ISS fail due to various reasons. Planning frameworks are intended to structure the planning process of these systems. There has already been substantial

progress within these frameworks and as illustrated in the following chapter 3 they cover several important areas in the planning process. Although these existing frameworks are already quite mature, there are some aspects that are not covered now. This thesis deals exactly with these uncovered aspects like dynamics within value networks. Before the new concepts are introduced, the following chapter provides an overview on the existing frameworks and identifies research gaps filled with the introduced framework.

CHAPTER

3 Existing Information System Planning Frameworks

Basically two different types of frameworks for analysis and planning of ICT-based ISS can be identified:

- Technical Frameworks
- Techno-Economic Frameworks

Whereas Technical Frameworks mainly concentrate on technical aspects of ICT-based ISS and even provide technical platforms to launch services ((Decker, Schiefer & Bulander 2006) (Höß, Strauß & Weisbecker 2006)), Techno-Economic Frameworks consider also economic aspects in more detail. The following section 3.1 provides an overview on various Technical Frameworks. Since this thesis is aiming at a holistic apporach for planning and analyzing ICT-based ISS, the remaining part of this chapter is focusing on Techno-Economic Frameworks.

3.1 Technical Frameworks

There has been intensive research activity focusing on the technical planning and analysis of ICT-based ISS (Höß et al. 2005) (Olla, Patel & Atkinson 2003) (Decker, Schiefer & Bulander 2006).
In order to be able to structure technical components of ICT-based ISS Höß (Höß et al. 2005) developed a classfication scheme. This scheme overlaps in some aspects with the scheme introduced for the case of telecommunication technologies in section 2.2.1. They classified ICT-based ISS according to the “type of end devices”, the “communication technology”, the “amount of functionality covered by the client”, the “availability of GPS” and the “availabilty of mobile printing functionality”. (Höß et al. 2005, p132ff)
Furthermore, this framework was applied to real world cases and resulted also in the development of a technical platform called DOMUS-Workbench (Höß, Strauß & Weisbecker 2006) facilitating the development of ICT-based ISS.

Technical Frameworks like the "Wireless computing reference model" (Olla, Patel & Atkinson 2003, p.319) assist in categorizing different technical components of a planned ICT-based ISS. As illustrated in Figure 13 this model structures the technical components of an ICT-based ISS into the following five layers (Olla, Patel & Atkinson 2003, p.318ff):

- **Device Layer**: This layer deals with all end devices used by the users to consume the ISS. It assists in structuring technologies related to end devices like software platforms running on these devices. (Olla, Patel & Atkinson 2003, p.319)
- **Network Layer:** This layer subsumes all aspects of the transmission backbone needed for ICT-based ISS. (Olla, Patel & Atkinson 2003, p.319)
- **Program Layer**: This layer covers aspects like business logic, integration middleware and security- and data management (Olla, Patel & Atkinson 2003, p.319).
- **Payment Layer**: This layer deals with aspects of the end user payment model inherent to the ISS (Olla, Patel & Atkinson 2003, p.319f).
- **Application Layer:** This layer covers environment where the planned application as well as other applications like location-base services platforms are supposed to run (Olla, Patel & Atkinson 2003, p.320).

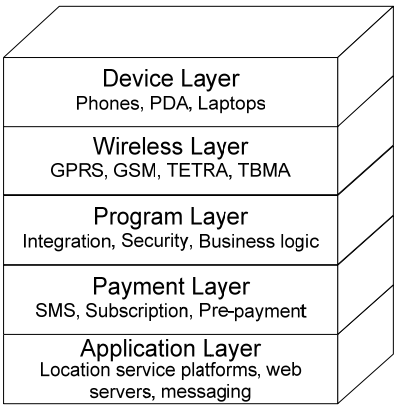


Figure 13 The Wireless Reference Model (Olla, Patel & Atkinson 2003, p.319)

The MODIFRAME framework is intended to facilitate the technical creation of ICT-based ISS. As illustrated in Figure 14, this framework supports the provision of services via different communication technologies, adapts content to end device specific constraints, includes context information and provides authentification- and anonymization- as well as billing functionality. Furthermore, third-party content and services can also be included into this framework. (Decker, Schiefer & Bulander 2006, p.171ff)

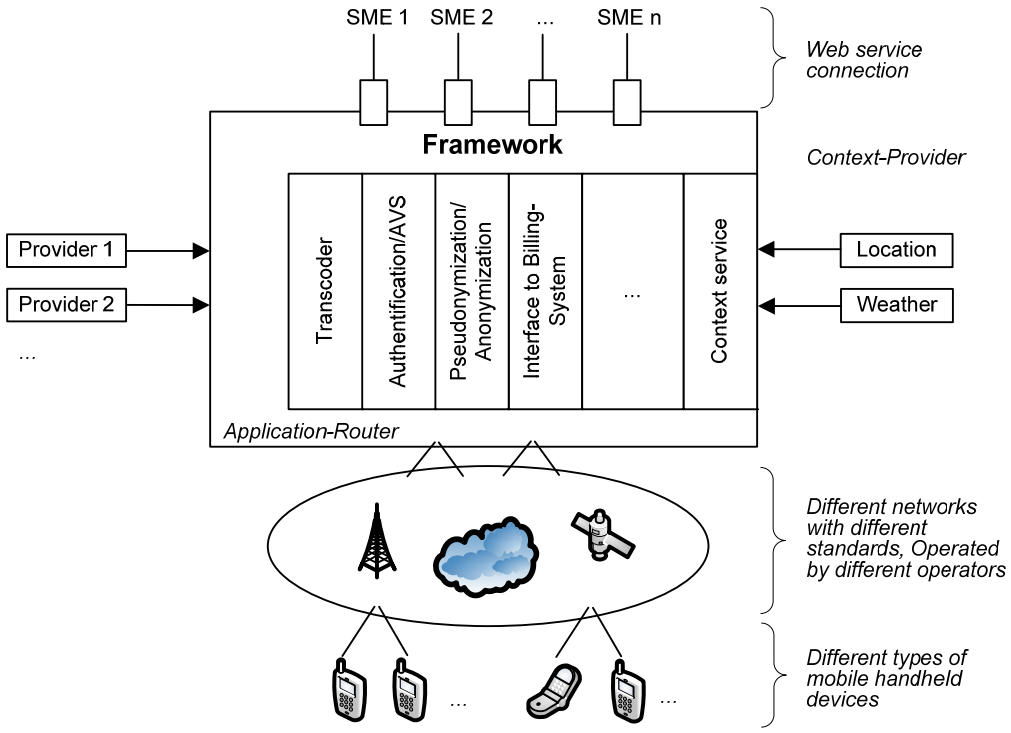


Figure 14 The MODIFRAME framework can be classified as an Technical Framework for mobile ICT-based ISS. It is focusing mainly on technical aspects and provides a technical platform to launch ICT-based ISS servies. (Decker, Schiefer & Bulander 2006)(figure modified from (Decker, Schiefer & Bulander 2006, p.172))

All in all, the classification framework of Höß (Höß et al. 2005) and the Wireless Reference Model of Olla, Patel & Atkinson (Olla, Patel & Atkinson 2003) are abstract concepts that can be applied even years after their generation and therefore facilitate the analysis and planning process of ICT-based ISS. Other concepts introduced in this section like the MODIFRAME framework are on a very operational level and mainly concerned with technical details. Since there has been a rapid evolution in the technical areas like programming- and end devices platforms, these concepts have become outdated and need to be adapted or replaced by concepts dealing with today's standards in respect to mobile comunication.

As a consequence, the concepts introduced within this thesis work on an abstracted level, meaning technical evolutions should only lead to minor adaptations and enhancement to the concept instead of entire replacements.

3.2 Techno-Economic Frameworks

The remaining sections within this chapter deal with Techno-Economic Frameworks which cover technical as well as economic components of an ICT-based ISS. After a description of selected frameworks in sections 3.3 to 3.6 a conclusion is drawn and aspects not covered by these frameworks are identified. These open aspects form the basis of the remaining thesis.

Scientific literature provides several existing techno-economic frameworks for ICT-based ISS. There has been a lot of research in the area of strategic planning of business models so far (Petrovic, Kittl & Teksten 2001) (Varshney, Vetter 2002) (Weill, Vitale 2001).

The following section provides an overview on the four selected frameworks which take into account technical as well as economic aspects of ISS. These four frameworks are:

- Fribourg ICT-Management Framework
- BIZTEKON (BIZ business, TEK technology, EKON economy)
- STOF (Service Technology Organization Finance) Model
- BMO (Business Model Ontology)

3.3 Fribourg ICT-Management Framework

The Fribourg ICT-Management Framework (Figure 15) is a strategic framework that mainly focuses on the management aspects of ISS.

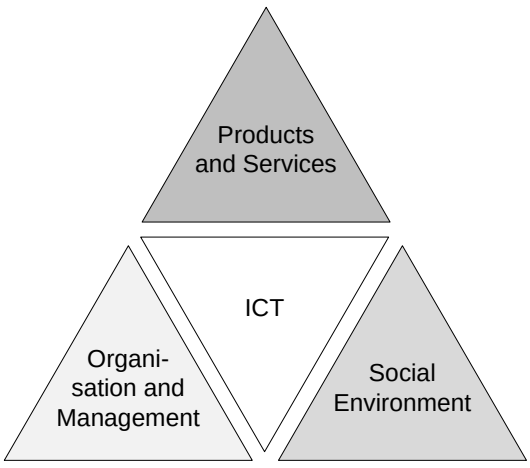


Figure 15 The Fribourg ICT-Management Framework (figure modified from (Teufel, Götte & Steiner 2004, p.16))

It identifies the following four components of ICT-based ISS (Teufel 2001, p.2ff) (Teufel, Götte & Steiner 2004, p.15ff):

- **Information and Communication Technology (ICT):** The ICT component deals with the technical basis and infrastructure for ISS. It emphasises the importance of awareness of technology convergence trends within the ISS business. (Teufel, Götte & Steiner 2004, p.15ff) (Teufel 2001, p.2ff)
- **Products and Services:** The Products and Services component deals with the products and services provided by an ISS company. Different aspects of products and services like the product itself, the price, the users and promotion for the service are considered from a management perspective within this component. (Teufel, Götte & Steiner 2004, p.15ff) (Teufel 2001, p.2ff)
- **Organization and Management:** The component Organization and Management deals, on one hand with all company-internal aspects such as processes, organization and management concepts. Special emphasis in respect to organization is placed on the ability to cope with the increasingly shorter product life cycles within a company. On the other hand external aspects are also considered within this component like management of cooperations with other partners. (Teufel, Götte & Steiner 2004, p.15ff) (Teufel 2001, p.2ff)
- **Social Environment:** The first three components dealt with aspects inherent to a company's business model. The Social Environment component deals with aspects influencing the business model externally like legal regulations, social- and ethical aspects. Each of the external aspects can be unique according to country and needs. Especially in the area of ICT-based services, standardizations and patents are topics that need increased attention. The analysis of technological trends and their impacts on society is considered to be another important aspect of the component "Social Environment". Since technology trends may influence whole societies in the way they live and use services, the framework also suggests it is important to continuously analyze these trends. The reason for this is because changes in the society evoked by technological trends may also lead to adjustments or redesigns of a company's business models in order to improve competitiveness. (Teufel, Götte & Steiner 2004, p.15ff) (Teufel 2001, p.2ff)

The Fribourg ICT-Management Framework provides a basic structure for the management of ICT-based ISS by classifying different aspects of these systems into the four categories described above. Therefore it facilitates the management of ICT-based ISS.

3.4 The BIZTEKON Framework

The BIZTEKON framework has been developed for structuring business models of ICT-based ISS. The term BIZTEKON is a concatenation of the abbreviations "BIZ" for business and "EKON" for economy which are related to "TEK" representing technology. (Gjerde, Eskedal & Venturin 2007, p.151)

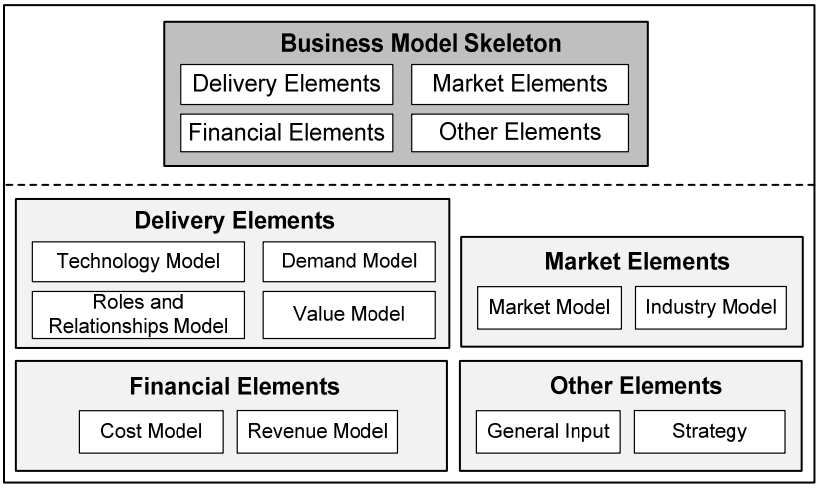


Figure 16 The BIZTEKON Business Model Skeleton (figure modified from (Gjerde, Eskedal & Venturin 2007, p.153))

The framework consists of three main parts (Gjerde, Eskedal & Venturin 2007, p.152ff):

- **BIZTEKON Terminology** - defines relevant notions and concepts to improve interdisciplinary team communication.
- **BIZTEKON Concept** - provides an overview on main building blocks of a business model (see Figure 16).
- **BIZTEKON Procedure** – defines an analysis process that basically consists of the analysis steps, data gathering, data processing, data analysis and a conclusion of the findings. (Gjerde, Eskedal & Venturin 2007)

The Concept part referred to as the "Business Model Skeleton" classifies four main components which can be further refined into different subcomponents (see Figure 16) (Gjerde, Eskedal & Venturin 2007, p.152ff):

- **Delivery Elements:** This element deals with technical aspects of the service (Technology Model), with roles and relationships between partners, competitors and customers (Roles and Relationships Model), aspects concerning the creation and distribution of value to the customers, (Value Model) as well as aspects of

the demand for the intended product on the market (Demand Model). Figure 17 provides an example of the Roles and Relationship Model mentioned.

- **Market Elements:** The Market Element is subdivided into a description of the targeted market (Market Model) and the industry in which this market is embedded (Industry Model).
- **Financial Elements:** The Financial Element is refined into an element dealing with the cost side of the planned system like capital expenditure (CAPEX) and operational expenditure (OPEX) represented in the Cost Model. Furthermore, it is an element dealing with the revenue side like pricing scheme and revenue sources represented in the Revenue Model.
- **Other Elements:** This element deals with general strategic and given societal and market specific circumstances. It can be subdivided into the three sub-elements "General input", "Society description" and "Strategy notes". The "General input" subelement deals with planning- (e.g. study period) and market specific (e.g. tax and regulations) aspects. The "Society description" describes factor surrounding the planned system dealing with aspects like the political system that may affect the system and societal aspects like special awareness' of potential customers (e.g. ecological awareness). The "Strategy Notes" *"… capture the major strategic decisions that affect the model – both on the higher (visionary) level and the practical (organisational/operational) level. Examples include the target geographical areas of operations, internal risk rates, target customers' segements given the ethical and moral issues and the corporate social responsibility terms, etc."*(Gjerde, Eskedal & Venturin 2007, p.154)

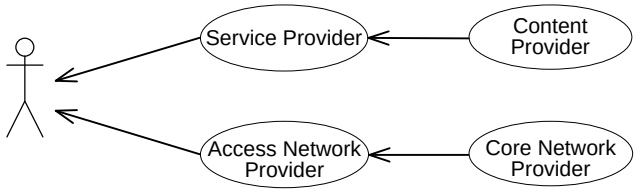


Figure 17 Example for the Roles and Relationship Model of the BIZTEKON framework (according to (Gjerde, Eskedal & Venturin 2007))

The BIZTEKON framework provides a comprehensive framework which covers main building blocks of technological as well as economical components of an ICT-based ISS. However, components like the Roles and Relationship Model illustrated in Figure 17 only cover basic aspects of different agents participating in a value network. The Roles and Relationship Model provides basic insights into the relations between participants of a value network providing an ICT-based ISS in a similar way to the UML Use Case

Diagram, broadly adopted in the software engineering community. In addition, the value model is proposes provide an overview on the value exchanges between the agents.
On the whole, the BIZTEKON framework provides a practical structure and process for business model analysis for ICT-based ISS, but lacks in providing a detailed insight into the value exchanges and dynamics between the participants of a value network.

3.5 STOF Framework

The STOF Framework is intended to structure the design of business models for ICT-based ISS. The framework consists of two main building blocks (Bouwman, De Vos & Haaker 2008, p.5ff):

- STOF Model
- STOF Method

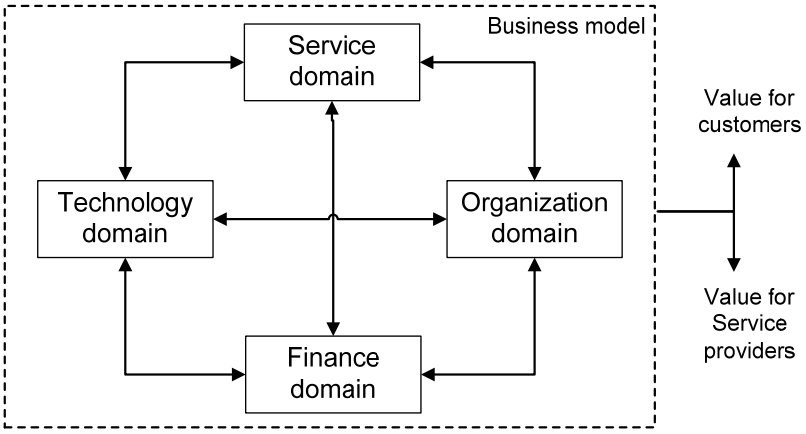


Figure 18 The STOF Model (figure modified from (Bouwman, De Vos & Haaker 2008, p.36))

The STOF Model (Figure 18) defines the basic building blocks of a business model for ICT-based ISS, whereas the STOF Method describes a basic planning process for the business model of ICT-based ISS (Faber, de Vos & Bouwman 2008, p.12ff). These two concepts will be described in the following two subsections.

3.5.1 The STOF Model

The STOF Model structures business models of ICT-based services into the following four main categories, whereas the first letters of each category are concatenated to the acronym STOF (Bouwman, De Vos & Haaker 2008, p.36ff):

- Service Domain
- Technoloy Domain
- Organization Domain
- Finance Domain

The "Service Domain" deals with aspects like the value delivered to the customers or target groups. The "Technology Domain" deals with technical aspects of the ISS like transmission infrastructure and middleware technologies. The "Organization Domain" deals with organizational aspects of the ISS like the agents contributing to the ISS. The "Finance Domain" deals with financial aspects like the revenues generated by the ISS. (Bouwman, De Vos & Haaker 2008, p.36ff)
Different key concepts, critical design variables (CDI) and relationships between these variables are identified and described for each domain (see also (Haaker, Faber & Bouwman 2004) (Faber et al. 2003) (Bouwman, De Vos & Haaker 2008) (de Reuver, Bouwman & Haaker 2009)*). "A CDI is defined as a design variable that is perceived to be (by practitioner and/or researcher) of eminent importance to the viability and sustainability of the business model under study."* (Bouwman, De Vos & Haaker 2008, p.72)
Examples for CDIs in the Service domain are "Targeting", "Branding" and "Customer Retention" (Bouwman, De Vos & Haaker 2008, p.73ff). Furthermore, these CDIs are related to Critical Success Factors (CSF) aiming at reaching the two ultimate goals of providing value to the customer and creating value for the service providers ("Network Value") (see Figure 18). Examples for CSF for the customer value are a "Compelling Value Proposition" and "Unobstrusive Customer Retention". On the other hand, examples for CSF for the Network Value are "Acceptable Profitability" and "Acceptable Risks".
All in all, the STOF Model provides a framework to structure business models for ICT-based ISS into four main building blocks. Furthermore, design variables and success factors for the creation of ICT-based ISS are provided by the framework.

3.5.2 The STOF Method

Based on the STOF Model which acts as a basic structure, the STOF Method describes the process of designing business models. The STOF Method consists of the following four process steps:

1. Quick Scan
2. Evaluation with CSFs
3. Specification of CDIs

4. Robustness check (Bouwman, De Vos & Haaker 2008)

The process of the STOF Method is illustrated in Figure 19.

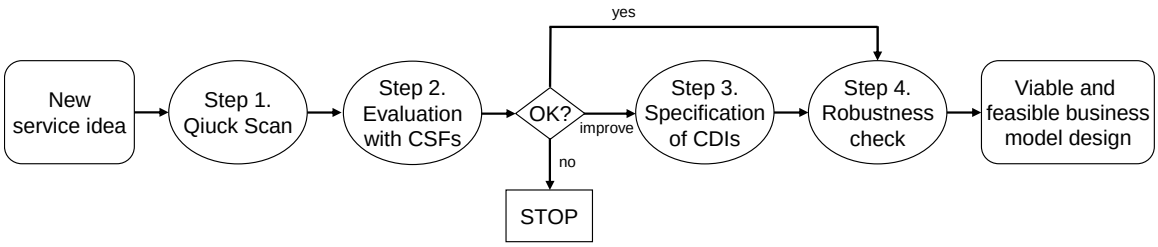


Figure 19 The STOF Method Process (figure modified from (Faber, de Vos & Bouwman 2008, p.28))

Within the first step an initial version of the intended business model is developed. Different aspects of the basic business model are considered and structured according to the previously identified four business domains "Service", "Technology", "Organization" and "Finance". The result of this process step is an outline of the business model. (Faber, de Vos & Bouwman 2008, p.28)
Figure 20 represents an example of a value network model resulting from this first step that is part of the Organization domain.

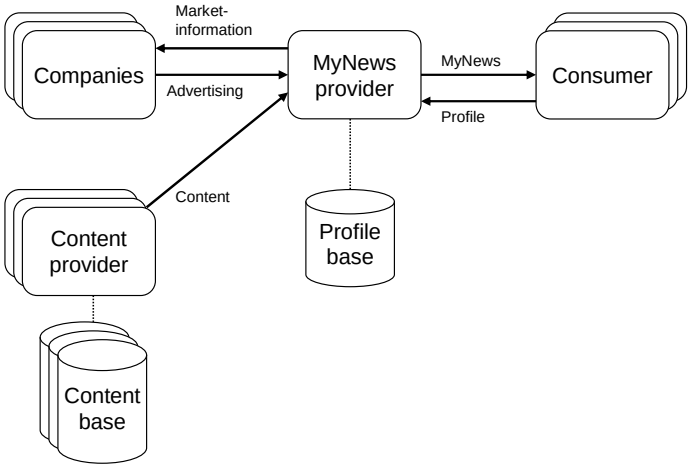


Figure 20 Example of a value network resulting of the STOF Method (according to (Faber, de Vos & Bouwman 2008, p.69))

The initial version of the business model, which resulted from the previous step, is checked for its viability in step 2. Therefore Critical Success Factors for the business model are evaluated, which can result in three possible outcomes (Faber, de Vos & Bouwman 2008, p.28):

- The business model will work well. As a consequence, go on with step 4.
- The business model needs further improvement. As a consequence, go on with step 3.
- The business model will never be able to succeed. As a consequence stop the planning process at this stage. (Faber, de Vos & Bouwman 2008, p.28)

As described above, step 3 is entered if the need for further improvements within the business model has been identified. Improvements can be achieved by changing the setup of the business model within certain areas. The Critical Design Issues are classified according to the four STOF domains and can therefore structure and guide this change and refinement process. After the changes directed to improve the business model are applied, the evaluation with the CSFs in step 2 is re-executed resulting in the three possible outcomes listed above. In case of the identification of room for improvement, steps 3 and 2 can be reiterated until a definite positive or negative prospect for the business model is determined. (Faber, de Vos & Bouwman 2008, p.28f) Finally, step 4 is intended to evaluate the business model's robustness and adaptivity to external changes (Bouwman, De Vos & Haaker 2008, p.132). *"Typical examples of external influences are changes in user requirements, regulatory changes, emerging new target groups and changing scale of operation, the application of a different revenue model or the incorporation of a new technology."* (Bouwman, De Vos & Haaker 2008, p.132)

3.5.3 Conclusion STOF Framework

The STOF framework covers the basic important building blocks of business models for ICT-based ISS and introduces a general planning process for these systems. A particular property of this framework is the explicit alignment of the framework on the creation of user- and provider value. The representation of an integrated view on all components of an ICT-based ISS in form of a value network representing resources and capabilities of the participants and the dynamics of value exchanges within the network is not an integrated part of the framework.

3.6 Business Model Ontology

The latest development in the area of strategic planning frameworks for ISS is represented by the Business Model Ontology (BMO) published by Osterwalder and Pigneur (Osterwalder, Pigneur 2010) and Fritscher and Pigneur (Fritscher, Pigneur 2010). This BMO is based to a great extend on early works of Osterwalder and Pigneur

(Osterwalder, Pigneur 2002) (Osterwalder, Pigneur 2004) (Osterwalder 2004) (Osterwalder, Pigneur & Tucci 2005) (Gordijn, Osterwalder & Pigneur 2005) which have been continuously improved during the past years.

3.6.1 Business Model Ontology Canvas

The BMO contains a Busniess Model Ontology Canvas that can be used as a common basis for the development of a business model within an interdisciplinary team (Figure 21).

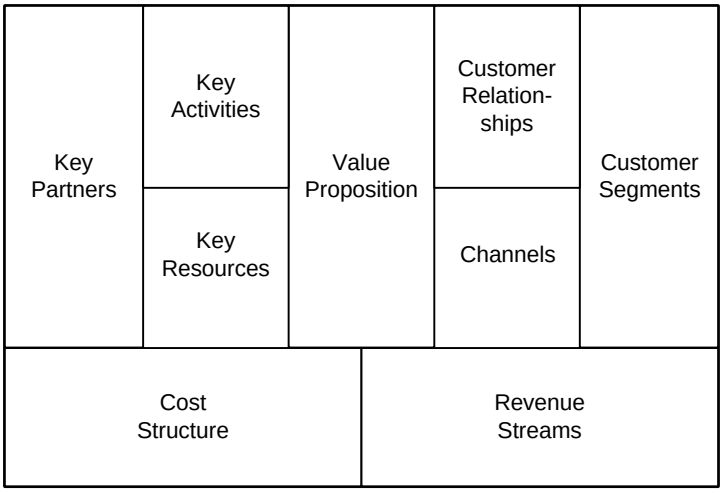


Figure 21 The Business Model Canvas (Osterwalder, Pigneur 2010, p.44)

This Business Model Canvas consists of the following nine building blocks structuring the intended business model (Osterwalder, Pigneur 2010, p.15ff):

- Value Proposition: This block represents the value delivered to the customer. This value can be a product or a service and should lead to a benefit for the customer. (Osterwalder, Pigneur 2010, p. 22ff)
- Customer Segments: *"The Customer Segments Building Block defines the different groups of people or organizations an enterprise aims to reach and serve[.]"* (Osterwalder, Pigneur 2010, p.20)
- Channels: *"The Channels Building Block describes how a company communicates with and reaches its Customer Segments to deliver a Value Proposition[.]"* (Osterwalder, Pigneur 2010, p.26) Osterwalder and Pigneur furthermore categorize these channels into
  - "direct" or "indirect" and
  - "own" or "partner" channels.

The first category distinguishes between a direct channel to the customer (e.g. in-house sales force) and an indirect channel, where the customer is reached through an intermediate (e.g. wholesaler).
The second category considers who owns the channel to the customer and distinguishes between channels that are owned by the company itself and channels that are owned by partners.
Business models can contain a mix of channel instances that belong to each of these categories. (Osterwalder, Pigneur 2010)

- **Customer Relationships:** "*The Customer Relationships Building Block describes the type of relationships a company establishes with specific Customer Segments [and …] may be driven by the following motivations:*
  - *Customer acquisition*
  - *Customer retention*
  - *Boosting sales (upselling)"* (Osterwalder, Pigneur 2010, p.28)

  Examples for types of the relationships range from the "Personal assistance" type where a direct relationship exists between a sales representative and the customer to the "Self Service" type where the customer has no direct contact to a sales representative. (Osterwalder, Pigneur 2010, p.29)
- **Key Resources:** *"The Key Resources Building Block describes the most important assets required to make a business model work[.]"* (Osterwalder, Pigneur 2010, p.34) According to Osterwalder and Pigneur (Osterwalder, Pigneur 2010, p.35) these resources can be categorized into:
  - Physical resources: Typical examples are assets like machines and buildings
  - Intellectual resources: Patents and copyrights, brands or data about customers are typical examples for Intellectual resources.
  - Human resources: This category represents the human resource within a company.
  - Financial resources: This category represents the financial resources (e.g. cash, credit lines) of a company.(Osterwalder, Pigneur 2010, p.35)
- **Key Activities:** *"The Key Activities Building Block describes the most important things a company must do to make its business model work[.]"* (Osterwalder, Pigneur 2010, p.36) Osterwalder and Pigneur (Osterwalder, Pigneur 2010, p.37) classify Key Activities into the following categories:
  - Production: Examples for this category are activities within manufacturing firms producing a certain product as their Value Proposition.

  - Problem solving: Activities or companies within the service sector like consulting firms or hospitals can be assigned to this category.
  - Platform/Network: Activities belonging to this category are typically related to business models based on a platform. For example, activities of eBay related to managing its web platform can be assigned to this category. (Osterwalder, Pigneur 2010, p.37)
- **Key Partnerships:** Since one agent often does not control all key resources that are required to create the intended Value Proposition, several agents create partnerships to complement one another. Osterwalder and Pigneur distinguish the following types of partnerships:
  - "*Strategic alliances between non-competitors*
  - *Coopetition: strategic partnership between competitors*
  - *Joint ventures to develop new businesses*
  - *Buyer-supplier relationships to assure reliable supplies"* (Osterwalder, Pigneur 2010, p.38)
- **Cost Structure:** *"The Cost Structure describes all costs incurred to operate a business model[.]"* (Osterwalder, Pigneur 2010, p.40)
  Osterwalder and Pigneur distinguish two categories of cost structures within a business model (Osterwalder, Pigneur 2010, p.41):
  - Cost-driven: The main focus within the business model class is on cost minimization at the production of the value proposition.
  - Value-driven: The main focus is on the value created. Cost minimization has not the highest priority in contrast to the cost-driven category.

  As stated by Fritscher and Pigneur (Fritscher, Pigneur 2010, p.30), *"[T] the Cost structure […] should be aligned to the core ideas of the business model[.]"*
- **Revenue Streams**: *"The Revenue Streams Building Block represents the cash a company generates from each Customer Segment (costs must be subtracted from revenues to create earnings)[.]"* (Osterwalder, Pigneur 2010, p.30) Osterwalder and Pigneur specify several sources that feed value streams such as "Asset sales", "Usage fees", "Subscription fees", "Lending/Renting/Leasing", "Licensing", "Brokerage fees" and "Advertising". (Osterwalder, Pigneur 2010, p.31f) Furthermore, they state two classes of Pricing Mechanisms (Osterwalder, Pigneur 2010, p.33) that can be applied to the revenue streams (see Table 2). (Osterwalder, Pigneur 2010, p.15ff)

Pricing Mechanisms			
Fixed Menu Pricing Predefined prices are based on static variables		**Dynamic Pricing** Prices change based on market conditions	
List price	Fixed prices for individual products, services, or other Value Propositions	*Negotiation (bargaining)*	Price negotiated between two or more partners depending on negotiation power and/or negotiation skills
Product feature dependent	Price depends on the number of quality of Value Proposition features	*Yield management*	Price depends on inventory and time of purchase (normally used for perishable resources such as hotel rooms or airline seats)
Customer segment dependent	Price depends on the type and characteristic of a Customer Segment	*Real-time-market*	Price is established dynamically based on supply and demand
Volume dependent	Price as a function of the quantity purchased	*Auctions*	Price determined by outcome of competitive bidding

Table 2 Pricing Mechanisms according to (Osterwalder, Pigneur 2010, p.33)

Furthermore, these nine building blocks can be grouped into four perspectives according to (Osterwalder, Pigneur 2004, p.4ff) (Fritscher, Pigneur 2010, p. 29ff):

- **Financial Perspective** – includes the cost- and revenue blocks and therefore subsumes financial aspects of the business model.
- **Activity Perspective** – includes the Key Resources, Key Activities and the Key Partnerships blocks and subsumes organizational aspects of the value proposition.
- **Customer Perspective** – includes the Customer Segments, Customer Relationships and the Channels blocks and subsumes aspects of the consumer side.
- **Product/Service Perspective** – includes the Value Proposition blocks as its only element and therefore deals with aspects of the value provided by the service provider to the customer.

3.6.2 Business Model Environment

Similar to the Step 4 in the STOF Method described in section 3.5.2, the BMO also contains an element, where the external environment surrounding the planned business model is analyzed. Osterwalder and Pigneur (Osterwalder, Pigneur 2010, p.200ff) define the following four main categories, whereas each category is refined with subelements, which need to be considered:

- *„Market forces*

  - *Market segments*
  - *Needs and demands*
  - *Market issues*
  - *Switching costs*
  - *Revenue attractiveness*
- *Macroeconomic forces*
  - *Global market conditions*
  - *Capital markets*
  - *Commodities and other resources*
  - *Economic infrastructure*
- *Industry forces*
  - *Suppliers and other value chain actors*
  - *Stakeholders*
  - *Competitors (Incumbents)*
  - *New entrants (Insurgents)*
  - *Substitute products and services*
- *Key trends*
  - *Technology trends*
  - *Regulatory trends*
  - *Societal and cultural trends*
  - *Socioeconomic trends" (Osterwalder, Pigneur 2010, p.200ff)*

The category "Industry forces" is similar to Porter´s Five Forces Model (Porter 2008, p.25ff) for strategic analysis of the competition within the industry.

3.6.3 Business Model Design Process

Similar to the business model frameworks introduced in section 3.4 and 3.5, the BMO also defines a Business Model Design Process. This process consists of five phases: "Mobilize", "Understand", "Design", "Implement", "Manage". It guides the team that generates the business model through the entire process starting with a preparation phase, going on to an analysis and design phase and ending with the implementation and management of a selected business model in the last two phases. (Osterwalder, Pigneur 2010, p.244ff)

3.6.4 Conclusion Business Model Ontology

The Business Model Ontology covers important building blocks of business models for ICT-based ISS. Moreover, it introduces several classification schemes within these building blocks to categorize typical properties of elements within these building blocks. An example therefore is the categorization of communication channels to customers as “direct” and “indirect” channels and as “own” and “partner” channels. Nevertheless, the BMO does not contain a concept that provides an integrated view on the particpants in the value networks and the value exchanges between these agents.

3.7 Conclusion of existing frameworks and the focus of this thesis: Value Networks as an central component of IS Planning Frameworks

The frameworks presented in section 3 provide abstract structures of business models within the area of ICT-based ISS. These structures permit analysts to deal with the complex task of structuring business models. Therefore these frameworks, especially the BMO, STOF and BIZTEKON framework, can be seen as a basis for the concepts and enhancements presented within this thesis. As stated above, the presented frameworks structure business models into basic building blocks that can be subsumed (according to (Bouwman, De Vos & Haaker 2008, p.36ff)) within the following four main areas:

- Financial area
- Service area
- Technology area
- Organization area

Techniques and tools to analyze each of these basic main areas with their subcategories are provided by the frameworks in their individual ways.
Table 3 provides an overview on concepts covered by existing planning frameworks for ICT-based ISS introduced in this chapter. The table contains the main building blocks of ICT-based ISS identified above and further concepts dealing with an integrated view on ICT-based ISS. These concepts deal with the exchange of values between agents that provide an ISS and the dynamics inherent to such a network of participants exchanging values. These dynamics can either accelerate or decelerate value exchanges between agents. As represented in Table 3 the introduced frameworks cover the main building blocks of ISS, but hardly deal with an integrated view on these building blocks to represent value exchanges and dynamics within the system.

	Concepts covered by existing frameworks					
Frameworks	Finance	Organization	Technology	Service	Value Exchanges	Multi party dynamics
Fribourg	X	X	X	X		
BIZTEKON	X	X	X	X	X	
STOF	X	X	X	X	X	
BMO	X	X	X	X		

Table 3 An overview on concepts covered by existing planning frameworks for ICT-based ISS.

Value networks which are described in detail in section 5 can be seen as a concept that creates a connection between elements of all four main areas identified above and therefore facilitates a connected and integrated view on the mechanisms within the business model (see Figure 22). Allee identified value network analysis as a complement to organization charts, asset management tools, social networks and business process modelling (Allee 2009, p.431)).

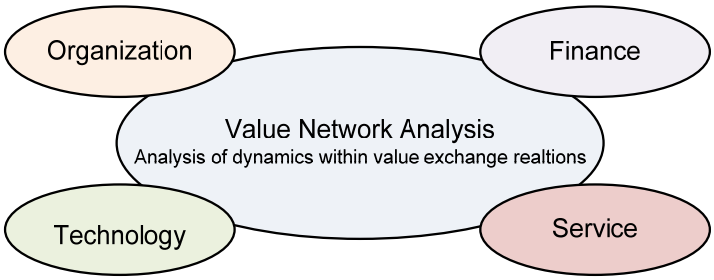


Figure 22 Value Networks provide an integrated view on the four main areas Service, Technology, Finance and Organization

The concept represented in Figure 22 can be seen analog to the idea of Scheer's "Architecture of Integrated Informationsystems" (ARIS) house (Scheer 2002, p.36ff). Scheer models different views on information systems like the "Organization-", "Function-", "Data-" and "Goods and Services View" with separate building blocks and then integrates them within the "Process View".

The frameworks introduced in this chapter consider the basic building blocks of ICT-based ISS (Finance, Service, Technology, Organization) mentioned above in the same way.

Since ICT-based ISS are complex systems, it is important to structure the system into building blocks, but in the end these building blocks have to be combined to one

system. Latest developments and the contributions of this thesis in the area of value networks provide a tool to facilitate an integrated representation of aspects of the different building blocks, its value exchanges and its dynamics.
Value networks can be seen as a central point since they include all aspects of the different parts of the frameworks.
Value networks consider the financial area through the monetary values exchanged and the service area through the modeling of the customers and the values consumed by them. Furthermore, value networks consider the technology area through the values exchanged and the assets required for producing the products and the organization area through the modeling of the agents within the value network and their capabilities and assets they contribute to the value generation within the value network.

In order to analyze and plan a system in a holistic way, this integrated view needs to be applied. Value networks can be seen as an essential tool to visualize the entire business idea and to provide a common platform for communication. Furthermore, value networks form a basis to identify and analyze dynamics within the entire business model.
As a consequence, we concentrated on value networks as a tool to represent the mentioned integrated view on the systems and enhance existing value network notations to be able to identify relations and dynamics that could not be otherwise identified. We modeled some business cases with existing value network approaches and identified potential for enhancements by identifying value accelerating and decelerating parts. Before we introduce our enhancements we will briefly provide an overview to existing value network notations.

All concepts introduced within the following sections can be seen as enhancements to the existing notations and frameworks and should be applied in addition to the frameworks and their analysis processes explained in section 3.

The next chapters are structured the following way:
Chapter 4 provides an overview on the current state of existing value network notations. New enhancement to these existing notations are introduced within chapter 5 to enrich the analysis process of value networks and to capture and explain network effects inherent within value networks. Chapter 6 furthermore introduces an entire analysis process for value networks of ISS that considers strategic aspects within value networks, such as systems dynamics- and scalability effects and strategic analysis of the strength of particular participants within value networks.

CHAPTER

4 State of the art – Value Networks

4.1 e3-Value Notation

Gordijn, Akkermans and van Vliet (Gordijn, Akkermans & Van Vliet 2000, p.40ff) (Gordijn, Akkermans & Van Vliet 2001, p.11ff) started the development of the e3-value notation based on the idea that sophisticated tools already existed to model the process (UML activity diagrams, Event driven process chains) or the IT-system (UML class diagrams) of a business case.

Requirement viewpoint	Stakeholders involved	Requirement viewpoint focus	Requiremnt viewpoint representation
Business value viewpoint	C*O'S Marketeers Customer	Values, actors, exchanges	e3 value ontology and UCM scenarios
Business process viewpoint	Tactical marketeer, Operational management	Processes, workers, information, goods, and control flows	UML • Activity diagrams • Sequence diagrams • Interaction diagrams High-level Petri Nets
System architecture viewpoint	IT department	Hard/software, components, data and control flows, Code organization	UML • Class diagrams • State transition diagrams • Sequence diagrams • Interaction diagrams • Deployment diagrams Architecture description languages

Figure 23 The e3-value ontology fills the gap for notations to describe the business value viewpoint. Several notations already exist for the business process- and system architecture viewpoint (Gordijn, Akkermans & Van Vliet 2001, p.11f) (figure modified from (Gordijn, Akkermans & Van Vliet 2001, p.12))

They identified that there was a lack of tools for modeling "… *the way economic value is created, exchanged, and consumend in a multi-actor network*" (Gordijn, Akkermans & Van Vliet 2001, p.12).
The e3-value notation is intended to fill this gap (see Figure 23).

The e3-value ontology contains a formal and detailed description of the notation and its concepts as follows:

- **Actor:** *"An actor is perceived by its environment as an independent economic (and often also legal) entity. By doing value activities (see below) actors make profit. In a sound viable, business model every actor is capable of making profit."* (Gordijn, Akkermans & Van Vliet 2000, p.43)
- **Value activity:** *"An actor performs one or more value activities, which are assumed to yield a profit."* (Gordijn, Yu & van der Raadt 2006, p.28)
- **Value object:** "Value objects are services, goods, money, or information, which are of economic value for at least one of the actors." (Pijpers, Gordijn & Akkermans 2009, p.5)
- **Value port:** *"An actor uses a value port to provide or request value objects to or from other actors."* (Gordijn, Yu & van der Raadt 2006, p.28)
- **Value interface:** "Actors have one or more value interfaces, grouping individual value ports. A value interface shows the value object an actor is willing to exchange in return for another value object through its ports. The exchange of value objects is atomic at the level of the value interface." (Gordijn, Akkermans & Van Vliet 2001, p.13)
- **Value exchange:** Value exchanges or "[v] value transfers are used to connect two value ports with each other. It represents one or more potential trades of value objects." (Pijpers, Gordijn & Akkermans 2009, p.5)

With this basic concept value networks representing the value exchanges between actors can be modeled (see Figure 24).
Based on a basic e3 value network, one can enrich the model with process related information to get a "Use Case Map" which facilitates further analysis (see Figure 24).
The concept of Use Case Maps is based on Buhr (Buhr 1998) and consists of the following elements:

- **Scenario path:** *"A scenario path consists of one or more segments, related by connection elements and start- and stop stimuli. It represents via which value interfaces objects of value must be exchanged, as a result of a start stimulus, or as a result of exchanges via other value interfaces."* (Gordijn, Akkermans 2001a, p.30)

- **Stimulus:** *"A scenario path starts with a start stimulus, which represents an initiating event caused, for example, by an actor. The last segment of a scenario path is connected to a stop stimulus. A stop stimulus indicates that the scenario path ends."* (Gordijn, Akkermans & Van Vliet 2001, p.14)
- **Segment:** *"A scenario path has one or more segements. Segments are used to relate value interfaces with each other, possibly via connection elements, to show that an exchange on one value interface causes an exchange on another value interface. Using connection elements, sophisticated causal relations can be represented."* (Gordijn, Akkermans 2001a, p.30)
- **Connection:** *"Connections are used to relate individual segments. An AND fork splits a scenario path into two or more sub path [sic], while the AND join collapses sub path into one path. An OR fork models a continuation of the scenario path into one direction, to be chosen from a number of alternatives. The OR join merges two or paths into on [sic] path. Finally, the direct connection interconnects two individual segments."* (Gordijn, Akkermans 2001b, p.2)

The Use Case Map assists in understanding the value flows between the participants of the value network. Based on AND- and OR- connection type, parallel and optional value flows can be represented. (Gordijn, De Bruin & Akkermans 2001, p.1ff)
As represented in Figure 24, the two concepts of "e3-value models" and "Use Case Maps" get consolidated into one model for further analysis.

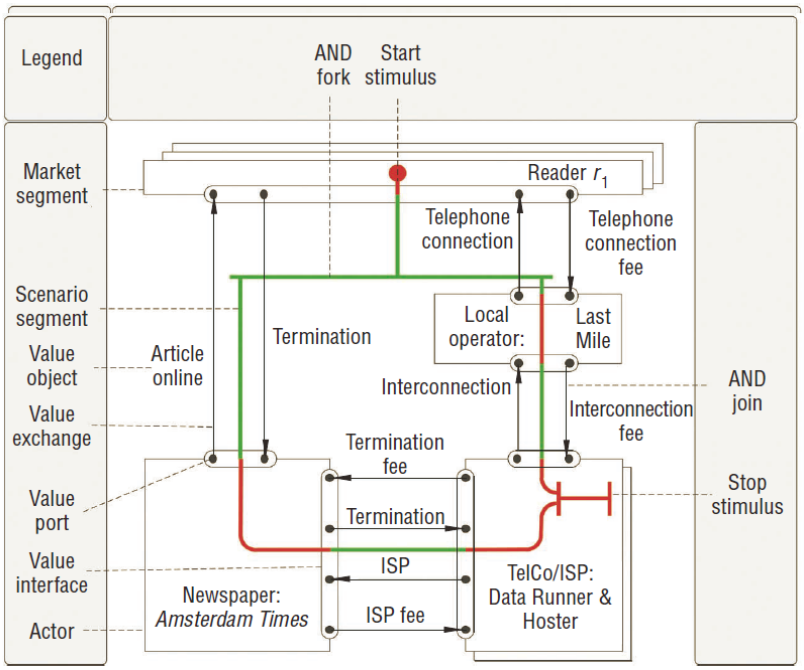


Figure 24 An example for a basic e3-value model (figure from (Gordijn, Akkermans & Van Vliet 2001, p.12))

The e3-value network combined with the UCM acts as a basis for another analysis dealing with the incoming and outgoing value flows for each actor. This analysis is called "Profit Sheets" and facilitates the analysis of the value flows for each participating actor by following the scenario path of the UCM. Profit sheets are simple spreadsheet based tables containing the current monetary in- and out-flows of values of each participant within the value network. The main goal of Profit Sheets is to have a rough idea about profitability for each actor within the value network. In a last step, "what-if"-scenarios can be analysed by modifying assumed value flows based on expected future influences and their changes to the value network. (Gordijn, De Bruin & Akkermans 2001, p.1ff) (Gordijn, Akkermans & Van Vliet 2001, p.16f)

In conclusion, the e3-value ontology provides a detailed and formal definition of a value network modelling notation which is enhanced by several analysis methods. The value network contains the participating actors and their value exchanges. Furthermore, value creating activities within the actor can also be modelled. Assets of each actor that form a basis for the value creation within each actor are not modelled with the e3-value notation.

The UCM enriches the value network with process information and facilitates the modelling of concurrent and alternative paths within the value network. The Profit Sheets provide a rough cut on profitability analysis for each actor and act as a basis for

what-if scenarios for analysing expected external or internal changes to the value network.

4.2 Allee‘s Value Network Analysis

Following the same idea as the other authors of the notations introduced in this section, Verna Allee models the entities and value exchanges between the entities as a network. Besides the representation of obvious exchange relations of tangible values between the participants within a value network, Allee puts special emphasis on the modeling and analysis of intangible value exchanges. Therefore she distinguishes between tangible and intangible value exchanges in the following way (Allee 2000, p.1ff) (Allee 2002, p.182ff) (Allee 2008, p.7ff) (Allee, Schwabe 2009, p.4ff):

- **Tangible Goods, Services, and Revenue:** *“Tangible exchanges involve goods, services, or revenue, including all transactions involving, but not limited to, contracts and invoices, return receipts of orders, requests for proposals, confirmations, or payments. Knowledge products or services that generate revenue, or that are expected and paid for as part of a service (such as reports or package inserts), are defined as a tangible and are depicted in the mapping as goods, services, and revenue.”* (Allee 2002, p.182)
- **Intangible Konwledge and Benefits:** *“Intangible knowledge and information exchanges flow around and support the core product and service value chain, but are not contractually paid for. These include strategic information, planning knowledge, process knowledge, technical know-how, collaborative design work, joint planning activities and policy development.”* (Allee 2002, p.182)

Furthermore, Allee uses the concept of “roles” to define the participants within a value network. These roles are filled by different individuals, groups or organizations. (Allee 2008, p.8ff)

Figure 25 represents a value network modeled with Allee`s notation distinguishing between tangible and intangible value exchanges.

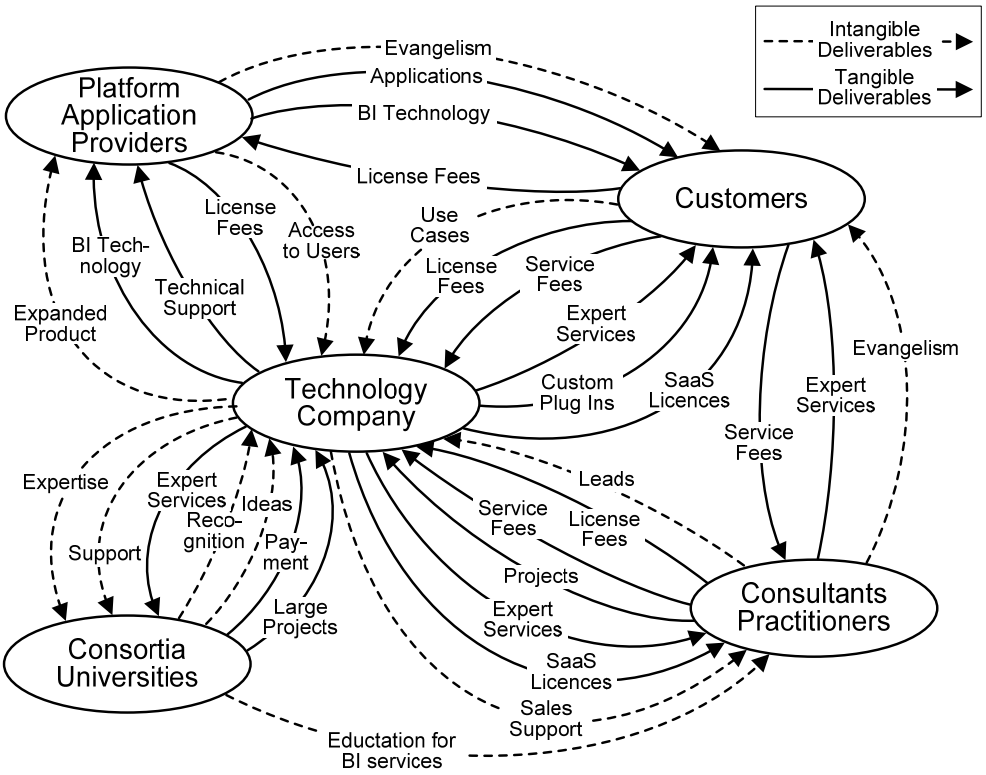


Figure 25 A value network based on Allee´s notation distinguishing between tangible and intangible value exchanges (figure modified from (Allee, Schwabe 2009, p.5))

With the modeling of tangible as well as intangible value exchanges within one model, an overview on the entire system can be created, which can not be modeled with typical process modeling notations (Allee 2002, p.199).
According to Allee, the Value Network Analysis can be seen as a complement to existing organizational tools such as organization charts, asset management tools, social networks and business process modeling (Allee 2009, p.431).

4.3 i* Framework

The i* Framework is mainly based on the contributions by Yu (Yu, Mylopoulos 1994) (Yu 1995) (Yu 1997) and has been developed in the requirements engineering and business process reengineering community. It identifies agents and the relations between these agents. In contrast to other modeling approaches introduced in this chapter, it does not focus on value exchanges between actors. Instead, it deals with strategic interests of actors and dependencies between actors which are inherent within value networks. The i* notation basically consists of two modeling notations, each

focusing on different aspects (Yu, Mylopoulos 1994, p.1ff) (Yu 1995, p.1ff) (Yu 1997, p.226ff):

- **Strategic Dependency (SD) model:** SD models aim at modeling the strategic aims of every actor and the way the actors intend to achieve these goals by co-operation with other actors. The result of the SD model is a compact overview on the strategic dependency relations between each actor. (Yu, Mylopoulos 1994, p.1ff) (Yu 1995, p.1ff) (Yu 1997, p.226ff)
- **Strategic Rational (SR) model:** In contrast to the SD model which focuses on the dependency relationships between the actors of a value network, the SR model focuses on the internal dependency relations within the actors. SR models visualize internal task relations needed to accomplish the individual goals. SR models are intended to represent the existing combination of tasks within an actor and furthermore to provide a toolset to generate new combinations of alternative tasks to achieve the same goals as with the existing combinations. Therefore SR models facilitate the identification and generation of alternative task configurations in the course of business process reengineering projects without loosing sight of the basic goals of each actor. (Yu, Mylopoulos 1994, p.1ff) (Yu 1995, p.1ff) (Yu 1997, p.226ff)

The SD and SR models briefly introduced above are described in detail in the following two sections.

4.3.1 The Strategic Dependency (SD) Model

The Strategic Dependency model in Figure 26 represents the dependency relations between actors within a goods acquisition process. The “client” wants to receive an item which is delivered by the “vendor”. Therefore the “client” depends on “purchasing” to get the item. Transitively, “purchasing” depends on the “vendor” to deliver the item. “Purchasing” also depends on “receiving” to receive the item, whereas the latter depends on “purchasing” regarding the purchasing information. “Accounts payable” depends on “purchasing” for the purchasing information, on “receiving” for the receiving status and on “vendor” for the invoice. The vendor depends on “accounts payable” for the payment relation. (Yu, Mylopoulos 1994, p.2ff)

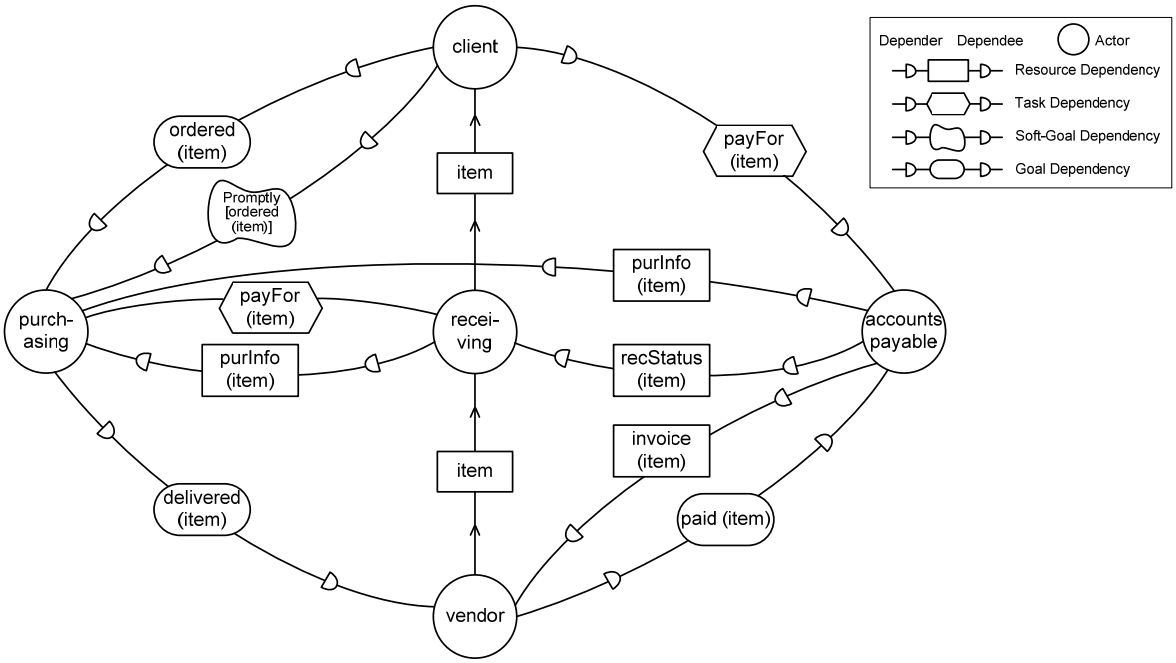


Figure 26 Strategic Dependency model representing a goods acquisition process (figure modified from (Yu, Mylopoulos 1994, p.4))

As illustrated in Figure 26, SD models consist of actors and dependency relations. According to Yu (Yu, Mylopoulos 1994, p.3) *"[w] we call the depending actor the depender, and the actor who is depended upon the dependee."* Furthermore, SD models differentiate four types of dependency relations (see also Figure 26):

- Goal dependency: *"In a Goal dependency, the depender depends on the dependee to bring about a certain state in the world. The dependee is given freedom to choose how to do it. With a goal dependency, the depender gains the ability to assume that the condition or state of the world will hold, but becomes vulnerable since the dependee may fail to bring about that condition."* (Yu 1995, p.13)
- Task dependency: *"In a Task dependency, the depender depends on the dependee to carry out an activity. A task dependency specifies how the task is to be performed, but not why. The depender is vulnerable since the dependee may fail to perform the task."* (Yu 1995, p.14)
- Resource dependency: *"In a Resource dependency, one actor (the depender) depends on the other (the dependee) for the availability of an entity (physical or informational). By establishing this dependency, the depender gains the ability to use this entity as a resource. At the same time, the depender becomes vulnerable if the entity turns out to be unavailable."* (Yu 1995, p.14)

- **Softgoal dependency:** *"A softgoal is typically a quality (or non-functional) attribute on one of the other intentional elements in a routine, e.g., that a payment be issued promptly."* (Yu, Mylopoulos 1994, p.7) *"In a Softgoal dependency, a depender depends on the dependee to perform some task that meets a softgoal. The meaning of the softgoal is specified in terms of the methods that are chosen in the course of pursuing the goal. As in a goal dependency, a depender gains the ability of having the goal condition brought about, but becomes vulnerable in case the dependee fails to bring about that condition. The difference here is that the conditions to be attained are elaborated as the task is performed."* (Yu 1995, p.14f)

All in all, the SD model provides a good overview on the strategic dependency relations between the actors of a value network.

4.3.2 The Strategic Rational Model

The Strategic Rational model in Figure 27 represents the internal task structure, dependencies and alternative task configurations for achieving the goal to "have an item" (Yu, Mylopoulos 1994, p.5ff).

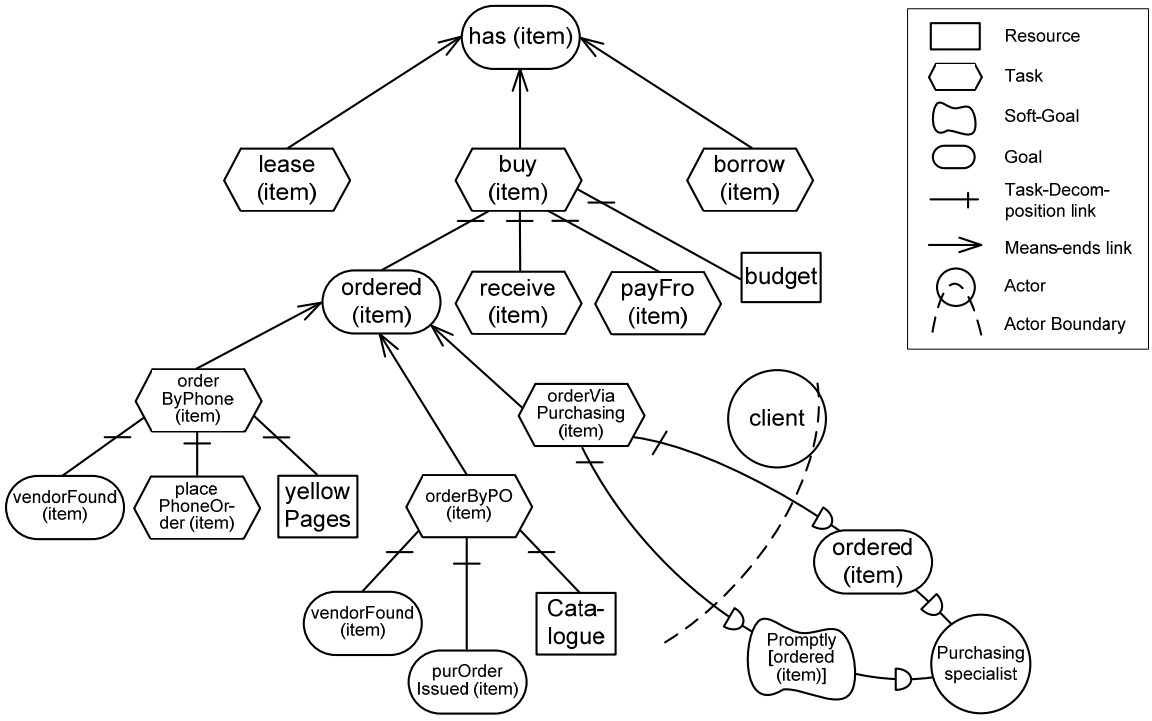


Figure 27 A Strategic Rational model representing alternative task combinations to achieve the internal goal "having an item" (figure modified from (Yu, Mylopoulos 1994, p.6))

A SR model consists of different types of nodes and links. Equivalent to the classification of dependency relations in the SD models, nodes are categorized into "goal-", "task-", "resource-" and "softgoal-" types. Links are classified into "means-ends link" and "task decomposition links". (Yu 1995, p.31ff) (Yu, Mylopoulos 1994, p.5ff)

- **Means-ends link:** *"A means-ends link indicates a relationship between an end – which can be a goal to be achieved, a task to be accomplished, a resource to be produced, or a softgoal to be satisficed – and a means for attaining it."* (Yu 1995, p.31) The means-ends links within Figure 27 represent three different ways of accomplishing the internal goal of "having an item". In order to achieve the goal "have an item" one can either execute the task "lease the item", "buy the item" or "borrow the item". (Yu, Mylopoulos 1994, p.5f)
- **Task decomposition link:** Task decomposition links are used to describe a particular task in detail by specifying its sub-elements, which can be classified into the introduced types "goal", "task", "resource" and "softgoal". Figure 27 provides several examples for a task decomposition link. The "order ByPhone (item)" task can be decomposed into the components "yellow pages"-resource, "place PhoneOrder (item)"-task and the "vendorFound (item)"-goal. (Yu 1995, p.31ff) (Yu, Mylopoulos 1994, p.5ff)

As already described in section 4.3, SR models offer a toolset to represent internal goals and relationships of an actor, which facilitates the generation of alternative task combinations within the course of process reengineering (Yu, Mylopoulos 1994, p.1ff) (Yu 1995, p.1ff). Despite the application in the process reengineering area, SD and SR models can also be applied in the area of strategic planning and analysis of ISS where they can act as a valuable extension to existing value network notations. Gordijn, Yu and van der Raadt (Gordijn, Yu & van der Raadt 2006) provide an example for the combination of the i* Framework and the e3 Value Network Notation described in detail in section 4.1.

4.4 Biem & Caswell Value Network Model

The Value network notation of Biem & Caswell (Biem, Caswell 2008) is one of the latest contributions to the area of value network analysis and is based on existing approaches like e3-value (section 4.1) and Allee's value network analysis (section 4.2). Similar to the referenced notations, value networks based on Biem & Caswell represent "actors" that exchange certain "values" between each other with the ultimate goal to deliver a common value to the end consumer. (Biem, Caswell 2008, p.1ff)

The definition of an actor is extended *"... to include any economic agents with a transferable where the transfer process can be monitored and acknowledged by a third party."* (Biem, Caswell 2008, p.3) The notation of Biem & Caswell is based on the ARA (Actor-, Resource-, Activity- layer) model (Hakansson, Johanson 1992, p.28ff) and therefore models the resources called "assets" and the activities called "capabilities" explicitly for each actor within the value network (Biem, Caswell 2008, p.4). This is an enhancement of the e3-value notation where only capabilities are modeled explicitly and to Allee's notation where just actors without any explicit properties are modeled.
Furthermore, Biem & Caswell classify the exchanged values into the categories "Brand", "Product", "Information", "Service" and "Coordination" and represents these categories by individually colored symbols (Biem, Caswell 2008, p.4). This categorization enhances the "value object" concept of e3-value that does not define specific object types and the categorization of tangible and intangible value exchanges of Allee's notation.
Biem & Caswell also propose an iterative approach that assists in constructing and analyzing value networks (Biem, Caswell 2008, p.6f).
Since the notation of Biem & Caswell forms a basis of further enhancements introduced within this thesis, illustrations of the notation concepts follow in section 5.

4.5 Conclusion and identification of room for improvement for Value Network Notations

This chapter provided an overview on existing value network notations. Starting with the e3-value notation (section 4.1), which provided a detailed definition of the elements of a value network and its analysis concepts, continuing with Allee's Value Network notation (section 4.2) which put its emphasis on the representation of intangible value exchanges, leading to the i* Framework (section 4.3) for modeling strategic relations within a value network. Finally, Biem & Caswell's value network notation represents the latest value network notation, which is based on the e3-value together with Allee's value network notation and has been introduced in section 4.4.
All introduced notations facilitate the representation of the basic building blocks and value exchanges within a value network.
However, practical applications of Biem & Caswell's model have led to the insight that there are still effects in business models that can not be explained using the models currently available, which, in turn, led us to develop some extensions to this model.

Conventional modeling techniques such as e3-value e-business modeling method or Biem & Caswell's method represent value exchanges between economic entities, but internal and external forces influencing the agents that provide the values cannot be captured.
The motivation of an agent directly influences the quality of the value provided and, in consequence, the entire value network. Highly motivated agents may accelerate the value generation in the value network, whereas it takes just one agent to decelerate the value generation of an entire value network. Current research (Vroom 1964) (Porter, Lawler 1968) (Vroom 1995) (Kelman 1961) (Barbuto 2005) shows that both internal and external forces determine the motivation of each agent. This motivation mainly influences an agent's job prioritization and therefore timeliness and quality of service. In order to capture these factors, we need to refine existing models and introduce an extended notation.

Figure 28 represents the basic idea of the enhancements introduced in chapter 5. The value network on the left represents a simplified value network of an ICT-based ISS modelled with Biem & Caswell's Notation. The value network on the right represents the same value network including the enhancements of exogenous influences and endogenous motivation. The highlighted agent "Content creator" is rated by a neutral exogenous influence marked with the "~" symbol and a negative endogenous motivation marked with the "-" symbol at the source of the value exchange link. Based on these neutral and negative ratings, this agent is identified as a weak spot within the value network, which may influence the entire value network in a negative way. These facts can not be presented with existing notations as illustrated on the left side of Figure 28.

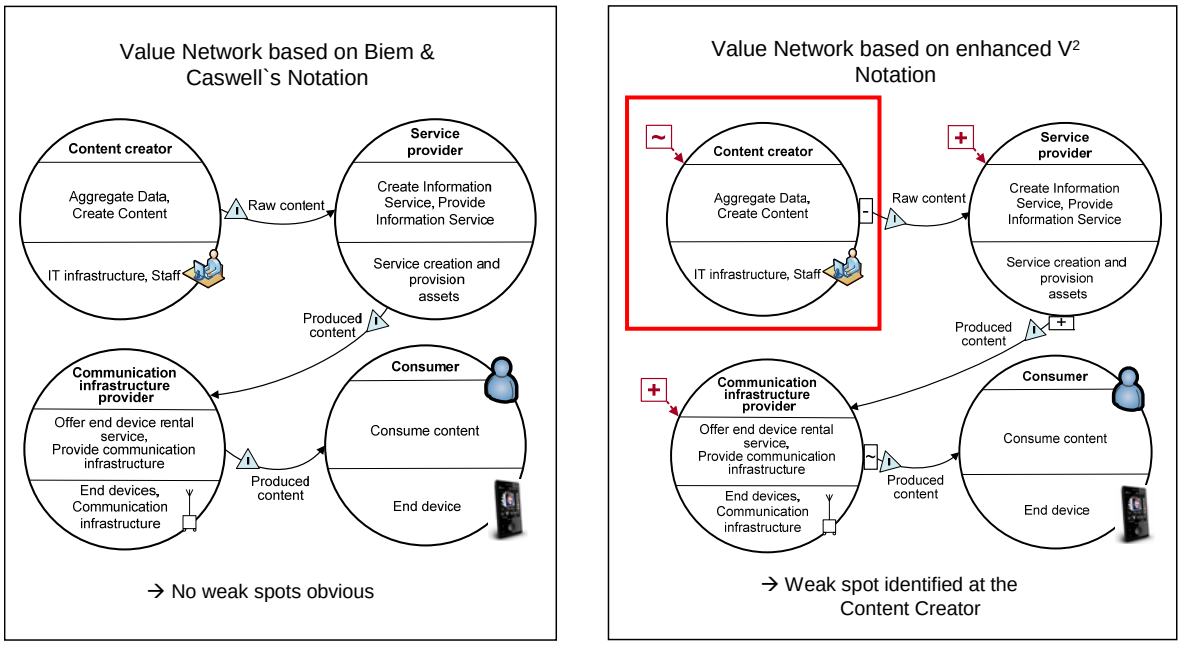


Figure 28 The enhancements with endogenous motivation and exogenous influences at each actor facilitate the identification of weak spots and system engines within the value network. The actor "Content creator" has a neutral exogenous influence and a passive endogenous motivation and therefore acts as a weak spot for the value network.

The extended notation is called the "V² Value Network Notation" and is described in detail in the following chapter 5.

CHAPTER

5 The V² Value Network Notation for ICT-based ISS

Today nearly every business system has different economic entities working together in complex, network-like structures in order to be able to provide a benefit for the end customer. The associated value streams can be represented as a value network (see Figure 28 or the left side in Figure 39).
Strategic analysis of a company's relationships to other partners within a business system requires enhanced management tools (Biem, Caswell 2008, p.1). Inter-organizational transactions can become quite complex easily because of global trends and technological advances (Biem, Caswell 2008, p.1). In order to keep track of these relationships, modeling techniques such as the e3-value e-business modeling method (Gordijn, Akkermans & Van Vliet 2000) have been developed.
Particularly business models in the area of ICT-based information service systems can not be described in a linear fashion as with Porters (Porter 1985) value chain model (Biem, Caswell 2008, p.1). ISS providers need to cooperate with other partners in order to be able to provide the intended service.
There has been a lot of research activity in the area of value networks so far. Early studies such as the i* strategic dependency model (Yu 1995) (Yu, Mylopoulos 1994) (Gordijn, Yu & van der Raadt 2006), the Allee's value network model (Verna 2003) (Allee 2009), the e3-value e-business modeling method (Gordijn, Akkermans & Van Vliet 2000) and the c3 network (Weigand et al. 2007), which is based on the e3-value e-business modeling method, help to do basic analysis of value networks (Biem, Caswell 2008, p.1ff). The latest enhancement for value network notations is from Biem & Caswell (Biem, Caswell 2008) which is mainly based on the e3-value e-business modeling method.

However, practical applications of Biem & Caswell's model have led to the insight that there are still effects in business models that can not be explained with the models currently available and led us to develop some extensions to this model (see Figure 28).

In the conclusion of the analysis of existing value network notaions in section 4.5 it was shown, that conventional modeling techniques such as e3-value e-business modeling method or Biem & Caswell's method represent value exchanges between economic entities, but internal and external forces influencing the agents that provide the values cannot be captured.
Since the motivation of an agent directly influences the quality of the value provided and, in consequence, the entire value network, explicit modelling of this concept may reveal effects, that could not be modelled with existing approaches.
In order to capture exogenous influences and endogenous motivation for each actor, we need to refine existing models and introduce an extended notation.
The new Value Network Notation we call for reference further "V²", proposed in this thesis, builds on Biem & Caswell's notation (Biem, Caswell 2008) and enhances it in several ways. Based on our preliminary results shown at (Vorraber, Voessner 2010) (Vorraber, Vössner 2011) the V²-concepts will be refined and further concepts will be presented within this thesis.

5.1 Basic building blocks

Figure 29 shows an economic entity which represents and describes agents participating in a value network. We speak of an '**economic entity**' if an individual business plan can be designed for a value network participant (Biem, Caswell 2008, p.3ff). An economic entity can be a firm, a business unit or an individual (Biem, Caswell 2008, p.4). In practice we observed in ISS networks sometimes business plans/models where the cost side would dominate the revenues side. This was often an example for "good will" or "cross project values".
An economic entity consists according to Biem & Caswell (Biem, Caswell 2008, p.3ff) (who based their concept on Hakansson & Johanson (Hakansson, Johanson 1992, p.28ff)) of three parts: **'Agent'** (or actor) represents the legal entity driving the individual business model. **'Capabilities'** represents all dynamic aspects such as processes and activities that are executed by the economic entity when participating in the value network (e.g. aggregating information).

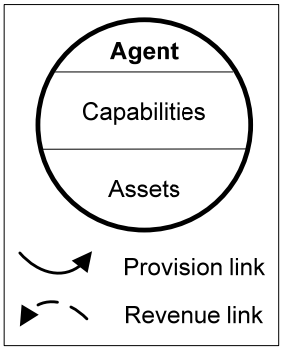


Figure 29 Economic entities represent agents participating in a value network. Provision and revenue links represent value exchanges between economic entities (figure modified from (Biem, Caswell 2008, p.4)).

'Assets' are all static things of tangible (e.g. IT-systems) and intangible (e.g. knowledge) nature tied permanently or semi-permanently to the economic entity in order to facilitate its value generation (Biem, Caswell 2008, p.4) (Wernerfelt 1984, p.172ff). Economic entities exchange values between each other (Biem, Caswell 2008, p.1ff). The source and destination of value exchanges are modeled with arcs where the arrow of such a link points to the destination of the value exchange. There are two different link styles that represent two different directions of a value provision either in the direction of the end customer (provision link) or vice versa (revenue link). The provision link is represented by a solid line. The revenue link is represented by a dotted line and visualizes value transfers that are generated for paying the participant for his value provisions.

The values exchanged between economic entities are represented by transfer objects. The transfer objects are based on the concepts of 'value objects' by Gordijn, Akkermans & Van Vliet (Gordijn, Akkermans & Van Vliet 2000) and on the 'offerings' concept described by Normann & Ramirez (Normann, Ramirez 1993) which was later extended by Biem and Caswell (Biem, Caswell 2008). We will categorize different types of transfer objects according to our extension of Biem and Caswell's notation (Biem, Caswell 2008). Transfer object types are represented by labeled rectangles placed on transfer links.

5.2 Types of transfer objects

The basic types of transfer objects according to Biem & Caswell (Biem, Caswell 2008) are 'product', 'brand', 'service', 'coordination' and 'information'.

Figure 30 represents the types of transfer objects of the V² value network notation used in this thesis consisting of Biem & Caswell's (Biem, Caswell 2008) types and our enhancements ('monetary value' and 'intangible value').

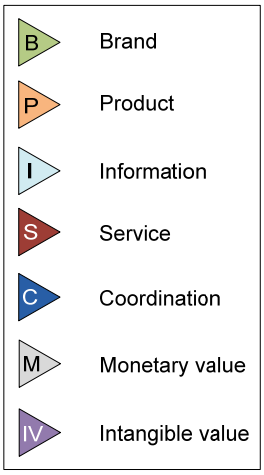


Figure 30 Transfer objects represent the values exchanged between economic entities. Transfer objects are categorized into different types (figure modified from (Biem, Caswell 2008, p.4f)). These categories are enhanced by our new types (M, IV).

5.2.1 Information

In our context of modeling information service systems, the transfer object type 'information' represents the transfer of information in a sense of a trading good.

5.2.2 Service

According to (Biem, Caswell 2008, p.4ff) the transfer object type 'service' represents a service delivery provided by a service provider to a service recipient. Service delivery changes the state of 'something' at the service receiver. This something can be tangible (e.g. IT components) or intangible (e.g. knowledge).

5.2.3 Monetary Value

The transfer object type 'monetary value' is based on Gordijn, Akkermans & Van Vliet´s (Gordijn, Akkermans & Van Vliet 2000) modeling of payment transactions in their e3-value e-business modeling method. Monetary value flows represent the exchange of monetary values, where the values are transferred from 'source participants' to 'receiving participants' represented by directed arcs.

5.2.4 Intangible Value

The transfer object type 'intangible value' represents the exchange of intangible values. It is based on the concept of modeling consumer experiences with value objects by Gordijn, Akkermans & Van Vliet (Gordijn, Akkermans & Van Vliet 2000). We use intangible values for example for modeling the raising of a company's reputation based on positive customer experiences.

5.2.5 Brand

The transfer object type 'brand' is defined according to Biem & Caswell as "*… a prior awareness of the potential value generated by the economic entity (actor), typically as a consequence of past offerings appreciation or a deliberate marketable intangible.*" (Biem, Caswell 2008, p.4)

5.2.6 Product

The transfer object type 'product' is defined according to Biem & Caswell as "*… any transferable out where the ownership of the transferable is also transferred to the recipient.*" (Biem, Caswell 2008, p.4)

5.2.7 Coordination

The transfer object type 'Coordination' is defined according to Biem & Caswell in the following way: "*Coordination creates value by managing the network of economic entities [actors] and their offerings.*" (Biem, Caswell 2008, p.4)

5.3 Notation Enhancements – Endogenous motivation and exogenous influences

We extend the existing value network notation described above with two concepts in order to be able to explain effects that could not be described otherwise.
Notations such as the e3-value e-business modeling method and Biem & Caswell's notation (Biem, Caswell 2008) describe value transfers between agents which greatly help to understand the basic structure of a value network. In real world scenarios, however, we observe dynamic, network intrinsic forces that can accelerate and decelerate the rate of value exchange between the agents. This has a dramatic impact on the value provision for the end customer.

If there is, for example, an agent in the middle of a value stream who is not really motivated to participate in the network, this particular agent may influence the value provision of the entire network in a negative way by becoming a bottleneck for the delivered services to the end customer. This can lead to the paradox effect that the end customer still gets poor service, even if agents preceding and following this unmotivated agent are highly motivated. Furthermore, this poorly performing agent does not only affect the value flow negatively, he also influences the motivation of the other agents in a negative way. Agents who are initially motivated but do not get their expected revenue flows back may lose interest in participating in the network and therefore also become unmotivated. In this case the whole business model/system can become unstable.
During several real world case studies in the area of ICT-based ISS we found business cases where exactly the effects described above occurred. For companies it is crucial to detect both, poor and excellent value network constellations already during system design in order to make the right strategic decisions. Our framework helps to analyze existing value networks and assists in planning new value networks.

As stated above several works in the area of motivation theory such as Vroom (Vroom 1964) (Vroom 1995) and Porter & Lawler (Porter, Lawler 1968) prove the existence of internal and external forces, mainly based on job prioritization of involved individuals, which is influenced by personal or organizational motivation and incentives. In order to model these internal and external forces which may cause acceleration or deceleration of the value generation in a value network, we introduce the concepts of endogenous motivation and exogenous influences. Both determine the value provision of the agent (see Figure 33).

5.3.1 Theoretical underpinning of endogenous motivation and exogenous influences

The endogenous motivation is based on the "expectancy theory" of Vroom (Vroom 1964) (Vroom 1995) where "*[h]e argued that employees tend to rationally evaluate various on-the-job work behaviors (e.g., working harder) and then choose those behaviors they believe will lead to their most valued work-related rewards and outcomes (e.g., a promotion). Thus, the attractiveness of a particular task and the energy invested in it will depend a great deal on the extent to which the employee believes its accomplishment will lead to valued outcomes.*" (Steers, Mowday & Shapiro 2004, p.382).

Porter and Lawler based their model on the expectancy theory of Vroom and refined this model by creating a cognitive expectancy framework describing the process which is underlying the work motivation (see Figure 31) (Steers, Mowday & Shapiro 2004, p.381f) based on (Porter, Lawler 1968, p.10ff).

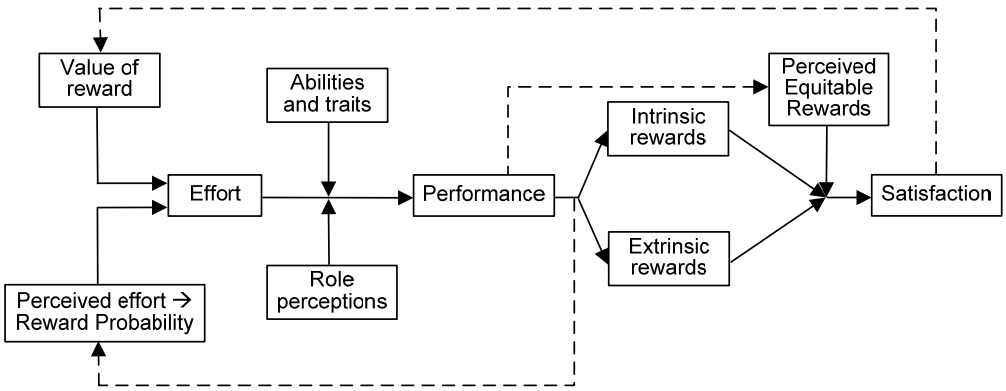


Figure 31 The Cognitive Expectancy Framework of Porter and Lawler (figure modified from (Porter, Lawler 1968, p.17))

According to the Expectancy Theory of Vroom, this framework (see Figure 31) describes that the attractiveness of the potential outcome of an individual's behavior ("Value of reward") and the perceived probability that effort leads to this reward ("Perceived effort-reward probability") influence the effort of an individual in the work situation (Porter, Lawler 1968, p.16ff) (Porter, Lawler 1968, p.160f). The term "Effort", used in this framework, is synonym for the term "motivation" (Porter, Lawler 1968, p.21).

Since every individual has a different level of abilities, the framework describes that the "Effort", combined with the "Abilities and traits" of the individual and its "Role perception", determine the "Performance" of the individual in a work situation (Porter, Lawler 1968, p.160f).

Based on its performance, an individual experiences rewards, which can be either intrinsic (e.g. feeling of accomplishment) or extrinsic (e.g. external reward) (Porter, Lawler 1968, p.28f) (Porter, Lawler 1968, p.160f). The framework states that every individual has a notion about the level of rewards a person should receive for his performance on a specific task ("Perceived equitable rewards") (Porter, Lawler 1968, p.29f). The "Satisfaction" of an individual is therefore determined by "*… the difference between perceived equitable and actual rewards* [.]" (Porter, Lawler 1968, p.162).

Porter and Lawler furthermore state that the "Perceived equitable rewards" are influenced by individual ratings of the employee's performance in the way that *"…*

higher levels of self-related performance are associated with higher levels of expected equitable rewards." (Porter, Lawler 1968, p.164)
As described by Steers, Mowday & Shapiro, the framework of Porter and Lawler *"… incorporated a feedback loop to recognize learning by employees about past relationships. That is, if superior performance in the past failed to lead to superior rewards, future employee effort may suffer as incentives and the reward system lose credibility in the employee´s eyes.*" (Steers, Mowday & Shapiro 2004, p.382)

The concept of "Endogenous Motivation" described within this work matches the variable "Effort" in the cognitive expectancy framework of Porter and Lawler described above, whereas the concept of "Exogenous Influence" matches the variable "Extrinsic rewards" in the expectancy framework. Further, external influences are described in section 5.3.1.1 as "Instrumental" and "Self-concept-external" sources of motivation.

5.3.1.1 Categorization of motivation sources

Since there exist many different studies about sources of motivation (see Steers, Mowday & Shapiro (Steers, Mowday & Shapiro 2004) for an overview on different theories) Barbuto (Barbuto 2005) has introduced a classification schema for different sources of motivation. As shown in Figure 32, sources of motivation can be categorized either as "intrinsic" or "extrinsic". These two main categories can be further divided into to five different subcategories.
Intrinsic motivation deals with personal emotions such as fun, trust and self-worth that are derived from internal influcens. On the contrary, extrinsic motivation is derived from a persons surrounding. (Barbuto 2005, p.31f) (John Jr, Barbuto 1998, p.1011ff)

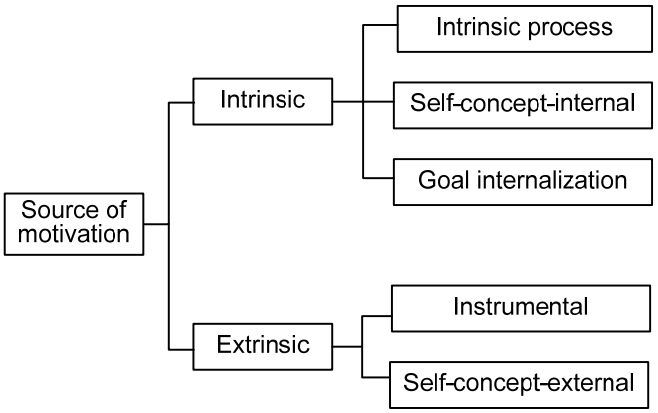


Figure 32 Sources of motivation according to Barbuto (Barbuto 2005, p.31f)

5.3.1.1.1 Intrinsic motivation sources

Barbutto attributes the following sources of motivation to the category "Intrinsic" :

- Intrinsic process
- Self-concept-internal
- Goal internalization. (Barbuto 2005, p.31f)

As explained above, these three subcategories describe motivation sources that are influenced by an individual's internal factors (Barbuto 2005, p.31f). "**Intrinsic process**" motivation sources are characterized by the fact that "*… the work itself acts as the incentive because workers enjoy what they are doing.*" (Barbuto 2005, p.28).

The concept of "**Self-concept-internal**" motivation sources is also based on internal motivation factors. But it differs from the "Intrinsic process" motivation sources in the fact that the former is based on the reinforcement of pleasure based on the accomplishment of a task, whereas the latter is based on the reinforcement of pleasure evoked through the task itself. (Barbuto 2005, p.28ff)
Furthermore, Barbuto describes the "Self-concept-internal" motivation source in the following way:
"In this type of motivation, the individuals set internal standards for traits, competencies, and values that become the basis for their ideal selves [(Leonard, Beauvais & Scholl 1999)]. Persons are then motivated to engage in behaviors that reinforce these standards and later achieve higher levels of competency." (Barbuto 2005, p.30)

The concept of "**Goal internalization**" is defined in the following way:
"Behavior motivated by goal internalization occurs when individuals adopt attitudes and behaviors congruent with their personal value systems. Strong ideals and beliefs are paramount in this motivational source [(John Jr, Barbuto 1998)]. Individuals motivated by goal internalization believe in the cause and have developed a strong sense of duty to work toward the goal of the collective." (Barbuto 2005, p.31)

All in all, the concept of "Goal internalization" is especially characterized by the fact that the individuals believe in the cause, while with the "Intrinsic process" concept, the individuals need to enjoy the work being performed. Finally, the concept of "Self-concept-internal" is especially characterized by the fact that the individuals are stimulated by personal challenge and self-regulation. (Barbuto 2005, p.31)

5.3.1.1.2 Extrinsic motivation sources

Barbuto defines the concept of "**Instrumental**" motivation and at the same time delineates this concept from "Self-concept-external" motivation in the following way:
"Instrumental rewards motivate individuals when they perceive their behavior will lead to certain extrinsic tangible outcomes, such as pay, promotions, bonuses, etc. (Kelman, 1958)." (Barbuto 2005, p.29)
Instrumental motivation is based on the concept that the motivation is derived from tangible external rewards. This concept does not include social rewards and interpersonal exchanges which form the basis for the "Self-concept-external" motivation type. (Barbuto 2005, p.29)

Furthermore, "**Self-concept-external**" motivation *"[…] tends to be externally based when individuals are other-directed and seek affirmation of traits, competencies, and value from external perceptions. The ideal self is adopted from the role expectations of reference groups, explaining why individuals high in self-concept-external motivation behave in ways that satisfy reference group members, first to gain acceptance, and after achieving that, to gain status. […] Classical articulations of social rewards or social exchanges are consistent in concept and motivational explanation with self-concept-external motives."* (Barbuto 2005, p.29f)

5.4 Endogenous motivation

The endogenous motivation describes the level of motivation of employees within agents who participate in the value network and provide value generating activities. These activities can be based on several factors such as organizational/personal values (e.g. expressed in the organization's mission statement) of the agent, internal reputation or other motivation factors already mentioned such as good will for "family and friends" and "cross project benefits".

5.4.1 Levels of endogenous motivation

We classify endogenous motivation into three categories (see Figure 33):

- **Defensive (-):** The agent performs the value activity only if it is not conflicting with his own goals. Employees give the least attention to the value network task. This situation can also be described as "passive aggression" according to Buss (Buss 1961, p.203f) (Giacalone, Greenberg 1997, p.39).
- **Neutral (~):** The agent performs the value activity collaboratively in a timely manner. Tasks of the value activity have lower priority than personal tasks.

- **Active (+):** The agent performs and pursues value activity and collaboration actively. Tasks have either a higher than or equal priority than personal tasks.

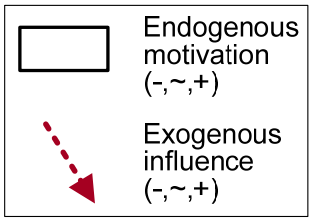


Figure 33 Endogenous motivation and exogenous influences are the significant enhancements to existing notations that help to explain value network effects that could not be described with existing notations.

5.5 Exogenous Influences

The exogenous influence describes external forces (e.g. from management) which facilitate or restrain the participation of the agent in the value network. This can be for various reasons such as strategy, business or legal constraints. Examples of external forces are direct orders to participate in the business venture. The concept of exogenous influences is based on Kelman's (Kelman 1961) external influences on a persons compliance and on Porter & Lawler's (Porter, Lawler 1968) extrinsic rewards as a consequence of the agent's performance.

5.5.1 Levels of exogenous motivation

Similarly to the endogenous motivation, we classify the exogenous influences into three categories (see Figure 33):

- **Defensive (-):** The external force disencourages the value activity.
- **Neutral (~):** The external force neither endorses, facilitates nor discourages the activity.
- **Active (+):** The external force actively encourages and facilitates the activity (e.g. special reward programs, management inquiries about project progress or performance).

5.6 Typical Combinations of endogenous motivation and exogenous influences

Altogether there are nine possible combinations between endogenous motivation and exogenous influence levels. For the discussion we select the four most interesting combinations that have a special impact on a value network (see Figure 34).

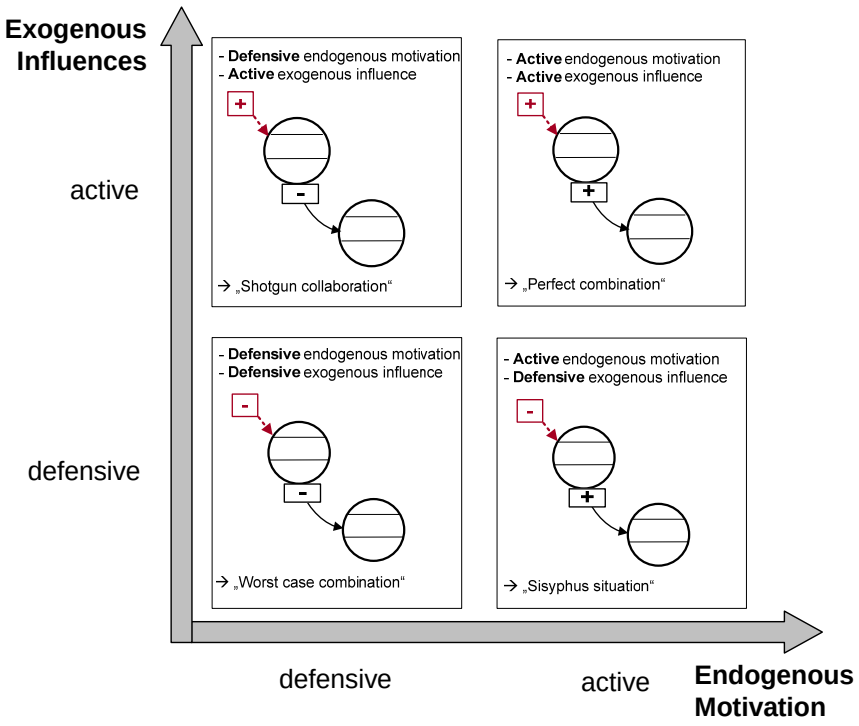


Figure 34 Typical combinations of endogenous motivation and exogenous influences

5.6.1 The “Worst Case Combination”

The worst case is a defensive (-) endogenous motivation combined with a defensive (-) exogenous influence (see Figure 34). Agents with this constellation are a severe threat for the entire value network. Negative impact may spread over the whole network. If this agent is supposed to provide a key component of the value network, the business case will fail with high probability.

5.6.2 "The Sisyphus Situation"- An active endogenous motivation struggling against defensive exogenous influence

Sometimes projects – often department-internal projects - are very much being pushed by employees based on personal beliefs. These employees are totally convinced of the project's meaningfulness and potential and invest a lot of personal effort into the project. As a consequence the endogenous motivation can be classified as active (+). Management, on the other hand, which has a negative attitude towards the project, is not convinced of the project's goals and at most tolerates the project or shows some resistance is represented by a defensive rating (-) for the exogenous influences (see Figure 34).

As a real world example for such a constellation, we can quote an example of a former R&D project manager for diesel engines of a well known German car manufacturer who pushed his idea to develop diesel engines for racing cars which became an internal project (active endogenous motivation). He was fully convinced that diesel engines may perform very well in racing cars, which was totally contradicting the corporate strategy to position gasoline engines for consumer sports cars and diesel engines for family and utility cars. Despite the defensive, negative external influence from (top) management the project survived because of the high professional reputation and personal engagement of the project manager. In the end the project was a tremendous success: the car manufacturer won several prestigious car races with diesel powered engines, the project manager was promoted and the whole corporate strategy changed based on these successes – a happy ending after all.

5.6.3 The "Shotgun Collaboration": Passive endogenous motivation paired with active exogenous influence

Exactly the opposite constellation to the previous one is a defensive (-) endogenous motivation coupled with an active (+) exogenous influence (see Figure 34). We call this case "Shotgun Collaboration" to indicate a forced marriage for no "obvious" reasons. Such a combination most likely occurs if employees are not committed to the tasks they have to fulfill as part of the greater value network. This may be based on several reasons. For example they do not understand why they should perform the task, or they think all other tasks are more important. The management of these employees on the other hand is very interested in collaborating in the value network and is actively pushing the project. This combination often occurs in value network collaborations which are outside the core business of an enterprise – at least from an employee's perspective.

A practical example for this combination comes from a technology transfer project between academia and industry. The academic department acted as a scientific partner in a research collaboration with an industry partner. The department was the initiator of the project and fully convinced the upper management of the industry partner to collaborate in this project. One core task in that project was to aggregate piles of data together with employees from a very operational level. These employees showed a very defensive endogenous motivation because they did not really understand why they should participate in the project. They were not committed to the project and felt distracted from their core tasks – despite great upper management attention and buy in. Projects with such a constellation can become quite exhausting for other agents in the value network who need to cooperate.

5.6.4 "The Perfect Combination"

If both factors - endogenous motivation and exogenous influence - can be rated as active (+), the actor has a perfect combination in respect to these two factors (see Figure 34). Agents with this combination can be valuable sources of power and high performers in a value network.

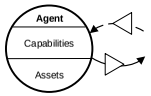
5.6.5 Conclusion

The enhancements to existing notations introduced with the V² Value Network Notation enables the explanation of multi party network effects that could not be described otherwise.
Figure 35 provides a compact overview on the elements and concepts of this notation.

The V² Value Network Notation:

Economic Entity, Links and Transfer Objects:

Economic Entity:



We speak of an Economic Entity if...
an individual business plan can be designed for the a value network participant. An economic entity can be a firm, a business unit or an individual. (Biem & Caswell, 2008)

Ports:
Actor have ports which are used either to provide a transfer object (**out port)** or to receive a transfer object (**in port**). An exchange between actors is only possible between opposite port pairs (in+out or vice versa). (Gordijn, Akkermans & Van Vliet 2000)

Transfer Object:
Transfer object represent the value exchanged between economic entities. Transfer objects are categorized into different types. Examples for transfer objects are products, information, services, money (monetary value) or reputation (intangible value).

Agent:
The agent represents the legal entity driving the individual business model (Biem & Caswell, 2008).

Capabilities:
Capabilities represents all dynamic aspects such as processes and activities that are executed by the economic entity when participating in the value network (e.g. aggregating information) (Biem & Caswell, 2008).

Assets:
Assets are all static things of tangible (e.g. IT-systems) and intangible (e.g. knowledge) nature tied permanently or semi-permanently to the economic entity in order to facilitate its value generation. (Biem & Caswell, 2008) (Wernfeldt, 1984)

Provision Link:
The provision link is used by one agent to provide a transfer object to an other agent in direction of end customer value provision.

Revenue Link:
The revenue link is used by one agent to provide a transfer object representing revenues (monetary/intangible values) to an other agent in the opposite direction of the end customer value provision.

Types of Transfer Objects:

Brand:
„A brand is a prior awareness of the potential value generated by the economic entity (actor), typically as a consequence of past offerings appreciation or a deliberate marketable intangible." (Biem & Caswell, 2008)

Product:
„A product is any transferable out where the ownership of the transferable is also transferred to the recipient." (Biem & Caswell, 2008)

Service:
A service is provided by a service provider to a service recipient. Service delivery changes the state of ‚Something' at the receiver. This something can be tangible (e.g. IT-components) or intangible (e.g. knowledge). (Biem & Caswell, 2008)

Information:
The transfer object type ‘information' represents the transfer of information in a sense of a trading good. (Biem & Caswell, 2008)

Coordination:
„Coordination creates value by managing the network of economic entities (actors) and their offerings." (Biem & Caswell, 2008)

Monetary value:
The transfer object type ‘monetary value' is based on (Gordijn, Akkermans & Van Vliet 2000) and represent the exchange of monetary values, where the values are transferred from ‘source participants' to ‘receiving participants' represented by directed arcs.

Intangible value:
The transfer object type ‘intangible value' represents the exchange of intangible values. It is based on the concept of modeling consumer experiences with value objects by Gordijn, Akkermans & Van Vliet (Gordijn, Akkermans & Van Vliet 2000). We use intangible values for example for modeling the raising of a company's reputation based on positive customer experiences.

Basic explanation of endogenous motivation and exogenous influences:

Endogenous motivation:
The endogenous motivation describes the level of motivation of employees within an agent who participate in the value network and provide value generating activities. These activities can be based on several factors such as organizational/personal values (e.g. expressed in the organization's mission statement) of the agent, internal reputation or other motivation factors such as good will for „family and friends" and „cross project benefits".

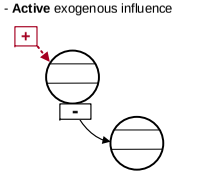
- **"defensive"**: The agent provides the value activity only if it is not conflicting with his own goals. Employees give the least attention to the value network task („passive aggression").
- **"neutral"**: The agent provides the value activity collaboratively in a timely manner. Tasks of the value activity have lower priority than Personal tasks.
- **"active"**: The agent performs and pursues value activity and collaboration actively. Tasks have either a higher than or equal priority than personal tasks.

Exogenous influence:
External forces (e.g. management) which facilitate or restrain the participation of the agent in the value network. This may be based on several reasons:
- business reasons
- legal reasons

- **"defensive"**: The external force disencourages the value activity.
- **"neutral"**: The external force neither endorses, facilitates nor discourages the value activity.
- **"active"**: The external force actively encourages and facilitates the activity (e.g. special reward programs, management inquiries about project progress or performance.

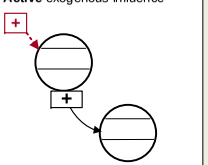
Typical combinations of endogenous motivations and exogenous influences:

- **Defensive** endogenous motivation
- **Active** exogenous influence



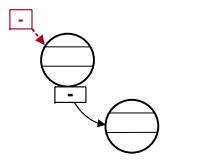
→ „Shotgun combination"

- **Active** endogenous motivation
- **Active** exogenous influence



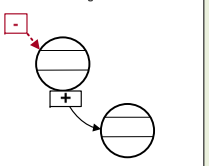
→ „Perfect combination"

- **Defensive** endogenous motivation
- **Defensive** exogenous influence



→ „Worst case combination"

- **Active** endogenous motivation
- **Defensive** exogenous influence



→ „Sisyphus Situation"

Quick overview:

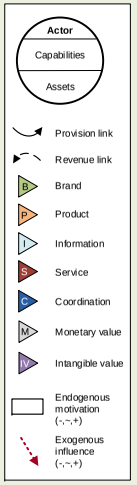


Figure 35 The V² Value Network Notation

CHAPTER

6 The analysis process for Value Networks of ICT-based ISS

The existing frameworks introduced in chapter 3 cover important aspects for the analysis and planning of ICT-based ISS. As described in section 3.7, these frameworks do not provide tools to analyze dynamics within value networks. As a consequence, enhancements to existing value network notations were developed and introduced in chapter 5. Based on these enhancements and on existing literature, a framework for the analysis of value networks of ICT-based ISS is introduced within this chapter. Since value networks integrate the different building blocks of ICT-based ISS they play a central role within business models for ICT-based ISS and are therefore crucial for the success of these systems.

The presented framework is aimed at strategic planners and analysers who have access to internal information sources regarding the ICT-based ISS. The resulting structures and graphical representations of the analysis and guidance process presented within this framework can be further used as a common basis for discussion with stakeholders also involved in the analysis or planning process such as top management or controlling departments.

The analysis and planning process proposed in this thesis is represented in Figure 36.

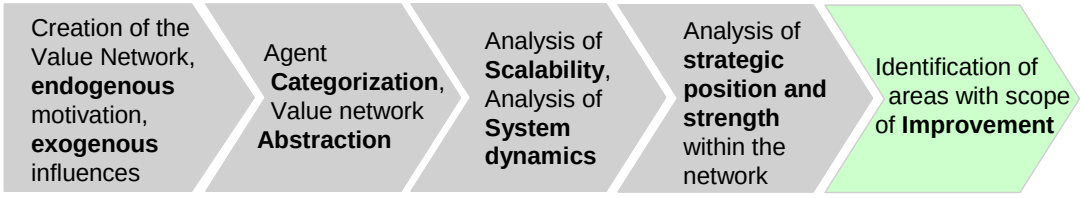


Figure 36 The analysis process for value networks

This process acts as practical guidance through the strategic planning framework and can be used for the analysis of existing ISS as well as for the planning of new ISS. In the case of the planning of new ISSs, the fourth step, “Analysis of strategic position and strength within the value network”, can also be executed directly after the creation

of the value network in the first step. The last process step is highlighted in a different shade than the previous process step to mark the final process step in which areas of improvement can be identified based on the results of the previous process steps. The following section will provide a detailed description of every process step.

6.1 Step 1 : Creation of the value network and analysis of endogenous motivation and exogenous influences

This step forms the foundation for all consecutive analysis steps. In this step the basic value network is created based on the V^2 value network notation. Furthermore, the endogenous motivation and the exogenous influences are identified.
A detailed description of the V^2 value network notation and the theoretical foundation of the concept of endogenous motivation and exogenous influences can be found in chapter 5.
The creation of the basic value network can be sub-divided into three basic steps:

- Identification of the participants of the value network.
- Description of the participants in terms of their capabilities and assets.
- Description of the value exchanges between the participants.

Based on this basic description of the value network, the enhancements to existing value network notations can be added in form of the endogenous motivation and exogenous influence levels of each value network participant.

6.1.1 Identification of the participants of the value network

First of all, the participants of the value network (economic entities) have to be identified. As specified in section 5.1, we speak of an '**economic entity**' if an individual business plan can be designed for a value network participant (Biem, Caswell 2008). An economic entity can be a firm, a business unit or an individual (Biem, Caswell 2008). Examples for economic entities are information provider, information distributor or end customers.

6.1.2 Detailed description of the participants

After the basic identification of the participants has succeeded, each participant has to be described in detail. Beside a general description of the participant, the main focus is

laid on the capabilities and assets. As defined in section 5.1, “capabilities” are all dynamic aspects or activities (e.g. validation and preparation of information) and “assets” are all static aspects (e.g. special IT-systems or specially skilled employees) of an agent that can be contributed to the value network.

6.1.3 Description of the relations between the participants

Since in this stage all participants are described in detail, all value exchanges between the participants have to be described in the following stage. Basically the value exchange-links are classified according to the direction of the value provision:

- “Provision links” describe value exchanges in the direction of the end customer and are represented by a solid line (e.g. provision of an information service to the end customer).
- “Revenue links” describe value exchanges against the direction of the end customer and are represented by a dotted line (e.g. payment for a service to the service provider).

The values transferred on these links can be further classified into different types (e.g. Information, Service, Monetary Value). Section 5.2 provides a detailed description of these value object types.

After the completion of the described three sub-steps, a basic value network that contains all participants and the value exchanges is created. Figure 37 shows an example of a basic value network of an ISS where a “Content creator” provides raw content to a “Service provider” which, in turn, creates an information service based on the content received. Furthermore, this information service is distributed through the infrastructure of a “Communication infrastructure provider” to the “Consumer”. The revenue links in this value network are value exchanges in the form of fees and are therefore represented by the value object type “Monetary value”.

This basic value network enables further enhancements to the value network and acts as a basis for the analysis steps explained in the following sections.

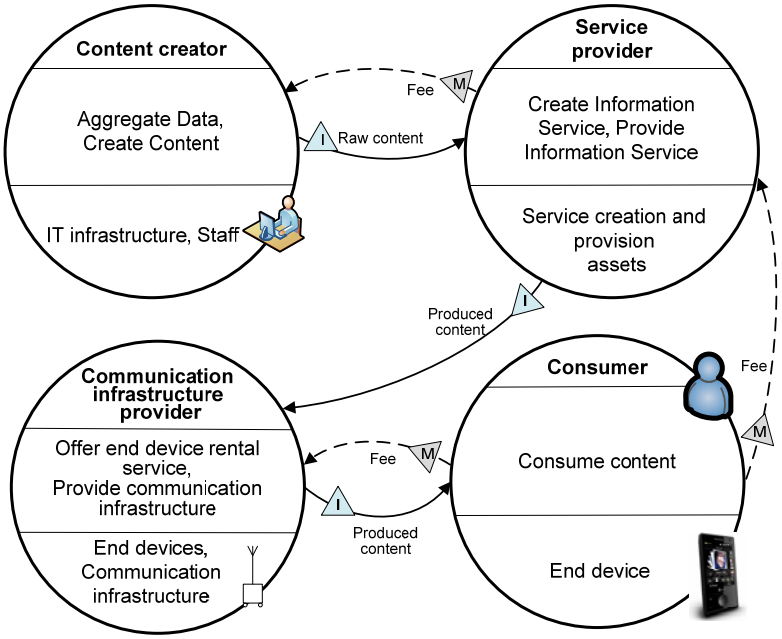


Figure 37 Example of a basic value network of an ISS

6.1.4 Analysis of endogenous motivation and exogenous influence

The basic value network has been developed in the first part of this step 1. Now two enhancements to this value network are added. These enhancements represent the endogenous motivation and the exogenous influence of each participant within the value network. These enhancements have proved to be of importance in identifying participants and value exchanges that can either accelerate or decelerate the value creation within a value network. For a detailed description of the concepts of endogenous motivation and exogenous influences see section 5.3 to section 5.6.

In short, the endogenous motivation describes the level of motivation of employees within an agent who participate in the value network and provide value generating activities. The endogenous motivation is classified into three categories:

- **Defensive (-):** The agent performs the value activity only if it is not conflicting with his own goals. Employees give the least attention to the value network task. This situation can also be described as “passive aggression” according to Buss (Buss 1961, p.203f) (Giacalone, Greenberg 1997, p.39).
- **Neutral (~):** The agent performs the value activity collaboratively in a timely manner. Tasks of the value activity have lower priority than personal tasks.
- **Active (+):** The agent performs and pursues value activity and collaboration actively. Tasks have either a higher than or equal priority than personal tasks.

The exogenous influence describes external forces (e.g. from management) which facilitate or restrain the participation of the agent in the value network. This can be for various reasons such as strategy, business or legal constraints. Similarly the exogenous influences are classified into three categories:

- **Defensive (-):** The external force disencourages the value activity.
- **Neutral (~):** The external force neither endorses, facilitates nor discourages the activity.
- **Active (+):** The external force actively encourages and facilitates the activity (e.g. special reward programs, management inquiries about project progress or performance).

The relevance of the enhancements of the value network notation with the concepts of endogenous motivation and exogenous influences is illustrated in Figure 28. Through the incorporation of the endogenous motivation and exogenous influence levels of each participant, a potentially weak spot within the value network in the form of the "Content creator" can be identified. The exogenous influence is rated as neutral and the endogenous motivation as defensive. This constellation may lead to the effect, that the whole value network builds upon content with a medium quality level and therefore does not exploit the entire potential within the value network.

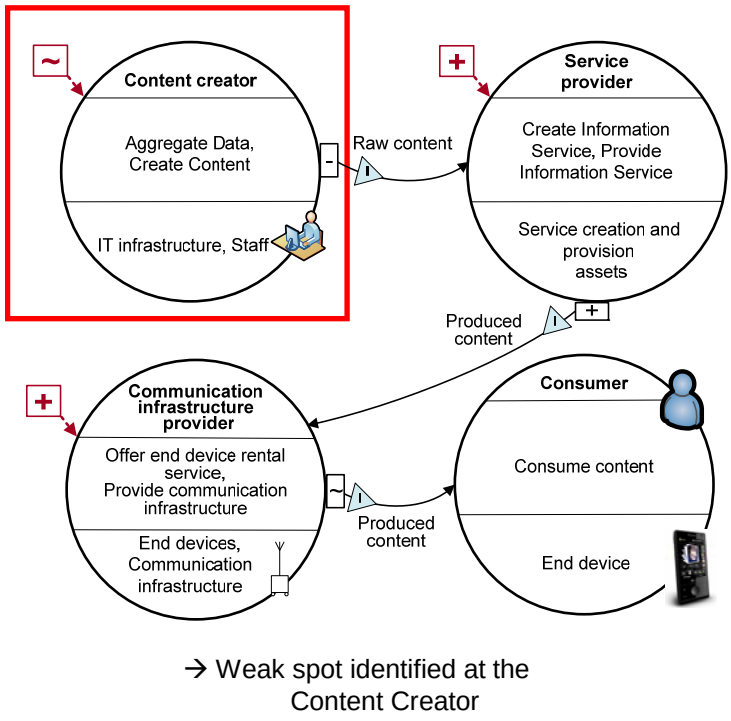


Figure 38 The enhancements of endogenous motivation and exogenous influences facilitate the identification of elements within the value network that accelerate or decelerate the value generation within a value network.

As a consequence the enhancements of the V^2 notation facilitate the identification of weak spots within the value network. Therefore this step provides the basis to analyze dynamic network effects.

6.2 Step 2: Categorization of the value network participants and abstraction of the value network

Value networks can easily get complex and confusing due to the number of participants and value exchange links. Therefore the value network is abstracted in this step in a way that complexity gets reduced without losing essential information (see Figure 39).

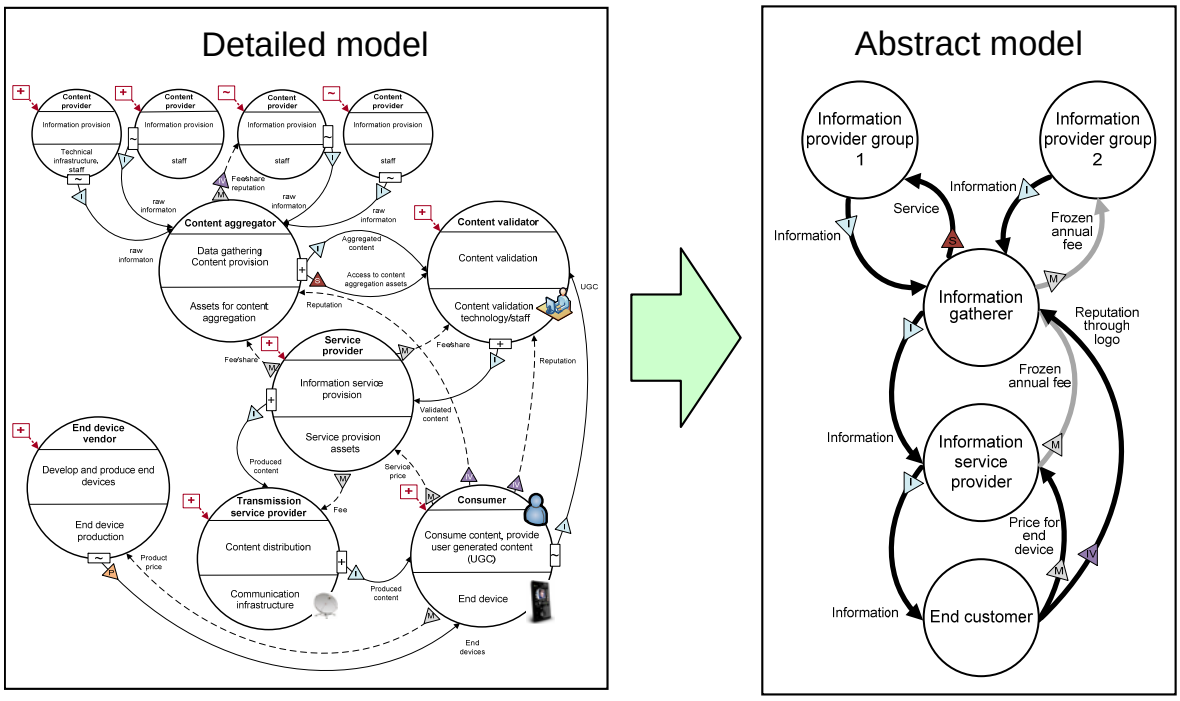


Figure 39 Categorization and Abstraction of the value network participants reduce complexity without loss of essential information.

Complexity reduction is achieved by categorization of value network participants and abstraction of value exchanges.

6.2.1 Categorization of the value network participants

Participants in a value network of ICT-based ISS can basically be classified into the following categories:

- **Information sources:** Participants who provide information to the ICT-based ISS are classified within this category.
- **Information gatherer:** Participants who aggregate the information provided by information sources are assigned to this category.
- **Information validator:** Since information for ICT-based ISS can be provided by several information sources which may be not always certified and trustworthy (e.g. user generated content), information has to be validated by certain agents who are classified within this category.
- **Information service provider:** Participants of the value network acting as the providers of the ICT-based ISS from the user's point of view are assigned to this category.

- **Information distributor:** Participants who provide the communication infrastructure required to transport the contents of the ICT-based ISS to the customers are classified within this category.
- **End customer:** All participants that consume the ICT-based ISS are assigned to this category.

Within this analysis step all value network participants are classified according to the introduced categories. If a participant has more than one role within a value network, he can also be assigned to multiple categories.

6.2.2 Abstraction of the value network

After the categorization of the participants, the value network gets abstracted by subsuming homogenous participants according to the following criteria:

- Similar properties in regard to „Capabilities“ and „Assets“.
- Similar properties in regard to the direction of the value provision (provision- and revenue link) and in regard to the type of the exchanged value object (e.g. information, monetary value).

Figure 39 provides an example for this abstraction step, where the detailed model can be seen on the left side and the abstracted model on the right. Since participants located in the top of the value network have similar properties and value exchange links, they are subsumed into two abstract value network participants (information group 1 and 2) in the right value network. Furthermore, different sub-departments of a value network participant are aggregated to one abstract participant in the abstract value network, since no essential information is lost for the following analysis steps concerning analysis of scalability and dynamics of value exhanges.

6.3 Step 3: Analysis of system dynamics and scalability of the value network

The analysis of system dynamics within the value network exchanges and the scalability of the value network relations is based on the abstracted value network resulting from the previous step.

6.3.1 Analysis of system dynamics of the value network

The aim of the analysis of system dynamics in the value network is to identify system engines within the relations that accelerate the value generation. The analysis tests every value network relation if an improvement of the value provision in the direction of the end customer (provision link) also leads to an improvement of the service in the reverse direction (revenue link). In the case that there is an improvement, the value network relation is marked as dynamic (see Figure 40 and Figure 41). If there is no improvement at the revenue link, the relation is marked as static (see Figure 40 and Figure 41).

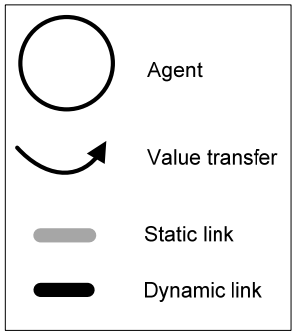


Figure 40 Legend for representing static and dynamic links within an abstracted value network

Figure 41 provides an example of a dynamic as well as of a static link. The dynamic case on the left side shows that an improvement of the information provided by the "information provider" to the "information gatherer" leads to an improvement of the service provided by the "information gatherer" in response to the "information provider".
The static case on the right side shows that there is no improvement of the value transported over the revenue link (frozen yearly fee) in response to an improvement of the value provided over the provision link (information).

„Does an improvement of the service in direction to the end customer (provision link) also lead to an improvement of the service in the reverse direction (revenue link)?“

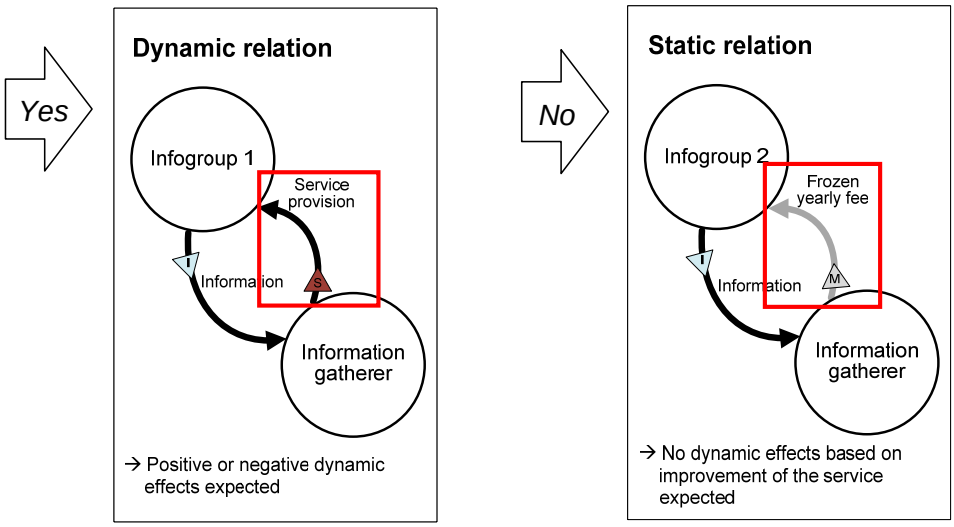


Figure 41 Analysis for system dynamics in value networks

The identification of the potential for “positive-” or “negative engines” in the form of dynamic relations in the value network is crucial. Dynamic relations may be the source of value network engines that accelerate the value generation within the value network. If a value exchange relation with a dynamic character works well and both participants benefit, this relation can reinforce the value generation within the whole network. An example for this effect is the dynamic relation between the information provider and the information gatherer in Figure 41. If the information provider delivers improved information to the information gatherer and can therefore expect improved revenues, the result of the value exchange may be improved information which is available for further value provision in the value network. Since the ISS is based on the improved information from the information gatherer, this dynamic relation can have an influence on the entire value network in the way that the improved information may lead to an improved information service distributed to the end customer.
The same mechanism may also be applicable for the negative case, where poor information may lead to poor revenues for the information provider and therefore reinforce the value provision in a negative way. Furthermore, the ISS builds upon this weak information base and may distribute a suboptimal information service to its customers.

Static relations, on the other hand, have a balancing character within the value network.

6.3.2 Analysis of the scalabiltiy of the value network

The aim of the analysis of the scalability of the value network is to identify value network relations that lead to scaled monetary or non-monetary revenues for value network participants in the case of a positive development of the ISS. The analysis is based on the assumption that the number of customers using the ISS is directly related to the success of the ISS. The analysis tests for every value network relation if an increase of the number of end customers also increases the revenues of the individual agent participating in that value network relation (see Figure 42). The focus of this analysis is mainly to evaluate whether a participant in the value network can benefit from the ISS if the business model is developing well.

„Does an increase of the number of customers also lead to an increase of the revenue for the individual participating value network member?“

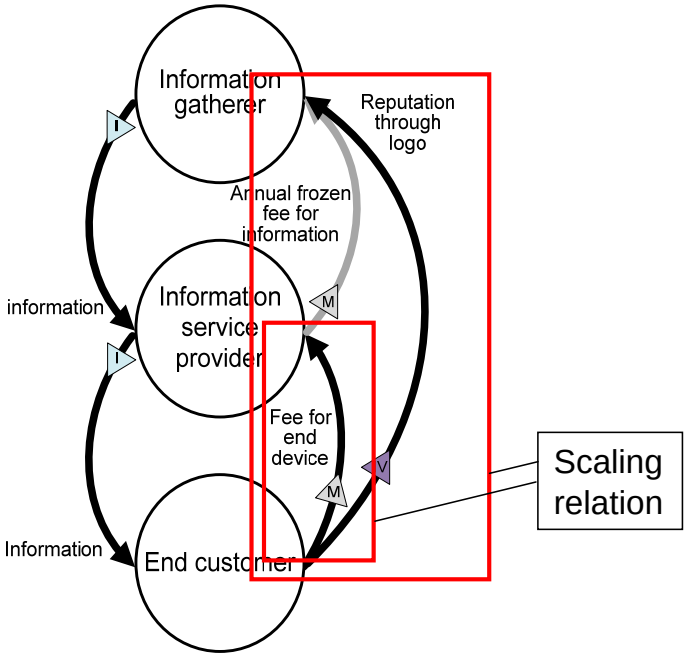


Figure 42 Analysis of Scalability of relations within the value network

6.4 Step 4: Analysis of strategic position and strength within the value network

Current research (Ballon 2009) shows that ISS are mainly based on platforms. In the course of this study Ballon identifies platform categories that influence the ISS building on them. Analysis of the platform type, which an ICT-based ISS is based on, can provide valuable insights into strategic roles of value network participants. We use the findings of Ballon to classify the platform type a particular ICT-based ISS is based on and to identify the strategic position and strength of a value network participant within a value network.

In the case of planning a new ICT-based ISS this step can also be executed earlier in the planning process. The categorization of the platform type can be done before step 1 whereas the determination of the individual strength of a participant within the value network can be done directly after step 1.

The categorization of the platform type, which the ISS is based on, can help to identify the appropriate platform type for the ISS and consecutively to identify partners for the value network.

The analysis of the strength of a participant within the value network may reveal a weak position for particular participants and therefore lead to a reiteration in the selection process of value network partners.

6.4.1 Criterias for analysis of strategic position and strength in value networks

One possibility to identify the strength of a participant within a value network is to analyze which strategic roles he holds within the network. Ballon (Ballon 2009) describes four important strategic so-called "gatekeeper-roles" within value networks based on Van Bossuyt et al. (Van Bossuyt et al. 2007):

- **„Service Creation Environment":** Ballon describes the Service Creation Environments as *"[a] a set of development and hosting tools for third-party service developers."* (Ballon 2009, p.11) This role describes the participants within a value network that control the technical and economic development of an ICT-based ISS. The technical part is covered by the development tools (e.g. APIs) provided by the gatekeeper to third-party service creators, whereas the economic part is covered by gatekeepers controlling the hosting of services of third-party service creators in this environment.

- **„Profile/Identity Management“:** Since individual knowledge about the end customer is a crucial asset, the gatekeeper role Profile/Identity Management is strategically important. Ballon defines this role *as “ … a component that manages general user data and user preferences for various services and user preferences for multiple user situations.”* (Ballon 2009, p.11)
- **„Service Provisioning/Service Brokerage“:** The agent within a value network who has direct contact with the customer by acting as the provider of the service to the customer owns a strong strategic position within the value network. This position is represented by the “Service Provisioning/Service Brokerage” gatekeeper defined by Ballon in the following way: *“The broker represents the reference point for end-users to retrieve, subscribe and use Service and Service Components.”* (Ballon 2009, p.11)
- **“Charging & Billing“:** The charging and billing relation is another form of direct contact with the end customer. Therefore this role is also considered as strategically important. According to Ballon, *“[c] charging and billing components are essential when considering architecture development.“* (Ballon 2009, p.11)

The more of the listed roles a participant holds, the stronger becomes his position within the value network (Ballon 2009).

Based on the identified gatekeeper roles, Ballon (Ballon 2009) classifies the following four platform types for mobile ICT-based ISS.

- **„Telco-centric Platform – Enabler Platform“:** Within this platform the telecom provider has a very dominating role. He owns all four gatekeeper roles and therefore controls the service creation, service provision, service delivery as well as customer relations. A typical example for a telco-centric platform provider is Vodafone with its “Vodafone Live!” platform available in Europe (see Figure 43). (Ballon 2009)
- **„Device-centric Platform – System Integrator Platform“:** A typical example for this platform type is Apple with its product family iPhone and iPad (see Figure 43). The end device has a central role within this platform type. The value network participant who owns the end device platform typically owns most of the important gatekeeper roles since he controls the end devices (in the case of Apple), the software platform (e.g. iOS, Android) and the service brokerage through the control over app stores. In contrast to the Telco-centric Platform, the dominant participant within this value network does not entirely control the development of applications that are provided to the customer. The

platform owner of the Device-centric Platform provides an Application Programming Interface (API) and opens the development of services to 3rd party developers, whereas the owner of the Telco-centric Platform tightly controls the development of apps and opens it only to selected developers. (Ballon 2009)

- **„Aggregator-centric Platform – Neutral Platform“:** An example for this platform type is Google Open Social API (see Figure 43). Google provides an API that is capable to interrelate different social networks which implement this API and therefore enable the exchange of information between different social networks. Google owns a so called „neutral" role within this platform type. (Ballon 2009)
- **„Service-centric Platform – Broker Platform“:** A current example for this platform type is the „eBay Mobile“ platform (see Figure 43). Within this platform eBay acts as a broker and brings together providers and customers of goods and services and thereby controls the relation to the customer. (Ballon 2009)

A further method for analyzing the strength of a particpant's position within a value network is to determine the level of control he has over the following criteria:

- „Control over Assets“ and
- „Control over Customers“. (Ballon 2009)

The criterion „Control over Assets“ is based on the strategic "Resource-based View"-concept according to Barney (Barney 2001) (see also (Wernerfelt 1984)). The strength of individual participants within the value network is determined by the ability of the participant to control strategic valuable resources that are required to provide the service to the end customer. An example can be special assets such as certain sensors which generate data that no one else is capable of producing.

The criterion „Control over Customers“ is the second important factor to determine the strategic strength of a participant within the value network. The control over a customer is closely woven with a direct relationship to the customer (e.g. in the form of a charging and billing relationship). (Ballon 2009)
The ability to directly collect information about the customer in the form of patterns of use of the ICT-based ISS or other user relevant data and furthermore to exploit this data poses a strategic advantage to the participant owning this potential. Due to the importance of this data the owner of this capability strengthens its bargaining power against other participants within the value network. (Winkelmann 2008)

This potential is also described by Weill & Vitale who state that *"[t] the owner of customer data has the potential to develop powerful insights into customers' needs and desires."* (Weill, Vitale 2001, p.261)

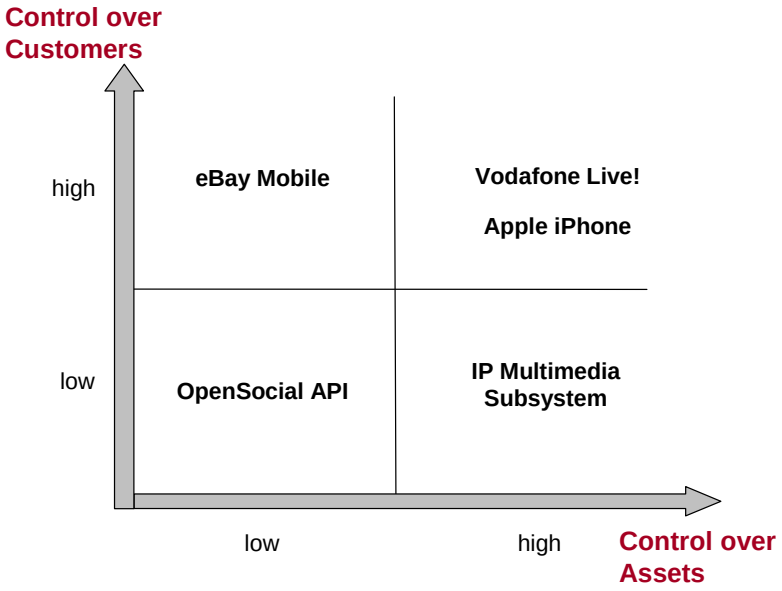


Figure 43 The two factors "Control over assets" and "Control over customers" determines the relative strength of a participant within a value network (figure modified from (Ballon 2009))

As illustrated in Figure 43, the two factors "Control over assets" and "Control over customers" determine the relative strength of a participant within a value network. The higher these two criteria can be rated for a participant, the stronger is his position within the value network. Some examples for combinations of different levels of the two criteria have been discussed in the introduction of the different platform types in section 6.4.1 and are illustrated in Figure 43. A practical example for a high level of control over the assets and a low level of control over the customer is represented by the "IP Multimedia Subsystem" (IMS). Here a telecom provider controls most of the assets required for service provision in form of the network facilities and provides the IMS and an API for third party developers to develop applications. The control over the customers is handed over to the third party developers. (Ballon 2009)

6.5 Step 5: Identification of areas with room for improvement

The last step of the analysis process is aimed at identifying room for improvement. Based on the data and analysis results conducted in the previous steps, potentials for improvement can be found in the following areas:

6.5.1 Configuration of the value network participants

Within step 1 of the analysis process all participants and their relations within the value network were identified. Based on this data and all analysis results of the subsequent analysis steps, areas for improvement can be identified at the participants of the value network. The participants are analyzed once more according to their capabilities and assets, which they are contributing to the value network. They are checked whether their assets and capabilities contribute to an optimal value generation within the value network or if there are alternative partners who would improve the value generation. If areas for improvement can be identified, a new iteration through the entire analysis process can be started with different participants.

6.5.2 Configuration of the value exchanges within the value network

After the analysis of the participant's assets and capabilities, the value exchanges between the participants are tested for areas of improvements. Basically, each agent should benefit from his participation within the value network. Potentials for improvement can be identified by cost-benefit analysis within existing ISS and by simulations for the planned ICT-based ISS. As a result of this analysis step, rearrangements of value exchange relations can be applied to the value network.

6.5.3 Endogenous motivation of and exogenous influences on the participants of the value network

Based on the data gathered in analysis step 1 regarding the endogenous motivation and exogenous influences on the participants in the value network, investigations for areas of improvement can also be conducted for these factors. Since we know that only a single participant rated with a low motivation level can influence the entire network negatively, improvements in this area act as levers for the whole business model. In order to be able to formulate concrete steps for improvements, the underlying reasons

for the bad motivation levels have to be identified before. Negative exogenous influences may be based on conflicting strategic aims. The i* Framework introduced within section 4.3 can be used to model the strategic aims of each participant. In order to be able to identify the reasons for negative endogenous motivation, the employees of the particular participant have to be analyzed. For a categorization of factors influencing the motivation of an employee, see section 5.3.1.1. Changes to improve endogenous motivation and exogenous influence may be elaborated individually for each participant and range from changes at value exchange relations to the ultimate exchange of the concerned participant.

6.5.4 Configuration of system dynamics and scalability of relations within the value network

The results of the analysis of the scalability and system dynamics within relations in step 3 can also be used to identify room for improvement.
In respect to the analysis of system dynamics within the relations, there is no rule of thumb whether dynamic or static relations are better for the overall success of the value network. Each relation has to be analyzed individually and the effects of the type of the relation have to be considered locally for the participants directly involved in the relation as well as the effects for the entire value network. All in all, it is important for strategic management to be aware that dynamic value network relations need to be checked continuously since value exchanges can change dynamically and therefore affect local as well as global value exchanges within the value network.
Most of the business models within the area of ICT-based ISS are based on the mechanism that the number of customers is directly related to the success of the service. The more customers using the service, the greater the success of the business case. Examples for business models incorporating this mechanism are fee-based business models as well as advertisement-based business models.
Based on this mechanism, scalability analysis has been conducted within step 3. If this analysis identifies relations, where the revenues of a participant do not scale with the number of end customers, individual actions for improvements can be developed to turn these value exchange relations also into scaling relations.

6.5.5 Configuration of the relative strength of a participant within the value network

The analysis conducted in step 4, where the relative strengths of participants within the value network have been analyzed, forms an important basis for strategic posi-

tioning within a value network. If a value network participant has identified a weak position within the value network in relation to the other participants, he is also able to identify the cause for this weak position based on the described method in section 6.4.1. This method forms the basis for the development of strategies to improve the current situation and to strengthen one's position within the value network. Within the planning process of a new ISS this may mean to re-run the analysis process with alternative value network participants, or rearranged value network relations. Within the analysis process of existing ICT-based ISS, changes of the position that determines the relative strength within the value network may be difficult because this would imply weakening the position of other participants which, in turn, could cause resistance by the affected participants.

6.5.6 Quantification and real world check of the modeled value exchanges

Based on the idea of profit sheets within the e3-value method (see section 4.1) all value exchanges should be analyzed and quantified. For existing ICT-based ISS, quantification can be based on existing real world data. In addition to monetary data as defined by the e3-value method, all types of value exchanges should be quantified since not only monetary value exchanges are important for a successful value network. Exchanges of values that can not be quantified at first sight may be approximated by proxy variables. Quantification for these value exchanges has to be elaborated individually for each case.
In the case of planning a new ICT-based ISS with the introduced framework, quantification of the value exchanges may be predicted based on existing empirical values.

On the whole, the application of the analysis methods for strategic planning of new ICT-based ISS, as well as for strategic analysis of existing ISS, ensures a systematic approach based on the existing state of art methods as well as based on new research findings, especially in the area of value networks.

CHAPTER

7 Evaluation

This chapter provides an overview on the applied research methods, the reseach design and the results of the evaluation.

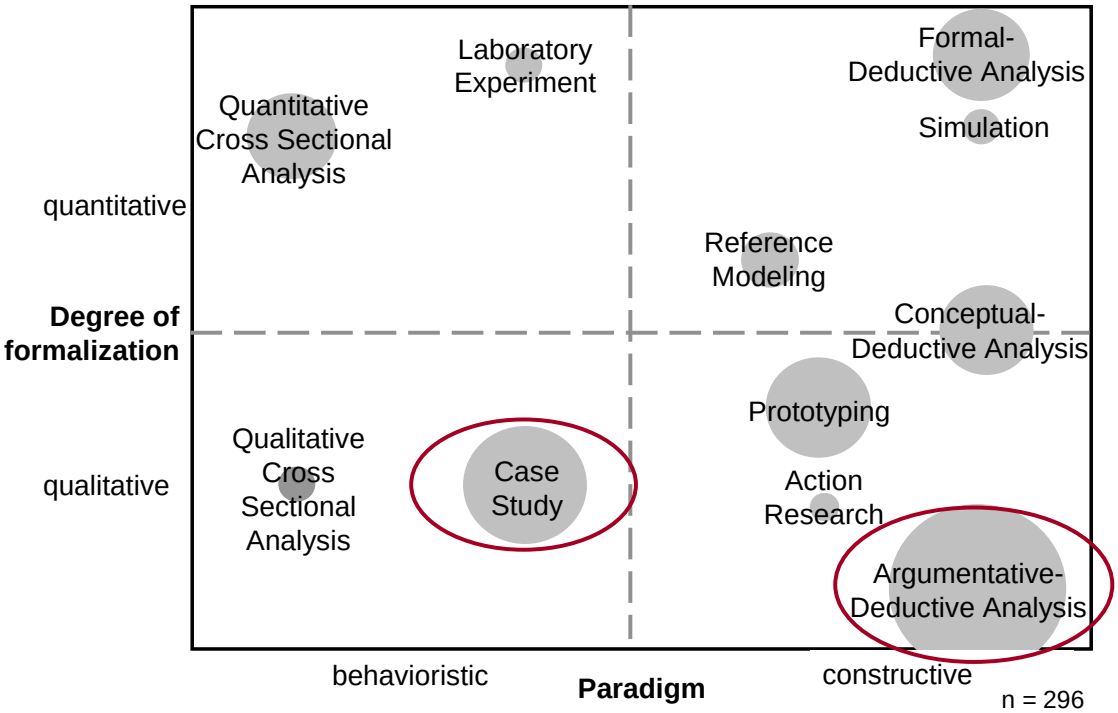


Figure 44 A compilation of various research methods used in the area of business informatics. The size of each marker point assigned to the research method represents the relative frequency of occurrence of the research method in the 296 analyzed articles. Qualitative research methods are dominant in the area of business informatics. (Wilde & Hess, 2007) (figure modified from (Wilde & Hess, 2007, p.284)) “Case Study” and "Argumentative Deductive Analysis" are the research methods used within this thesis.

Figure 44 provides an overview on a study about research methods within the field of business informatics. The study classified 296 research articles in the area of business informatics according to the research methods applied within the articles. Furthermore

these research methods where assigned to a portfolio structured into the underlying "Paradigm" which can be either behavioristic or constructive and into the "Degree of formalization" which can be either qualitative or quantitative. The size of each marker point assigned to the research methods in Figure 44 represents the relative frequency of occurrence of each research method in the evaluated articles. This study revealed that 65% of the investigated articles can be classified as qualitative research methods, whereas 35% are quantitative. (Wilde & Hess, 2007, p.280ff)

This work focuses on a framework that assists in planning entire ICT-based ISSs, which can be seen as complex systems. The framework considers technical, economic as well as social aspects and therefore provides a macro view on the whole system. The aim of the framework is to cover aspects of ICT-based ISSs in a holistic way to facilitate the planning and analysis of such systems. We use Case Studies and Argumentative Deductive Analysis to cope with such complex cases. This approach is also suggested by Wilde and Hess (Wilde & Hess, 2007, p.282).

Quantitative approaches like laboratory experiments are more suitable to investigate isolated problems on a detailed view. Here single aspects of the entire system may be investigated in detail using quantitative methods. An other quantitative research method like "Formal deductive analysis" is well suited, if the investigated system can be described mathematically in a detailed way.

Since the focus of this work is laid on a macro view on entire ICT-based ISSs, real world test cases are chosen to evaluate the framework using the research methods Case Study and Argumentative Deductive Analysis. Our model builds on several quantitatively generated frameworks and uses qualitative empirical results in case studies for system validation.
Furthermore the applicability of the framework is shown in a proof of concept by planning a new service based on the framework.

7.1 Research Design

The research design is structured into four phases:

- Creation of the framework
- Verification
- Validation
- Proof of Concept

Within the phase *Creation of the framework,* a profound literature analysis about strategic planning frameworks for ICT-based information service systems (see chapter 3) and value network theory (see chapter 4) was conducted. Furthermore, several real world business models in the area of information service systems were analyzed in depth and impulses from talks with experts were collected.
Based on this initial work, room for improvement was identified and, as a result, the framework introduced in this thesis was developed. For example, during our initial analysis we modeled value networks with the existing Biem & Caswell notation and developed the enhancements introduced in chapter 5 and the analysis process introduced in chapter 6.

Verification of the concepts within this framework is based on existing literature, logical argumentation and formal definitions. The concepts for endogenous motivation and exogenous influence are based on the scientific underpinnings described in detail in section 5.3.1.

Validation of the framework was done separately with multiple real world case studies as part of research collaborations with industry. In order to prove the applicability of and to demonstrate the usefulness and value of the framework, five real world large scale business models in the area of ICT-based ISS were used. All structural and strategic information as well as revenue streams and other financial data over, time which can not be disclosed here for confidential reasons, were provided by the research partners. Based on the proposed framework, reasons for network effects were revealed that could not be modeled by existing notations otherwise.
The cases were selected according to the roles of the analyzed industry partners within the value network. In order to ensure the analysis of the concepts with cases covering a broad range of different roles of agents the cases were selected according to the roles covered by the analyzed partners. The identified categories of roles of agents within an ICT-based ISS value networks are:

- Content Provider
- Content Aggregator
- Content Validator
- Technical Service Provider
- Service provider for end customer

Table 4 provides an overview on the test cases and the role categories covered by the analyzed agents per test case.

	Roles of analyzed agents in value network				
Test Cases	Content provider	Content Aggregator	Content Validator	Technical Service Provider	Service provider for end customer
A		X		X	
B	X	X	X	X	X
C	X	X	X	X	
D	X	X	X	X	X
E	X	X	X		

Table 4 Overview on the roles of the analyzed actors per test case

Finally, in the phase *Proof of concept,* the framework was used to plan a new ICT-based ISS as part of a research collaboration with industry. The framework provided a structured approach for the planners of the project partner and guided them through the development process. In this step, applicability and usefulness of the framework for the planning process was proved.
Each case investigated in the validation and proof of concept phase is documented in project reports that can not be disclosed here for confidential reasons.

7.2 Results

During the validation of the concepts introduced in this thesis, several real world effects have been revealed that could not have been identified with existing tools. These effects can be categorized into findings based on the analysis of endogenous motivation and exogenous influence on the value network participants and on the analysis of dynamics within the value exchanges between these agents facilitated by a quantification of these value flows.
This section provides examples for effects within the studied real world cases that have been revealed by applying the framework introduced in this thesis.

The following case provides an example for an effect based on the analysis of endogenous motivation and exogenous influence of the participants of an ICT-based ISS value network.
Figure 45 shows a detailed perspective from the value network model of this case put in V^2 notation. Executives of the “Content Validator”-agent could not explain the reluctance of the “Service Provider” to support aggregation and distribution of added

content which came from the "Content Validator". Analysis revealed an inherent conflict of interest at the "Service Provider". Adaption and development of the added content was in conflict to future revenue streams to be captured by the "Service Provider" itself. Due to a current lack of own content the agent's management had to collaborate which is depicted as a "~".

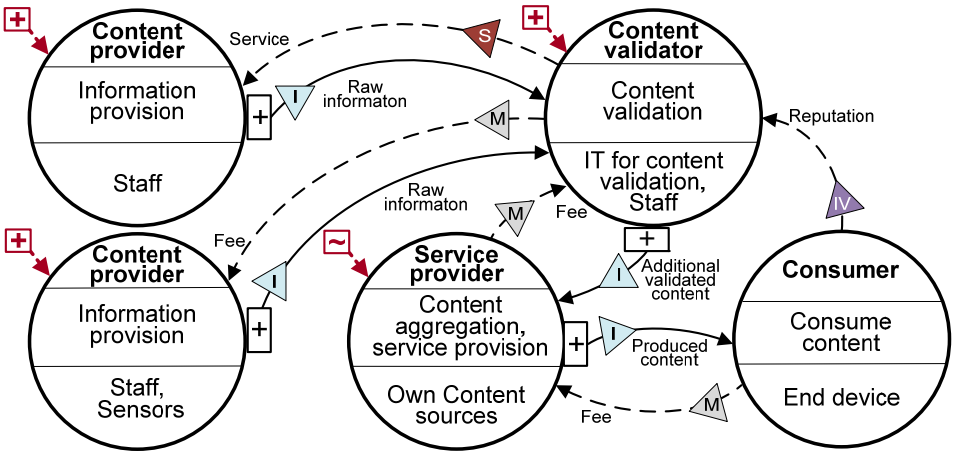


Figure 45 A value network of an ISS based on the V² Value network notation out of the validation set shows reluctant cooperation by the management of the "Service Provider" which revealed an inherent conflict of interest at this agent.

Figure 46 represents another value network of an ISS, used as a tourist guide in a theme park, based on the V² Value network notation. Analysis based on the framework revealed a negative endogenous motivation of employees interacting directly with the end customers (visitors) by providing the end devices needed to take advantage of the service. Furthermore, these employees also charged the end customers with a fee before they were allowed to use the ICT-based ISS. As a consequence, these employees were acting in the following gatekeeper roles crucial to the success of the ISS:

- The service provider gatekeeper role
- The gatekeeper role that holds the charging relation to the end customer

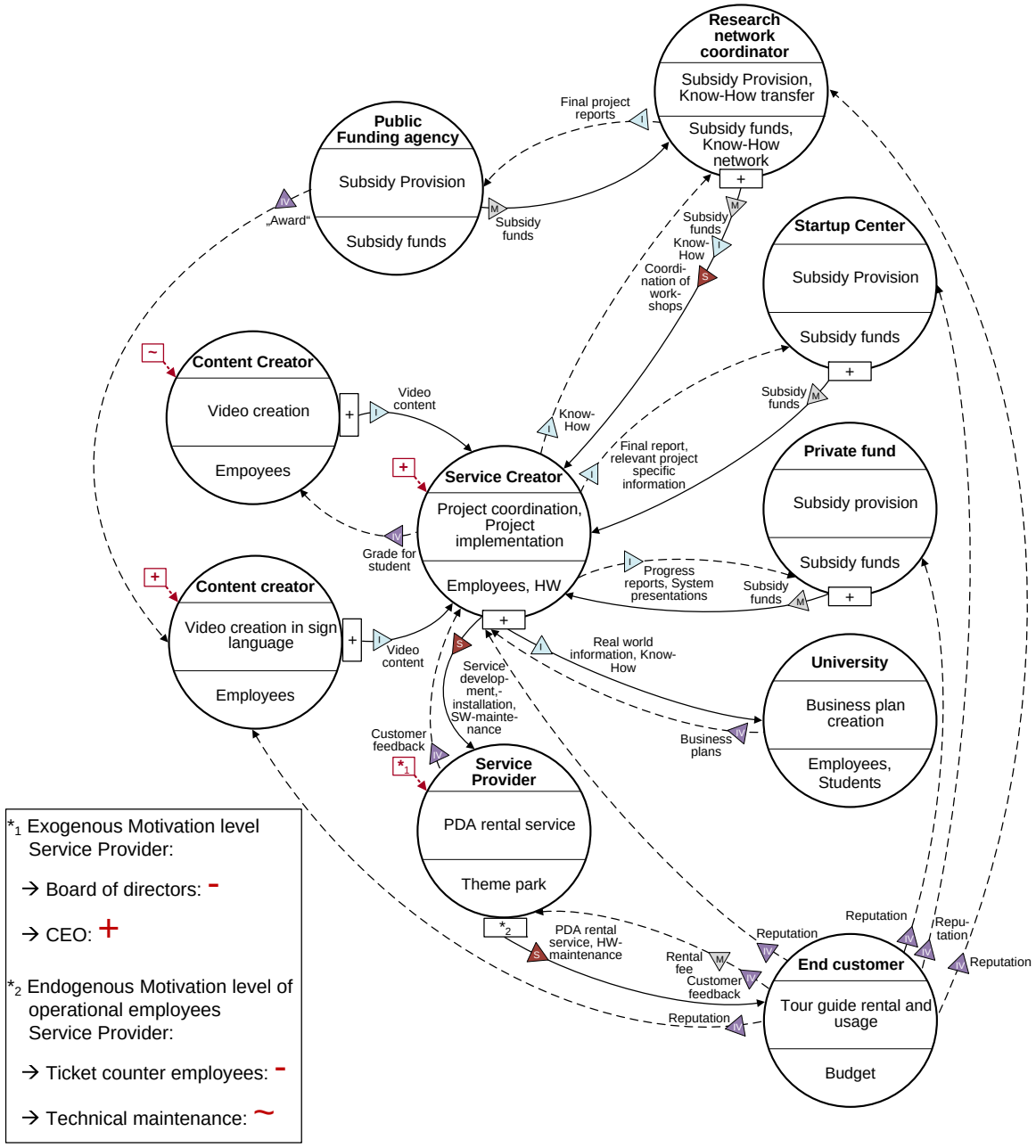


Figure 46 A value network of an ISS based on the V^2 Value network notation out of the validation set shows negative endogenous motivation of employees acting as a direct end customer service provider. This fact, in combination with a neutral endogenous motivation of the technical maintenance employee maintaining the customer end devices, is identified as one of the reasons for the moderate to negative success of the ISS.

The primary task of these employees was to collect the entrance fee for the theme park. These employees felt they were being distracted from their core tasks when they had to lend the end devices which are required to use the ISS to the end customers.

For them it was just an additional task distracting them from their core task without providing any benefit to them. As a consequence, they had a negative endogenous motivation.
This fact, in combination with a neutral endogenous motivation of the technical employee maintaining the customer end devices and a negative exogenous influence by the board of directors, is identified as one of the reasons for the moderate to negative success of the ISS evident in the revenues of the rental service.

In the course of the analysis of existing ISS, the analysis of the dynamics within the value exchange relations between the participants of the value network, in combination with the process of quantification of tangible as well as intangible value exchanges, is an important tool for identifying areas for improvement (see section 6.5.6).
At this point, the following case from the evaluation set can be quoted.
Figure 47 provides an abstract value network of this case. The value exchange relation from the “end customer” to the “information gatherer” indicates a revenue link transporting an intangible value object. This relation represents the revenue intention from the “information gatherer” for providing the gathered information to the end customer via the ICT-based ISS. The “information gatherer” wanted to improve the company’s reputation with the end customer through the participation within the value network. In order to illustrate this participation to the “end customer”, the “information gatherer” added a branded logo to the ISS which had been developed exclusively for this purpose. After an initial analysis, the value network and its exchange relations looked well aligned. However, the process of quantification of the value exchanges revealed that the value exchanges did not work as well as supposed by the industry partner. As indicated in Figure 47, quantification revealed a potential for improvement in the intangible value exchange relation between the end customer and the information gatherer.
In the course of the quantification analysis, a real world test for this value exchange relation had been conducted. This test revealed that only one third of all end devices needed to take advantage of the ISS had this logo on the packaging. Since the end user recognizes the logo on the packaging only during the purchasing process, the effect of associating the company with the ISS is a singular event. What’s more, there wasn’t a single device where the logo was recognizable during the use of the system either by placing the logo on the hardware or by showing it on the screen of the end device.
The industry partner had not been aware of this fact and agreed there was room for improvement which was identified through the use of the framework.

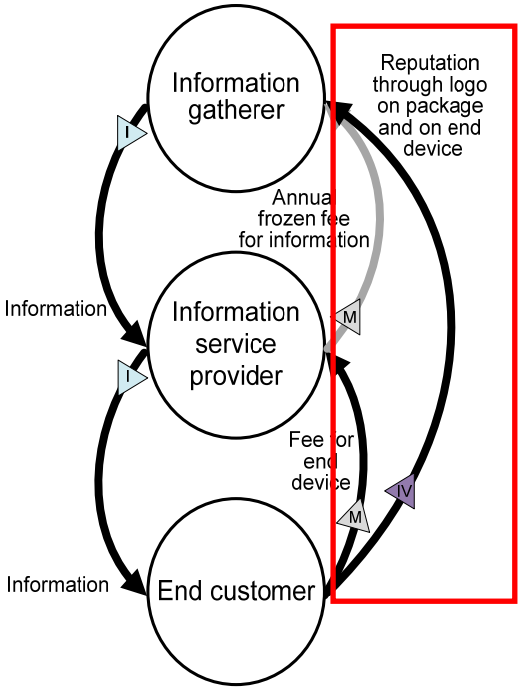


Figure 47 Quantification of value exchanges based on a business case out of the validation set revealed potentials for improvement for the ISS.

The analysis of a further test case revealed a weak strategic position for the analyzed service provider within the value network. Furthermore, room for improvement was identified in the value exchange relation between the service provider and the end customer. As a result of the analysis based on this framework, the development of a new service was suggested. The industry partner approved the identified weaknesses and started a project to implement the suggested ICT-based ISS.

In the course of the phase “Proof of concept”, this suggested ICT-based ISS was planned, based on the framework introduced in this thesis.

This new ICT-based ISS incorporated the suggested improvements which resulted from the analysis of the test case out of the validation set. As a consequence, the new ICT-based ISS improved the strategic position of the analyzed agent within the value network and improved the value proposition to the end customer.

CHAPTER

8 Conclusion and further work

As illustrated in chapter 7, the framework introduced within this thesis provides a structured approach to analyse and plan an ICT-based ISS. The framework builds on existing frameworks and introduces enhancements to reveal reasons for network effects that could not be identified with existing approaches.
The V^2 value network notation introduced in chapter 5 represents value networks of business systems in an abstract and concise manner to facilitate strategic analysis. The enhancements of existing notations, in terms of endogenous motivation and exogenous influence, cover the topic of motivation and motivation-influencing forces which are important factors in real world business.
The analysis process introduced in chapter 6 facilitates a structured analysis of dynamics within the value exchange relations in a value network. During the planning phase, the framework helps to find the suitable partners and to avoid flaws in the value network constellation in advance. If the concepts are applied to already existing areas, threats and potentials can be detected and explained. Since V^2 can capture individual incentives and motivations, it becomes furthermore possible to estimate the potential of strategic alliances among agents in a business system more effectively.
Finally, the illustrations resulting from the analysis and planning process proved to be a common basis for interdisciplinary communication within the project team and for communication with the management.

8.1 Research Questions

Referring to research question no.1, *"Is it possible to create a framework for the structured planning of ICT-based ISS that enables the analysis of multi party network constellations and the explanation of motivation related network effects?"*, it can be said, that there exist planning frameworks that capture various aspects of ICT-based ISS like Organization, Finance, Service and Technology. Value networks were identified as a concept that integrates these various areas into an integrated view. Analysis

has shown that existing planning frameworks for ICT-based ISS lack to provide tools to analyze multiparty network constellations within these value networks. Therefore the enhancements to existing value network notations introduced within this thesis have been developed. Furthermore an analysis process that structures analysis and planning of ICT-based ISS with special focus on dynamics within the value network has been introduced. Together these two building blocks provide a tool to analyze multi party network constellations and to explain motivation related network effects.

Referreing to research question no. 2*, "Can this framework be applied to analyze network effects in ICT-based ISS being observed in practice?",* it can be stated that the framework proved its applicability in practice. The framework was validated with multiple real world case studies. Partners from industry and academia provided structural and strategic information as well as revenue streams and other financial data about the analyzed ICT-based ISS. Based on the framework introduced real world network effects were revealed that could not be explained with existing notations.

8.2 Future Research

The framework introduced in this thesis was developed and validated in the area of ICT-based ISS. An area of future research would be the exploration of the applicability of the concepts introduced to other application areas. Some aspects of the framework, such as the analysis of the strategic strength of partners within the value network, are directed to the area of ICT-based ISS since the gatekeeper roles analyzed are specific to this area. Application of these analysis steps in areas different to ICT-based ISS would require adaptations to these gatekeeper roles.
On the other hand, concepts of this framework, for example, like the analysis of the motivation and motivation-influencing forces within the value network, are generic concepts that theoretically may be applied, independent of the area of application.
Since there is a need to form value networks between different agents to able to provide the intended value to the end customer across various industry areas, a broad scope of application area for the concepts introduced may be explored in future.
As a consequence, further work regarding the applicability of the introduced concepts within other industry areas are an interesting field of future research.
At the same time, there are plans to continue the development of the framework and to investigate further real-world cases for continuing validation.

Annex

A Publications and Talks

Vorraber, W. & Voessner, S. 2011, "Modeling Endogenous Motivation and Exogenous Influences in Value Networks of Information Service Systems", *JCIT,* Vol. 6, no. 8, pp. 356-363.

Vorraber, W. & Voessner, S. 2010, "An extended value network notation for information service systems*", in Proc. International Conference on Services Science, Management and Engineering SSME 2010*, December 26-28, 2010, pp. 494-497.

Vorraber, W. "An extended value network notation for information service systems*", in HP Labs, Palo Alto*, August 03, 2011

Vorraber, W. & Voessner, S. 2010, "An extended value network notation for information service systems*", in International Conference on Services Science, Management and Engineering SSME 2010*, December 26-28, 2010

Vorraber, W. "Generic framework for strategic planning of ICT-based Information Service Systems*", in Forschungskolloquium Techno-Ökonomie Graz-Leoben-Wien*, May 25, 2009

Modeling Endogenous Motivation and Exogenous Influences in Value Networks of Information Service Systems
Wolfgang VORRABER, Siegfried VÖ SSNER
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Modeling Endogenous Motivation and Exogenous Influences in Value Networks of Information Service Systems

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Abstract

Information Service Systems (ISS) are growing rapidly with the broad adoption of mobile devices such as smart phones. Although a lot of effort is put into conventional strategic ISS network planning, many of these systems do not meet expectations. One reason is that conventional value network analysis is limited to static transaction-based analysis and does not cover dynamic network effects. In this paper we present a new, enhanced visual notation for value networks to be used for analysis and strategic planning. We include endogenous motivation and exogenous forces which model the subjective behavior of agents interacting in such a value network. In contrast to existing notations for ISS our approach enables us to analyze multi party network constellations and explain a variety of motivation related network effects being observed in practice. Validation of our approach was done using multiple real world case studies from industry.

Keywords: *Value Network Analysis, Strategic Planning, Information Service Systems*

1. Introduction

Today nearly every business system has different economic entities working together in complex, network-like structures in order to be able to provide a benefit for the end customer. The associated value stream can be represented as a value network (see figure 1).

Strategic analysis of a company's relationships to other partners within a business system requires enhanced management tools [1]. Inter-organizational transactions can become quite complex easily because of global trends and technological advances [1]. In order to keep track of these relationships, modeling techniques such as the e3-value™ e-business modeling method [2] have been developed.

Particularly business models in the area of Information and Communication Technology- (ICT) based information service systems can not be described in a linear fashion as with Porters [3] value chain model [1]. ISS providers need to cooperate with other partners in order to be able to provide the intended service.

There has been a lot of research activity in the area of value networks so far. Early studies such as the i* strategic dependency model [4] [5] [6], the Allee's value network model [7] [8], the e3-value™ e-business modeling method [2] and the c3 network [9], which is based on the e3-value™ e-business modeling method, help to do basic analysis of value networks [1]. The latest enhancement for value network notations is from Biem & Caswell [1] which is mainly based on the e3-value™ e-business modeling method.

However, practical applications of Biem & Caswell's model have led to the insight that there are still effects in business models that can not be explained with the models currently available and led us to develop some extensions to this model.

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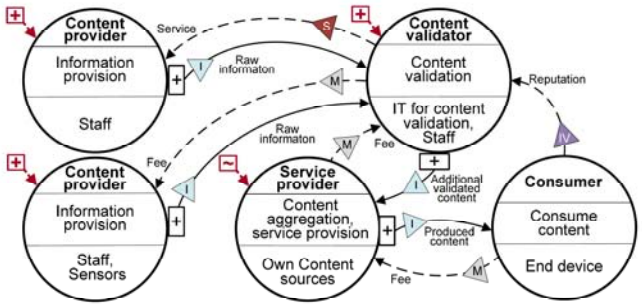

Fig.1 A value network of an information service system based on the Extended Value Network Notation (V2).

Conventional modeling techniques such as e3-value™ e-business modeling method or Biem & Caswell's method represent value exchanges between economic entities, but internal and external forces influencing the agents that provide the values cannot be captured.

The motivation of an agent directly influences the quality of the value provided and, in consequence, the entire value network. Highly motivated agents may accelerate the value generation in the value network, whereas it takes just one agent to decelerate the value generation of an entire value network. Current research [10] [11] [12] [13] shows that both internal and external forces determine the motivation of each agent. This motivation mainly influences an agent's job prioritization and so timeliness and quality of service. In order to capture these factors, we need to refine existing models and introduce an extended notation. Based on our preliminary results shown at [14] we refine our concepts and present further extensions.

2. Research Design

The presented approach is based on a profound literature analysis about strategic planning frameworks for ICT-based information service systems, value network theory and in depth analysis of several real world business models in the area of information service systems as part of a research collaboration with industry. During our initial analysis we modeled value networks with the existing Biem & Caswell notation and developed the enhancements described below using the results of several workshops with our industry partner. Validation of the notation was done separately with multiple real world case studies.

3. The V2 Value Network Notation

The new Value Network Notation we call for reference further "V2", proposed in this paper, builds on Biem & Caswell's notation [1] and enhances it in several ways.

3.1. Basic building blocks

Figure 2 shows an economic entity which represents and describes agents participating in a value network. We speak of an '**economic entity**' if an individual business plan can be designed for a value network participant [1]. An economic entity can be a firm, a business unit or an individual [1]. In practice we observed in ISS networks sometimes business plans/models where the cost side would dominate the revenues side. This was often an example for "good will" or "cross project values".

An economic entity consists according to Biem & Caswell [1] (who based their concept on Hakansson & Johanson [15]) of three parts: **'Agent'** (or actor) represents the legal entity driving the individual business model. **'Capabilities'** represents all dynamic aspects such as processes and activities that are executed by the economic entity when participating in the value network (e.g. aggregating information).

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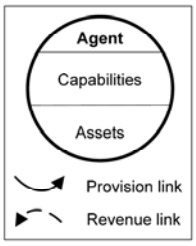

Fig. 2 Economic entities represent agents participating in a value network. Provision and revenue links represent value exchanges between economic entities (according to [1]) (figure modified).

'Assets' are all static things of tangible (e.g. IT-systems) and intangible (e.g. knowledge) nature tied permanently or semi-permanently to the economic entity in order to facilitate its value generation [1] [16]. Economic entities exchange values between each other [1]. The source and destination of value exchanges are modeled with arcs where the arrow of such a link points to the destination of the value exchange. There are two different link styles that represent two different directions of a value provision either in the direction of the end customer (provision link) or vice versa (revenue link). The provision link is represented by a solid line. The revenue link is represented by a dotted line and visualizes value transfers that are generated for paying the participant for his value provisions.

The values exchanged between economic entities are represented by transfer objects. The transfer objects are based on the concepts of 'value objects' by Gordijn, Akkermans & Van Vliet [2] and on the 'offerings' concept described by Normann & Ramirez [17] which was later extended by Biem and Caswell [1]. We will categorize different types of transfer objects according to our extension of Biem and Caswell's notation [1]. Transfer object types are represented by labeled rectangles placed on transfer links.

3.2. Types of transfer objects

The basic types of transfer objects according to Biem & Caswell [1] are 'product', 'brand', 'service', 'coordination' and 'information'. Figure 3 represents the types of transfer objects of the V2 value network notation used in this paper consisting of a subset of Biem & Caswells [1] types and our enhancements ('monetary value' and 'intangible value').

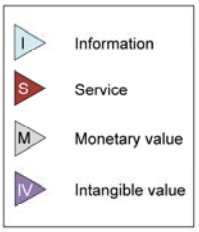

Fig. 3 Transfer objects represent the values exchanged between economic entities. Transfer objects are categorized into different types (according to [1]) (figure modified). These categories are enhanced by our new types (M, IV) .

3.2.1. Information

In our context of modeling information service systems, the transfer object type 'information' represents the transfer of information in a sense of a trading good.

3.2.2. Service

According to [1] the transfer object type 'service' represents a service delivery provided by a service provider to a service recipient. Service delivery changes the state of 'something' at the service receiver. This something can be tangible (e.g. IT components) or intangible (e.g.

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knowledge).

3.2.3. Monetary Value

The transfer object type 'monetary value' is based on Gordijn, Akkermans & Van Vliet´s [2] modeling of payment transactions in their e3-value™ e-business modeling method. Monetary value flows represent the exchange of monetary values, where the values are transferred from 'source participants' to 'receiving participants' represented by directed arcs.

3.2.4. Intangible Value

The transfer object type 'intangible value' represents the exchange of intangible values. It is based on the concept of modeling consumer experiences with value objects by Gordijn, Akkermans & Van Vliet [2]. We use intangible values for example for modeling the raising of a company's reputation based on positive customer experiences.

3.3. Endogenous motivation and exogenous influences

We extend the existing value network notation described above with two concepts in order to be able to explain effects that could not be described otherwise.

Notations such as the e3-value™ e-business modeling method and Biem & Caswells notation describe value transfers between agents which greatly help to understand the basic structure of a value network. In real world scenarios, however, we observe dynamic, network intrinsic forces that can accelerate and decelerate the rate of value exchange between the agents. This has a dramatic impact on the value provision for the end customer.

If there is, for example, an agent in the middle of a value stream who is not really motivated to participate in the network, this particular agent may influence the value provision of the entire network in a negative way by becoming a bottleneck for the delivered services to the end customer. This can lead to the paradox effect that the end customer still gets poor service, even if agents preceding and following this unmotivated agent are highly motivated. Furthermore, this poorly performing agent does not only affect the value flow negatively, he also influences the motivation of the other agents in a negative way. Agents who are initially motivated but do not get their expected revenue flows back may lose interest in participating in the network and therefore also become unmotivated. In this case the whole business model/system can become unstable.

During several real world case studies in the ISS area we found business cases where exactly the effects described above occurred. For companies it is crucial to detect both, poor and excellent value network constellations already during system design in order to make the right strategic decisions. Our framework helps to analyze existing value networks and assists in planning new value networks.

As stated above several works in the area of motivation theory such as Vroom [10] [12] and Porter & Lawler [11] prove the existence of internal and external forces, mainly based on job prioritization of involved individuals, which is influenced by personal or organizational motivation and incentives. In order to model these internal and external forces which may cause acceleration or deceleration of the value generation in a value network, we introduce the concepts of endogenous motivation and exogenous influences. Both determine the value provision of the agent (see figure 4).

3.3.1. Endogenous motivation

The endogenous motivation describes the level of motivation of employees within an agent who participate in the value network and provide value generating activities. These activities can be based on several factors such as organizational/personal values (e.g. expressed in the organization's mission statement) of the agent, internal reputation or other motivation factors already mentioned such as good will for "family and friends" and "cross project benefits". The endogenous motivation is based on the "expectancy theory" of Vroom [10] [12] where "[h] he argued that employees tend to rationally evaluate various on-the-job work behaviors (e.g., working harder) and then choose those behaviors they believe will lead to their most valued work-related rewards and outcomes (e.g., a promotion). Thus, the attractiveness of a particular task and the

energy invested in it will depend a great deal on the extent to which the employee believes its accomplishment will lead to valued outcomes." [18].

We classify endogenous motivation into three categories:

- **Defensive (-):** The agent performs the value activity only if it is not conflicting with his own goals. Employees give the least attention to the value network task. This situation can also be described as "passive aggression" according to Buss [19] [20].
- **Neutral (~):** The agent performs the value activity collaboratively in a timely manner. Tasks of the value activity have lower priority than personal tasks.
- **Active (+):** The agent performs and pursues value activity and collaboration actively. Tasks have either a higher than or equal priority than personal tasks.

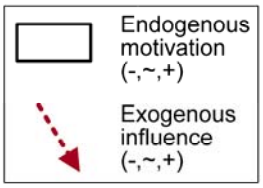

Fig. 4 Endogenous motivation and exogenous influences are the significant enhancements to existing notations that help to explain value network effects that could not be described with existing notations.

3.3.2. Exogenous influences

The exogenous influence describes external forces (e.g. from management) which facilitate or restrain the participation of the agent in the value network. This can be for various reasons such as strategy, business or legal constraints. Examples of external forces are direct orders to participate in the business venture. The concept of exogenous influences is based on Kelman's [13] external influences on a persons compliance and on Porter & Lawler's [11] extrinsic rewards as a consequence of the agent's performance.

Similarly, we classify the exogenous influences into three categories:

- **Defensive (-):** The external force disencourages the value activity.
- **Neutral (~):** The external force neither endorses, facilitates nor discourages the activity.
- **Active (+):** The external force actively encourages and facilitates the activity (e.g. special reward programs, management inquiries about project progress or performance).

3.4. Typical combinations of endogenous motivation and exogenous influences

Altogether there are nine possible combinations between endogenous motivation and exogenous influence levels. For the discussion we select the four most interesting combinations that have a special impact on a value network (see figure 5).

3.4.1. The "Worst Case Combination"

The worst case is a defensive (-) endogenous motivation combined with a defensive (-) exogenous influence (see figure 5). Agents with this constellation are a severe threat for the entire value network. Negative impact may spread over the whole network. If this agent is supposed to provide a key component of the value network, the business case will fail with high probability.

3.4.2. "The Sisyphus Situation"- An active endogenous motivation struggling against defensive exogenous influence

Sometimes projects – often department-internal projects - are very much being pushed by employees based on personal beliefs. These employees are totally convinced of the project's meaningfulness and potential and invest a lot of personal effort into the project. As a consequence the endogenous motivation can be classified as active (+). Management, on the other hand, which

has a negative attitude towards the project, is not convinced of the project's goals and at most tolerates the project or shows some resistance is represented by a defensive rating (-) for the exogenous influences (see figure 5).

As a real world example for such a constellation, we can quote an example of a former R&D project manager for diesel engines of a well known German car manufacturer who pushed his idea to develop diesel engines for racing cars which became an internal project (active endogenous motivation). He was fully convinced that diesel engines may perform very well in racing cars, which was totally contradicting the corporate strategy to position gasoline engines for consumer sports cars and diesel engines for family and utility cars. Despite the defensive, negative external influence from (top) management the project survived because of the high professional reputation and personal engagement of the project manager. In the end the project was a tremendous success: the car manufacturer won several prestigious car races with diesel powered engines, the project manager was promoted and the whole corporate strategy changed based on these successes – a happy ending after all.

3.4.3. The "Shotgun Collaboration": Passive endogenous motivation paired with active exogenous influence

Exactly the opposite constellation to the previous one is a defensive (-) endogenous motivation coupled with an active (+) exogenous influence (see figure 5). We call this case "Shotgun Collaboration" to indicate a forced marriage for no "obvious" reasons. Such a combination most likely occurs if employees are not committed to the tasks they have to fulfill as part of the greater value network. This may be based on several reasons. For example they do not understand why they should perform the task, or they think all other tasks are more important. The management of these employees on the other hand is very interested in collaborating in the value network and is actively pushing the project. This combination often occurs in value network collaborations which are outside the core business of an enterprise – at least from an employee's perspective.

A practical example for this combination comes from a technology transfer project between academia and industry. The academic department acted as a scientific partner in a research collaboration with an industry partner. The department was the initiator of the project and fully convinced the upper management of the industry partner to collaborate in this project. One core task in that project was to aggregate piles of data together with employees from a very operational level. These employees showed a very defensive endogenous motivation because they did not really understand why they should participate in the project. They were not committed to the project and felt distracted from their core tasks – despite great upper management attention and buy in. Projects with such a constellation can become quite exhausting for other agents in the value network who need to cooperate.

3.4.4. "The Perfect Combination"

If both factors - endogenous motivation and exogenous influence - can be rated as active (+), the actor has a perfect combination in respect to these two factors (see figure 5). Agents with this combination can be valuable sources of power and high performers in a value network.

Modeling Endogenous Motivation and Exogenous Influences in Value Networks of Information Service Systems
Wolfgang VORRABER, Siegfried VÖ SSNER
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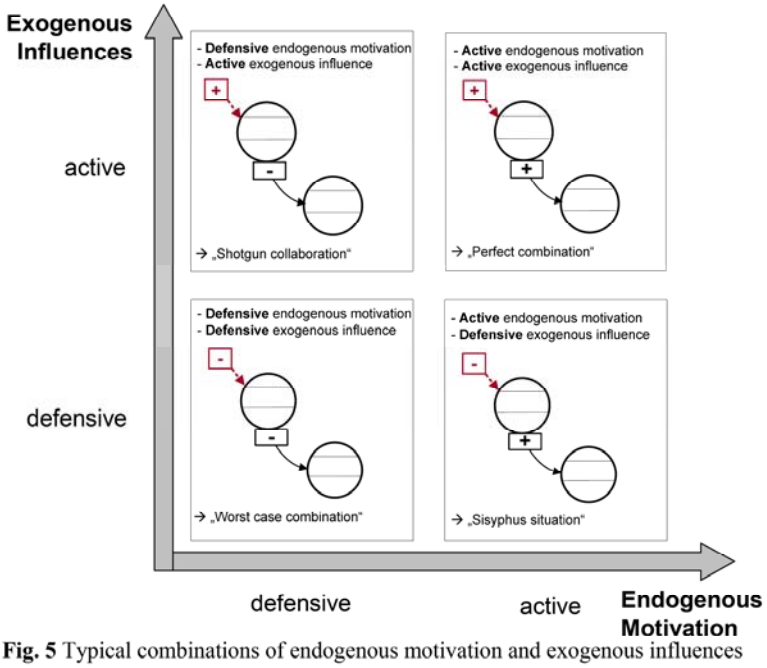

Fig. 5 Typical combinations of endogenous motivation and exogenous influences

4. Evaluation

In order to prove the applicability of and to demonstrate the usefulness and value of the enhancements to existing notations we used four real world, large scale business models in the area of information service systems. We were given all structural and strategic information as well as revenue streams and other financial data over time which we can not disclose here for confidentiality reasons. Based on our proposed notation we were able to reveal the reasons for network effects that could not be modeled by existing notations otherwise. Figure 1 shows a detail perspective from one model out of our evaluation set put in our V2 notation. Executives of the "Content Validator"-agent could not explain the reluctance of the "Service Provider" to support aggregation and distribution of added content which came from the "Content Validator". Analysis revealed an inherent conflict of interest at the "Service Provider". Adaption and development of the added content was in conflict to future revenue streams to be captured by the "Service Provider" itself. Due to a current lack of own content the agent's management had to collaborate, which is depicted as a "~". Finally the application of the extended notations helped our industry partners to identify threats and opportunities already in the design phase of information service systems and to communicate them both internally and externally.

5. Summary

The new V2 notation can represent value networks of business systems in an abstract and concise manner to facilitate strategic analysis. The enhancements to existing notations in terms of endogenous motivation and exogenous influences cover the topic of motivation and motivation-influencing forces which are important factors in real world business. The V2 value network notation can be used for strategic planning as well as for analysis of existing business cases. During the planning phase it helps to find the suitable partners and to avoid flaws in the value network constellation in advance. If the concepts are applied to already existing cases, threats and potentials can be detected, explained and communicated to management. Since V2 can capture individual incentives and motivations, it becomes furthermore possible to estimate the potential of strategic alliances among agents in a business system much better.

We plan to continue the development of V2 in the future and to investigate more real-world cases for continuing validation.

6. References

[1] A. Biem and N. Caswell, "A value network model for strategic analysis," in *Proceedings of the 41st Annual Hawaii International Conference on System Sciences,* 2008, pp. 361-361.
[2] J. Gordijn, H. Akkermans and H. Van Vliet, "Business modelling is not process modelling," in *Conceptual Modeling for E-Business and the Web,* Stephen W. Little and Heinrich C. Mayr, Ed. Berlin: Springer, 2000, pp. 40-51
[3] M. Porter, *Competitive Advantage: Creating and Sustaining Superior Performance.* New York: The Free Press, 1985.
[4] E. S. K. Yu, "Modelling strategic relationships for process reengineering," PhD thesis, University of Toronto, Dept of Computer Science, 1995.
[5] E. Yu and J. Mylopoulos, "From ER to "AR"—Modelling strategic actor relationships for business process reengineering," in *Entity-Relationship Approach—ER'94 Business Modelling and Re-Engineering,* Loucopoulos, Ed. Berlin: Springer, 1994, pp. 548-565.
[6] J. Gordijn, E. Yu and B. van der Raadt, "E-service design using i* and e^3 value modeling," *IEEE Software,* vol. 23, pp. 26-33, May-June, 2006.
[7] V. Allee, *The Future of Knowledge: Increasing Prosperity through Value Networks.* Boston: Butterworth-Heinemann, 2003.
[8] V. Allee, "Value-creating networks: organizational issues and challenges," *The Learning Organization,* vol. 16, pp. 427-442, Nov. 2009.
[9] H. Weigand, P. Johannesson, B. Andersson, M. Bergholtz, A. Edirisuriya and T. Ilayperuma, "Strategic analysis using Value Modeling-The c3-Value Approach," in *Proceedings of 40th Hawaii International Conference on System Sciences,* 2007, pp. 175c-175c.
[10] V. H. Vroom, *Work and Motivation. New York:* Wiley, 1964.
[11] L. W. Porter and E. E. Lawler, *Managerial Attitudes and Performance.* Homewood, Illinois: Richard D. Irwin, 1968.
[12] V. H. Vroom, *Work and Motivation.* San Francisco: Jossey-Bass, 1995.
[13] H. C. Kelman, "Processes of opinion change," *Public Opinion. Q.,* vol. 25, pp. 57-78, 1961.
[14] W. Vorraber and S. Vössner, "An extended value network notation for information service systems," in *Proceedings of SSME 2010 International Conference on Services Science, Management and Engineering*, 2010, pp. 494-497.
[15] H. Hakansson and J. Johanson, "A model of industrial networks," in *Industrial Networks: A New View of Reality*, B. Axelsson and G. Easton, Eds. London: Routledge Press, 1992, pp. 28-34.
[16] B. Wernerfelt, "A resource-based view of the firm," *Strategic Management Journal,* vol. 5, pp. 171-180, 1984.
[17] R. Normann and R. Ramirez, "From value chain to value constellation: designing interactive strategy," *Harv. Bus. Rev.*, vol. 71, pp. 65-77, Jul.-Aug. 1993.
[18] R. M. Steers, R. T. Mowday and D. L. Shapiro, "Introduction to special topic forum: The future of work motivation theory," *The Academy of Management Review,* vol. 29, pp. 379-387, 2004.
[19] A. H. Buss, *The Psychology of Aggression.* New York: Wiley, 1961.
[20] R. A. Giacalone and J. Greenberg, *Antisocial Behavior in Organizations.* California: SAGE Publications, Inc., 1997.

An Extended Value Network Notation for Information Service Systems

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***Abstract*—Information Service Systems (ISS) are growing rapidly with the broad adoption of mobile devices such as smart phones. Although a lot of effort is put into conventional strategic ISS network planning, many of these systems do not meet expectations. One reason is that conventional value network analysis is limited to static transaction-based analysis and does not cover dynamic network effects. In this paper we present a new, enhanced visual notation for value networks to be used for analysis and strategic planning. We include endogenous motivation and exogenous forces which model the subjective behavior of agents interacting in such a value network. In contrast to existing notations for ISS our approach enables us to analyze multi party network constellations and explain a variety of motivation related network effects being observed in practice. Validation of our approach was done using multiple real world case studies from industry.**

***Keywords*—value network analysis, strategic planning, information service systems**

I. INTRODUCTION

Today nearly every business system has different economic entities working together in complex, network-like structures in order to be able to provide a benefit for the end customer. The associated value stream can be represented as a value network (see Fig. 1).

Strategic analysis of a company's relationships to other partners within a business system requires enhanced management tools [1]. Inter-organizational transactions can become quite complex easily because of global trends and technological advances [1]. In order to keep track of these relationships, modeling techniques such as the e3-value™ e-business modeling method [2] have been developed.

Particularly business models in the area of Information and Communication Technology- (ICT) based information service systems can not be described in a linear fashion as with Porters [3] value chain model [1]. ISS providers need to cooperate with other partners in order to be able to provide the intended service.

There has been a lot of research activity in the area of value networks so far. Early studies such as the i* strategic dependency model [4] [5] [6], the Allee's value network model [7] [8], the e3-value™ e-business modeling method [2] and the c3 network [9], which is based on the e3-value™ e-business modeling method, help to do basic analysis of value networks [1]. The latest enhancement for value network notations is from Biem & Caswell [1] which is mainly based on the e3-value™ e-business modeling method.

However, practical applications of Biem & Caswell's model have led to the insight that there are still effects in business models that can not be explained with the models currently available and led us to develop some extensions to this model.

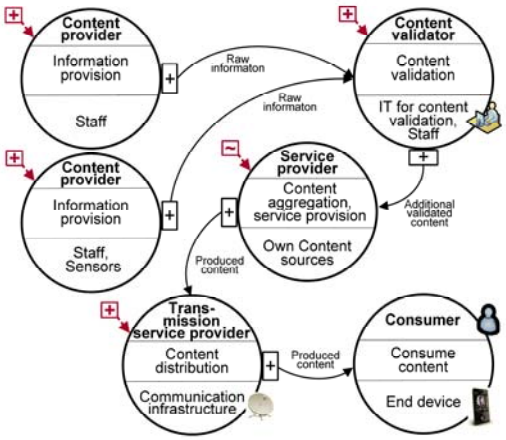

Figure 1. A value network of an information service system based on the Extended Value Network Notation (V2). The revenue streams are ommitted for clarity.

Conventional modeling techniques such as e3-value™ e-business modeling method or Biem & Caswell's method represent value exchanges between economic entities, but internal and external forces influencing the agents that provide the values cannot be captured.

The motivation of an agent directly influences the quality of the value provided and, in consequence, the entire value network. Highly motivated agents may accelerate the value generation in the value network, whereas it takes just one agent to decelerate the value generation of an entire value network. Current research [10] [11] [12] [17] shows that both internal and external forces determine the motivation of each agent. This motivation mainly influences an agent's job prioritization and so timeliness and quality of service. In order to capture these factors, we need to refine existing models and introduce an extended notation.

II. RESEARCH DESIGN

The presented approach is based on a profound literature analysis about strategic planning frameworks for ICT-based information service systems, value network theory and in depth analysis of several real world business models in the area of information service systems as part of a research collaboration with industry.

During our initial analysis we modeled value networks with the existing Biem & Caswell notation and developed the enhancements described below using the results of several workshops with our industry partner. Validation of the notation was done separately with multiple real world case studies.

III. THE V2 VALUE NETWORK NOTATION

The new V2 Value Network Notation, proposed in this paper, builds on Biem & Caswell's notation [1] and enhances it in several ways.

A. Basic building blocks

Fig. 2 shows an economic entity which represents and describes agents participating in a value network. We speak of an '**economic entity**' if an individual business plan can be designed for a value network participant [1]. An economic entity can be a firm, a business unit or an individual [1]. In practice we observed in ISS networks sometimes business plans/models where the cost side would dominate the revenues side. This was often an example for "good will" or "cross project values".

An economic entity consists according to Biem & Caswell [1] of three parts: **'Agent'** (or actor) represents the legal entity driving the individual business model. **'Capabilities'** represents all dynamic aspects such as processes and activities that are executed by the economic entity when participating in the value network (e.g. aggregating information).

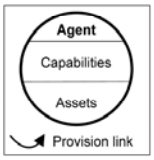

Figure 2. Economic entities represent agents participating in a value network. Provision links represent value exchanges between economic entities (according to [1]) (figure modified).

'Assets' are all static things of tangible (e.g. IT-systems) and intangible (e.g. knowledge) nature tied permanently or semi-permanently to the economic entity in order to facilitate its value generation [1] [13]. Economic entities exchange values between each other. The source and destination of value exchanges are modeled with arcs (provision links) where the arrow of such a link points to the destination of the value exchange. The provision link is used by an agent to provide a value to another agent.

B. Endogenous motivation and exogenous influences

We extend the existing value network notation described above with two concepts in order to be able to explain effects that could not be described otherwise.

Notations such as the e3-value™ e-business modeling method and Biem & Caswells notation describe value transfers between agents which greatly help to understand the basic structure of a value network. In real world scenarios, however, we observe dynamic, network intrinsic forces that can accelerate and decelerate the rate of value exchange between the agents. This has a dramatic impact on the value provision for the end customer.

If there is, for example, an agent in the middle of a value stream who is not really motivated to participate in the network, this particular agent may influence the value provision of the entire network in a negative way by becoming a bottleneck for the delivered services to the end customer. This can lead to the paradox effect that the end customer still gets poor service, even if agents preceding and following this unmotivated agent are highly motivated. Furthermore, this poorly performing agent does not only affect the value flow negatively, he also influences the motivation of the other agents in a negative way. Agents who are initially motivated but do not get their expected revenue flows back may lose interest in participating in the network and therefore also become unmotivated. In this case the whole business model/system can become unstable.

During several real world case studies in the ISS area we found business cases where exactly the effects described above occurred. For companies it is crucial to detect both, poor and excellent value network constellations already during system design in order to make the right strategic decisions. Our framework helps to analyze existing value networks and assists in planning new value networks.

As stated above several works in the area of motivation theory such as Vroom [10] [12] and Porter & Lawler [11] prove the existence of internal and external forces, mainly based on job prioritization of involved individuals, which is influenced by personal or organizational motivation and incentives. In order to model these internal and external forces which may cause acceleration or deceleration of the value generation in a value network, we introduce the concepts of endogenous motivation and exogenous influences. Both determine the value provision of the agent (see Fig. 3).

1) Endogenous motivation

The endogenous motivation describes the level of motivation of employees within an agent who participate in the value network and provide value generating activities. These activities can be based on several factors such as organizational/personal values (e.g. expressed in the organization's mission statement) of the agent, internal reputation or other motivation factors already mentioned such as good will for "family and friends" and "cross project benefits". The endogenous motivation is based on the "expectancy theory" of Vroom [10] [12] where "[h] he argued that employees tend to rationally evaluate various on-the-job work behaviors (e.g., working harder) and then choose those behaviors they believe will lead to their most valued work-related rewards and outcomes (e.g., a promotion). Thus, the attractiveness of a particular task and the energy invested in it will depend a great deal on the extent to which the employee

believes its accomplishment will lead to valued outcomes." [14].

We classify endogenous motivation into three categories:

- **Defensive (-):** The agent performs the value activity only if it is not conflicting with his own goals. Employees give the least attention to the value network task. This situation can also be described as "passive aggression" according to Buss [15] [16].
- **Neutral (~):** The agent performs the value activity collaboratively in a timely manner. Tasks of the value activity have lower priority than personal tasks.
- **Active (+):** The agent performs and pursues value activity and collaboration actively. Tasks have either a higher than or equal priority than personal tasks.

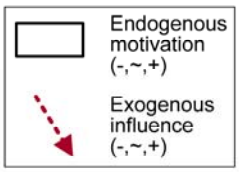

Figure 3. Endogenous motivation and exogenous influences are the significant enhancements to existing notations that help to explain value network effects that could not be described with existing notations.

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C. Typical combinations of endogenous motivation and exogenous influences

Altogether there are nine possible combinations between endogenous motivation and exogenous influence levels. For the discussion we select the four most interesting combinations that have a special impact on a value network.

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The worst case is a defensive (-) endogenous motivation combined with a defensive (-) exogenous influence. Agents with this constellation are a severe threat for the entire value network. Negative impact may spread over the whole network. If this agent is supposed to provide a key component of the value network, the business case will fail with high probability.

2) "The Sisyphus Situation"- An active endogenous motivation struggling against defensive exogenous influence

Sometimes projects – often department-internal projects - are very much being pushed by employees based on personal beliefs. These employees are totally convinced of the project's meaningfulness and potential and invest a lot of personal effort into the project. As a consequence the endogenous motivation can be classified as active (+). Management, on the other hand, which has a negative attitude towards the project, is not convinced of the project's goals and at most tolerates the project or shows some resistance is represented by a defensive rating (-) for the exogenous influences (see Fig. 4).

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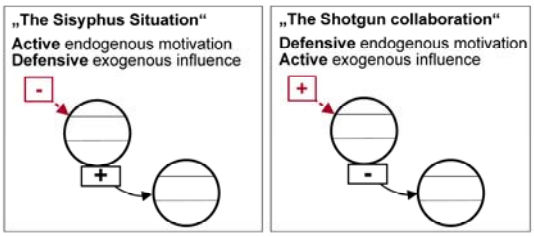

Figure 4. Active and defensive forces struggle against each other. *"The Sisyphus Situation"*(left): Here employees have an active endogenous motivation and push the project mainly based on personal persuasion. Management, on the other hand, discourages the value activity and has therefore a defensive exogenous influence. *"The Shotgun Collaboration"*(right): Employees are not committed to the tasks they have to fulfill and are therefore represented with a negative endogenous motivation. Management, on the other hand, is convinced about the participation in the value network and has therefore an active exogenous influence.

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In order to prove the applicability of and to demonstrate the usefulness and value of the enhancements to existing notations we used four real world, large scale business models in the area of information service systems. We were given all structural and strategic information as well as revenue streams and other financial data over time which we can not disclose here for confidentiality reasons. Based on our proposed notation we were able to reveal the reasons for network effects that could not be modeled by existing notations otherwise.

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REFERENCES

[1] A. Biem and N. Caswell, "A value network model for strategic analysis," in *Proceedings of the 41st Annual Hawaii International Conference on System Sciences,* 2008, pp. 361-361.

[2] J. Gordijn, H. Akkermans and H. Van Vliet, "Business modelling is not process modelling," in *Conceptual Modeling for E-Business and the Web,* Stephen W. Little and Heinrich C. Mayr, Ed. Berlin: Springer, 2000, pp. 40-51

[3] M. Porter, *Competitive Advantage: Creating and Sustaining Superior Performance.* New York: The Free Press, 1985.

[4] E. S. K. Yu, "Modelling strategic relationships for process reengineering," PhD thesis, University of Toronto, Dept of Computer Science, 1995.

[5] E. Yu and J. Mylopoulos, "From ER to "AR"—Modelling strategic actor relationships for business process reengineering," in *Entity-Relationship Approach—ER'94 Business Modelling and Re-Engineering,* Loucopoulos, Ed. Berlin: Springer, 1994, pp. 548-565.

[6] J. Gordijn, E. Yu and B. van der Raadt, "E-service design using i* and e^3 value modeling," *IEEE Software,* vol. 23, pp. 26-33, May-June, 2006.

[7] V. Allee, *The Future of Knowledge: Increasing Prosperity through Value Networks.* Boston: Butterworth-Heinemann, 2003.

[8] V. Allee, "Value-creating networks: organizational issues and challenges," *The Learning Organization,* vol. 16, pp. 427-442, Nov. 2009.

[9] H. Weigand, P. Johannesson, B. Andersson, M. Bergholtz, A. Edirisuriya and T. Ilayperuma, "Strategic analysis using Value Modeling-The c3-Value Approach," in *Proceedings of 40th Hawaii International Conference on System Sciences,* 2007, pp. 175c-175c.

[10] V. H. Vroom, *Work and Motivation. New York:* Wiley, 1964.

[11] L. W. Porter and E. E. Lawler, *Managerial Attitudes and Performance.* Homewood, Illinois: Richard D. Irwin, 1968.

[12] V. H. Vroom, *Work and Motivation.* San Francisco: Jossey-Bass, 1995.

[13] B. Wernerfelt, "A resource-based view of the firm," *Strategic Management Journal,* vol. 5, pp. 171-180, 1984.

[14] R. M. Steers, R. T. Mowday and D. L. Shapiro, "Introduction to special topic forum: The future of work motivation theory," *The Academy of Management Review,* vol. 29, pp. 379-387, 2004.

[15] A. H. Buss, *The Psychology of Aggression.* New York: Wiley, 1961.

[16] R. A. Giacalone and J. Greenberg, *Antisocial Behavior in Organizations.* California: SAGE Publications, Inc., 1997.

[17] H. C. Kelman, "Processes of opinion change," *Public Opinion. Q.,* vol. 25, pp. 57-78, 1961.

References

Aamodt, A. & Nygard, M. 1995, "Different roles and mutual dependencies of data, information, and knowledge - An AI perspective on their integration", *Data & Knowledge Engineering,* vol. 16, no. 3.

Allee, V. 2009, "Value-creating networks: organizational issues and challenges", *The Learning Organization,* vol. 16, no. 6, pp. 427-442.

Allee, V. 2008, "Value network analysis and value conversion of tangible and intangible assets", *Journal of Intellectual Capital,* vol. 9, no. 1, pp. 5-24.

Allee, V. 2002, "The future of knowledge: Increasing prosperity through value networks", Butterworth-Heinemann.

Allee, V. 2000, "Reconfiguring the value network", *Journal of Business strategy,* vol. 21, no. 4, pp. 36-39.

Allee, V. & Schwabe, O. 2009, "Measuring the Impact of Research Networks in the EU: Value Networks and Intellectual Capital Formation", *Proceedings of the European Conference on Intellectual Capital*.

Alter, S. 2008, "Defining information systems as work systems: implications for the IS field", *European Journal of Information Systems,* vol. 17.

Analysys Research, L. 2008, *Global Mobile Broadband: Market potential for 3G LTE (Long Term Evolution)*.

Ballon, P. 2009, "Platform Types and Gatekeeper Roles: the Case of the Mobile Communications Industry", *Copenhagen Business School Summer Conference*, pp. 17.

Barbuto, J.E. 2005, "Motivation and transactional, charismatic, and transformational leadership: A test of antecedents", *Journal of Leadership & Organizational Studies,* vol. 11, no. 4, pp. 26.

Barnes, S.J. 2002, "Provision of services via the Wireless Application Protocol: A strategic perspective", *Electronic Markets,* vol. 12, no. 1, pp. 14-21.

Barnett, N., Hodges, S. & Wilshire, M. 2000, "M-commerce: An Operator's Manual", vol. 37, no. 3, pp. 173.

Barney, J.B. 2001, "Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view", *Journal of management,* vol. 27, no. 6, pp. 643.

Benabou, R. & Tirole, J. 2003, "Intrinsic and extrinsic motivation", *Review of Economic Studies,* vol. 70, no. 3, pp. 489-520.

Biem, A. & Caswell, N. 2008, "A Value Network Model for Strategic Analysis", *Proceedings of the 41st Annual Hawaii International Conference on System Sciences, pp.361-367.*

Boar, B. 2001, *The Art of Strategic Planning for Information Technology,* Wiley & Sons.

Boston Analytics 2007, *A Study of the Mobile Value Added Services (MVAS) Market in India*.

Bourse, D. & Tafazolli, R. 2007, *Beyond 3G / 4G Radio Access Technologies (RATs) and Standards Roadmaps*.

Bouwman, H., De Vos, J. & Haaker, T. 2008, *Mobile Service Innovation and Business Models,* Springer-Verlag Berlin Heidelberg.

Bouwman, H. 2003, *State of the Art on Business Models*, TU Delft.

Buhr, R.J.A. 1998, "Use case maps as architectural entities for complex systems", *IEEE Transactions on Software Engineering,* vol. 24, no. 12, pp. 1131-1155.

Buss, A.H. 1961, *The psychology of aggression,* Wiley, New York.

Carlsson, C., Carlsson, J., Hyvonen, K., Puhakainen, J. & Walden, P. 2006, "Adoption of mobile devices/services—searching for answers with the UTAUT", *Proceedings of the 39th Annual Hawaii International Conference on System Sciences HICSS'06,* pp. 132a.

Chandler, A. 1962, *Strategy and Structure Chapters in the History of the American Industrial Enterprise,* MA: MIT Press.

Cisco Systems, I. 2011, *Cisco Visual Networking Index. Global Mobile Data Traffic Forecast Update, 2010-2015*.

comScore, I. 2011, *The comScore 2010 Mobile Year in Review*, comScore, Inc.

Davis, F.D. 1989, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", *MIS Quarterly,* vol. 13, no. 3.

de Reuver, M., Bouwman, H. & Haaker, T. 2009, "Mobile business models: organizational and financial design issues that matter", *Electronic Markets,* vol. 19, no. 1.

Decker, M., Schiefer, G. & Bulander, R. 2006, "Specific challenges for small and medium-sized enterprises (SME) in M-business: a SME-suitable framework for mobile services", *Proceedings of the International Conference on E-Business (ICE-B 2006)*, pp. 169.

Faber, E., Ballon, P., Bouwman, H., Haaker, T., Rietkerk, O. & Steen, M. 2003, "Designing business models for mobile ICT services", *Workshop on concepts, metrics & visualization, at the 16th Bled Electronic Commerce Conference eTransformation, Bled, Slovenia*.

Faber, E.C.C., de Vos, H. & Bouwman, W.A.G.A. 2008, *Creating Successful ICT-services: Practical Guidelines Based on the STOF Method,* Novay.

Fritscher, B. & Pigneur, Y. 2010, "Supporting Business Model Modelling: A Compromise between Creativity and Constraints" in *Task Models and Diagrams for User Interface Design*, eds. D. England, P. Palanque, J. Vanderdonckt & P. Wild, Springer Berlin Heidelberg, pp. 28-43.

Giacalone, R.A. & Greenberg, J. 1997, *Antisocial Behavior in Organizations,* SAGE Publications, Inc.

Gjerde, I., Eskedal, T. & Venturin, R. 2007, "BIZTEKON A framework for business modelling and techno-economic analysis", *International Conference on Telecommunications, 2007. ConTel 2007. 9th,* .

Google 2011a, *Google Maps Navigation for mobile - Satellite view*. Available: http://www.google.com/mobile/navigation/satellite-view.jpg [2012, 02/04].

Google 2011b, *Google Maps Navigation for mobile - Traffic view*. Available: http://www.google.com/mobile/navigation/traffic-view.jpg [2012, 02/04].

Gordijn, J. & Akkermans, H. 2001a, "A conceptual value modeling approach for e-business development", pp. 29.

Gordijn, J. & Akkermans, H. 2001b, "Ontology-based operators for e-Business model de-and reconstruction", *Proceedings of the 1st international conference on Knowledge capture,* ACM, pp. 60.

Gordijn, J., Akkermans, H. & Van Vliet, H. 2000, "Business modelling is not process modelling", *Conceptual Modeling for E-Business and the Web,* pp. 40-51.

Gordijn, J., Akkermans, H. & Van Vliet, J. 2001, "Designing and evaluating e-business models", *IEEE Intelligent Systems,* vol. 16, no. 4, pp. 11-17.

Gordijn, J. & Akkermans, J. 2003, "Value-based requirements engineering: Exploring innovative e-commerce ideas", *Requirements engineering,* vol. 8, no. 2, pp. 114-134.

Gordijn, J., De Bruin, H. & Akkermans, H. 2001, "Scenario methods for viewpoint integration in e-business requirements engineering", *Proceedings of the 34th Annual Hawaii International Conference on System Sciences,* IEEE, , pp. 10.

Gordijn, J., Osterwalder, A. & Pigneur, Y. 2005, "Comparing two business model ontologies for designing e-business models and value constellations", *Proceedings of the 18th BLED conference (e-Integration in Action), DR Vogel, P. Walden, J. Gricar, G. Lenart (eds.). University of Maribor*.

Gordijn, J., Yu, E. & van der Raadt, B. 2006, "E-service design using i* and e^3 value modeling", *Software, IEEE,* vol. 23, no. 3.

Haaker, T., Faber, E. & Bouwman, H. 2004, "Balancing strategic interests and technological requirements for mobile services", *ICEC '04: Proceedings of the 6th international conference on Electronic commerce,* ACM, New York, NY, USA.

Hakansson, H. & Johanson, J. 1992, "A Model of Industrial Networks" in *Industrial Networks: A New View of Reality*, eds. B. Axelsson & G. Easton, London: Routledge Press, pp. 28-34.

Höß, O., Spath, D., Weisbecker, A., Allag, A., Rosenthal, U. & Veit, M. 2005, "Ein Klassifikationsschema für die Architektur von mobilen Anwendungen-Erläutert an einem Praxisbeispiel zur mobilen Erfassung von Führerscheinprüfungen", *Mobile Business–Processes, Platforms, Payments,* pp. 131-142.

Höß, O., Strauß, O. & Weisbecker, A. 2006, "Eine Werkzeugumgebung für die modellbasierte, generative und plattformunabhängige Entwicklung von mobilen Anwendungen", *Aktuelle Trends in der Softwareforschung : Tagungsband zum doIT Software-Forschungstag 2006,* Heidelberg: dpunkt Verlag.

John Jr, E. & Barbuto, R.W.S. 1998, "Motivation sources inventory: Development and validation of new scales to measure an integrative taxonomy of motivation", *Psychological reports,* vol. 82, no. 3, pp. 1011-1022.

Katz, M. & Fitzek, F.H.P. 2005, "On the definition of the fourth generation wireless communications networks: The challenges ahead", *International Workshop on Convergent Technologies (IWCT), Oulu, Finland*.

Kelman, H.C. 1958, "Compliance, identification, and internalization: Three processes of attitude change", *The Journal of Conflict Resolution,* vol. 2, no. 1, pp. 51-60.

Kelman, H.C. 1961, "Processes of opinion change", *Public opinion quarterly,* vol. 25, no. 1, pp. 57.

Leonard, N.H., Beauvais, L.L. & Scholl, R.W. 1999, "Work motivation: The incorporation of self-concept-based processes", *Human relations,* vol. 52, no. 8, pp. 969-998.

Malhotra, Y., Galletta, D.F. & Kirsch, L.J. 2008, "How endogenous motivations influence user intentions: Beyond the dichotomy of extrinsic and intrinsic user motivations", *Journal of Management Information Systems,* vol. 25, no. 1, pp. 267-300.

MarketsandMarkets 2010, *World Mobile Applications Market - Advanced Technologies, Global Forecast (2010-2015).*

Mintzberg, H. 2000, *The Rise and Fall of Strategic Planning,* Pearson Education.

Normann, R. & Ramirez, R. 1993, "From value chain to value constellation: designing interactive strategy", *Harvard business review,* vol. 71, no. 4, pp. 65-77.

Olla, P., Patel, N. & Atkinson, C. 2003, "A case study of MMO's MADIC: a framework for creating mobile Internet systems", *Internet Research,* vol. 13.

Osterwalder, A. 2004, "The business model ontology: A proposition in a design science approach", *Academic Dissertation, Universite de Lausanne, Ecole des Hautes Etudes Commerciales,* vol. 2.

Osterwalder, A. & Pigneur, Y. 2010, *Business Model Generation - A Handbook for Visionaries, Game Changers, and Challengers,* John Wiley & Sons, Inc., Hoboken, New Jersey.

Osterwalder, A. & Pigneur, Y. 2004, "An ontology for e-business models", *Value creation from e-business models,* pp. 416.

Osterwalder, A. & Pigneur, Y. 2002, "An e-business model ontology for modeling e-business", *15th Bled Electronic Commerce Conference,* Bled, Slovenia, pp. 17.

Osterwalder, A., Pigneur, Y. & Tucci, C.L. 2005, "Clarifying business models: Origins, present, and future of the concept", *Communications of the association for Information Systems,* vol. 16, no. 1, pp. 1-25.

Petrovic, O., Kittl, C. & Teksten, R.D. 2001, "Developing business models for ebusiness", *International Conference on Electronic Commerce*.

Pijpers, V., Gordijn, J. & Akkermans, H. 2009, "e3 alignment : Exploring inter-organizational alignment in value webs", *Third International Conference on Research Challenges in Information Science, RCIS 2009.*

Porter, M.E. 2008, "The five competitive forces that shape strategy", *If you read nothing else on strategy, read these best-selling articles,* pp. 25.

Porter, L.W. & Lawler, E.E. 1968, *Managerial attitudes and performance,* 1. print edn, Richard D. Irwin, Homewood, Illinois.

Porter, M. 1985, *Competitive Advantage: Creating and Sustaining Superior Performance,* The Free Press.

RTR-GmbH 2011, *RTR Telecom Monitor Annual Review 2010.*

RTR-GmbH 2007, *RTR Telekom Monitor 1/2007.*

Sabat, H.K. 2002, "The evolving mobile wireless value chain and market structure", *Telecommunications Policy,* vol. 26, no. 9, pp. 505-535.

Scheer, A.W. 2002, *ARIS - Vom Geschäftsprozess zum Anwendungssystem,* 4. edn, Springer, Berlin.

Sharma, C. 2010, "Sizing up the global mobile apps market".

Sondhi, S., Biswas, S., Gupta, G. & Bharwani, P. 2011, *Mobile Value Added Services (MVAS) - A vehicle to usher in inclusive growth and bridge the digital divide.*

Steers, R.M., Mowday, R.T. & Shapiro, D.L. 2004, "Introduction to special topic forum: The future of work motivation theory", *The Academy of Management Review,* vol. 29, no. 3, pp. 379-387.

Sudha, P.S. 2011, "MOBILE VALUE ADDED SERVICES (MVAS)–VITAL TOOL FOR INCLUSIVE GROWTH IN INDIA", vol. 1, no. 4, pp. 153.

Teufel, S. 2001, "ICT-Management Framework", *Conference Proceedings, Conference on Advances in Infrastructure for Electronic Business, Science, and Education on the Internet, L'Aquila (Italy).*

Teufel, S., Götte, S. & Steiner, M. 2004, *Managementmethoden für ICT-Unternehmen: aktuelles Wissen von Forschenden des iimt der Universite de Fribourg und Spezialisten aus der Praxis,* Verlag Industrielle Organisation Zürich.

Timmers, P. 1998, "Business models for electronic markets", *Electronic markets,* vol. 8, no. 2, pp. 3-8.

UKAIS, *The definition of information systems*. Available: http://www.ukais.org.uk/about/DefinitionIS.aspx [2012, 01/17].

UMTS Forum 2011, *Mobile traffic forecasts 2010-2020 report*, IDATE et UMTS Forum.

Van Bossuyt, M., Ballon, P., Galli, L., Spedalierf, A. & Rovira, J. 2007, "Cross-case analysis of the user value proposition for next-generation mobile service platforms", *16th IST Mobile and Wireless Communications Summit, 2007,* IEEE, pp. 1.

Van de Kar, E. 2004, *Designing mobile information services; An Approach for Organisations in a Value Network, Dissertation, Delft University of Technology*.

Varshney, U. & Vetter, R. 2002, "Mobile Commerce: Framework, Applications and Networking Support", *Mobile Networks and Applications,* vol. Volume 7.

Verna, A. 2003, *The future of knowledge: increasing prosperity through value networks,* Butterworth-Heinemann.

Vorraber, W. & Voessner, S. 2010, "An extended value network notation for information service systems", *Proceedings of SSME 2010 International Conference on Services Science, Management and Engineering*, December 26-28, 2010, pp. 494-497.

Vorraber, W. & Vössner, S. 2011, "Modeling Endogenous Motivation and Exogenous Influences in Value Networks of Information Service Systems", *JCIT, vol. 6,* no. 8, pp. 356-363.

Vroom, V.H. 1995, *Work and motivation,* Jossey-Bass San Francisco.

Vroom, V.H. 1964, *Work and motivation,* Wiley, New York.

Ward, J., Griffiths, P., Whitmore, P. & Peppard, J. 2002, *Strategic Planning for Information Systems,* John Wiley & Sons Ltd.

Weigand, H., Johannesson, P., Andersson, B., Bergholtz, M., Edirisuriya, A. & Ilayperuma, T. 2007, "Strategic Analysis Using Value Modeling--The c3-Value Approach", *Hawaii International Conference on System Sciences.*

Weill, P. & Vitale, M.R. 2001, *Place to Space: Migrating to Ebusiness Models,* Harvard Business School Press, Boston, MA, USA.

Wernerfelt, B. 1984, "A resource-based view of the firm", *Strategic Management Journal,* vol. 5, no. 2, pp. 171-180.

Wilde, T. & Hess, T. 2007, "Forschungsmethoden der Wirtschaftsinformatik", WIRTSCHAFTSINFORMATIK, vol. 49, Iss. 4, pp.280-287.

Winkelmann, B. 2008, *Konvergenz von Mobilfunk- und Internetdiensten:Auswirkungen auf Wertschöpfungskette und Geschäftsmodelle des Mobilfunks*, Institut für Rundfunkökonomie an der Universität zu Köln.

Yan, X. 2003, "Mobile data communications in China", *Communications of the ACM,* vol. 46, no. 12, pp. 80-85.

Yu, E. & Mylopoulos, J. 1994, "From ER to “AR”—Modelling strategic actor relationships for business process reengineering", *Entity-Relationship Approach—ER'94 Business Modelling and Re-Engineering,* pp. 548-565.

Yu, E.S.K. 1997, "Towards modelling and reasoning support for early-phase requirements engineering", *1997, Proceedings of the Third IEEE International Symposium on Requirements Engineering,* IEEE, pp. 226.

Yu, E.S.K. 1995, *Modelling strategic relationships for process reengineering*, University of Toronto, Ont, Canada.

Xu, Y. 2001, "Return of the tigers: Asian Pacific innovation in mobile communications", Info, vol. 3, Iss. 2, pp. 231-242.