

# 1. Introduction

This thesis analyzes knowledge sharing and trading on electronic marketplaces. We shall develop a theory of knowledge sharing, which describes the effect of different influential factors, as well as a model for knowledge trading, which represents a framework for market engineers who want to design an electronic knowledge market.

In this chapter the research questions and the thesis outline are presented. Furthermore, we show the scientific approach which we use to answer the research questions.

## 1.1. Real World Problems

The ability to manage the internal and external knowledge assets is becoming an ever-increasing factor for the competitiveness of knowledge-intensive organizations [58]. In studies on Knowledge Management, it is emphasized that the most challenging problem is to motivate the participants to share their knowledge [107]. However, knowledge sharing is difficult to achieve and the employees are often not willing to share their knowledge [107]. Overall knowledge sharing is often insufficient from the organizational perspective compared to an organizational optimal sharing level.

### **Real World Problem I:**

Knowledge sharing is difficult to achieve and often insufficient.

Knowledge trading could solve these problems not only inside an organization, but also between organizations and individuals. We define knowledge trading as the transfer of usage rights for knowledge assets in exchange for a monetary payment with the help of a market mechanism. In practice, knowledge trading causes high transaction costs in finding the right expert or the right documented knowledge. It is crucial to reduce the transaction costs, especially in the case where the value of the expert advice is relatively low. If the transaction costs are too high, a market will not be successful. Also, the special characteristics of knowledge assets demand a specific market design.

### **Real World Problem II:**

Trading of knowledge assets is not well established, because of the high transaction costs and the specific properties of knowledge assets.

## 1.2. Research Questions

We extract four research questions out of the two real world problems.

If we analyze the trading and sharing of a good, it is crucial to know the characteristics of the good.

### **Research Question I:**

What are the characteristics of knowledge assets and what impact have these characteristics on the trading and sharing of these assets?

Most knowledge management systems have a kind of open knowledge repository where knowledge assets can be stored and every user has free access to it. However, knowledge sharing with an open repository has not been well understood until now[107]. In the case of open knowledge repositories, knowledge sharing relies on the individual knowledge possessor's effort. Therefore, it is crucial for the success of a knowledge sharing initiative to understand the knowledge-sharing motives of the participants. We are especially interested in the impact of incentives and culture on knowledge sharing.

### **Research Question II:**

Which factors affect knowledge sharing in an open repository situation?

A different concept to an open knowledge repository is a knowledge market. The trading of knowledge goods in an electronic market is compelling, because of the intangible nature of these goods. Therefore, the question arises, how can we trade knowledge goods. To foster trading of knowledge assets, we have to overcome different challenges of knowledge asset markets. These challenges are, among others, finding appropriate market mechanisms with respect to knowledge asset characteristics, establishing a critical mass of customers, overcoming the uncertainty of the knowledge-assets quality, and matching of advice seekers with appropriate experts or documented knowledge. For all these challenges suitable methods have to be found.

### **Research Question III:**

What are appropriate matching, quality assurance, and market mechanisms for electronic knowledge markets?

Another question is how an appropriate IT infrastructure for electronic knowledge markets should be designed. Knowledge markets should be integrated into the daily work and communicate with different systems inside and outside the company. Therefore, the right technical infrastructure is crucial for the success of a knowledge market.

**Research Question IV:**

How can knowledge trading support be provided with an appropriate IT infrastructure, which covers a broad range of usage scenarios?

## 1.3. Thesis Outline

The thesis is composed of four parts. The research questions I-IV are analyzed in the corresponding parts I-IV (which are called Knowledge Assets, Knowledge Sharing, Knowledge Trading, and KnowMarket).

### Chapter 1 Introduction

The research questions of the thesis are presented and the outline of the dissertation is sketched. Also, the scientific approach that is used in this thesis is described.

### Part I Knowledge Assets

#### Chapter 2 Knowledge Assets and their Transfer Mechanisms

This chapter analyzes the characteristics of knowledge assets and their impact on market design. Also, different views on knowledge are presented. We introduce the concept of *knowledge-transfer mechanisms* as a set of rules that govern the transfer of knowledge assets. Consequently we can distinguish between knowledge sharing and knowledge trading. Knowledge sharing is characterized by an open knowledge repository with non-discriminating access. Knowledge trading is the transfer of usage rights for knowledge assets by using market mechanisms, cf. [136, 135].

### Part II Knowledge Sharing

#### Chapter 3 Theory of Knowledge Sharing

We present a theory of different motivational factors, which influence the voluntary contribution to an open knowledge repository. The theory of knowledge sharing is grounded on game theory and experimental economics. This gives us the ability to analyze knowledge sharing in different environments. The new theory provides us with testable propositions for the impact of culture and incentives on knowledge sharing. Some preliminary ideas of knowledge-sharing motives and the influence of incentives and culture have been presented in [141].

**Chapter 4** Empirical Analysis of the Effect of Incentives and Culture on Knowledge Sharing

We present a field study of the knowledge-sharing activities in a real knowledge management system. This kind of study produces results that are more realistic than an experimental study and provides deeper insights than case studies. We analyze the combined influence of incentives and culture on knowledge sharing in large organizations. The hypotheses resulting from the knowledge-sharing model of Chapter 3 are tested against real knowledge-sharing behavior observed in a multinational knowledge management system. Parts of the empirical study have been presented in [141].

**Part III** Knowledge Trading

**Chapter 5** Model for Knowledge Trading

A model for knowledge trading is proposed. Different possible solutions for quality assurance and matching are discussed. A typology of market mechanisms for knowledge trading is presented. Based on this typology, different propositions about the performance of market mechanisms are derived, cf. [140, 139].

**Chapter 6** Experimental Evaluation of different Market Mechanisms for Knowledge Trading

For the analysis of knowledge markets we have designed and implemented an experimental environment, called the *Data Trader Game*. This computer-assisted game was used for the real-life experiments of different market mechanisms and their effects on knowledge transfer. The propositions of Chapter 5 and parts of the propositions of Chapter 3 have been tested against the experimental results. Parts of the experimental results have been published in [137] and [138].

**Part IV** KnowMarket

**Chapter 7** IT Infrastructure for Electronic Knowledge Markets

In this chapter an IT architecture for electronic knowledge markets is presented. We model the static and dynamic aspects of the architecture with UML. A prototype of an electronic knowledge market was developed according to the architecture, called *KnowMarket*. We have developed KnowMarket as an XML Web Service architecture, so that the knowledge market can be easily integrated into other programs like office applications or portals and therefore is well integrated into the daily work.

**Part V** Conclusion

**Chapter 8** Conclusion

The concluding chapter summarizes the contribution of this dissertation. Furthermore, Chapter 8 indicates promising research challenges and open questions. Also, the applicability and the benefit of this work are described.

In Figure 1.1 the overall road map of the thesis and the interdependencies of the chapters and sections are sketched.

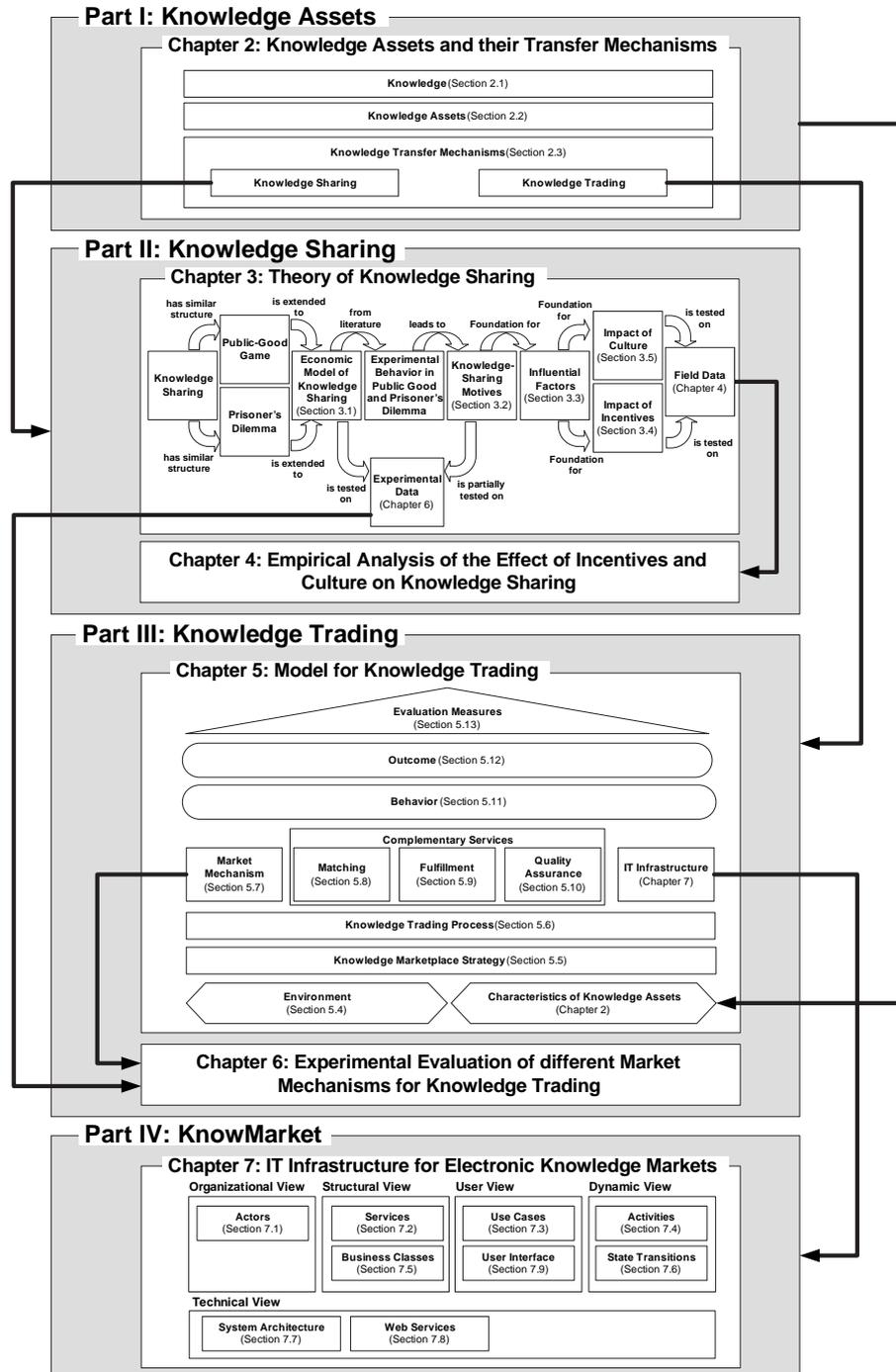


Figure 1.1.: Road Map of the Thesis and Interdependencies of Chapters and Sections

## 1.4. Scientific Approach

Different scientific methods are necessary for the different parts of the thesis. We use a critical rationalistic approach for Chapter 3 and 4 as well as for Section 5.7 and Chapter 6, because the main contributions in these sections are hypotheses and the empirical test of them. For the remaining part of Chapter 5 and for Chapter 7 we use a design science approach, because the contributions of these parts are IT artifacts [127, 90] which include also models, methods, constructs and applications.

Therefore, this thesis spans a bridge between different Information Systems' (IS) research traditions. While in the European and esp. in the German IS (“Wirtschaftsinformatik”) tradition the design science approach is popular, American IS research is dominated by a quantitative empirical approach [63, 87].

### 1.4.1. Critical Rationalism

For the contributions in the form of hypotheses and tests, we use a critical rationalistic epistemological view according to Popper [154]. The main assumption is—in line with the logical positivism—that an objective reality exists that has regular patterns of causations. However, there is no way to prove that a theory is a true representation of the reality. We can only falsify a theory [154].

The main task of a scientist in this view is to discover cause-and-effect relationships in nature (cf. [19, 35, 186]). The goal is to create a theory, which is a causal model for a phenomenon of interest. In this thesis the phenomenon of interest is *knowledge transfer*, which includes *knowledge sharing* and *knowledge trading*. A theory consists of assumptions (axioms) and propositions. A proposition is a functional relationship between constructs, which is logically true if the assumptions are true [35]. Such a logical derivation from the assumptions to the propositions can be in the form of a mathematical proof, as we did e.g. in Proposition 2 (p. 64). But it is also legitimate to discuss the logical connection between assumptions and propositions in verbal argumentation. Therefore, the critical rationalistic method uses deduction and not induction to construct a theory.

To test a theory we have to derive hypotheses out of the propositions. A hypothesis is a comparative statement about an explicitly measurable effect [35]. Therefore, we have to state how we measure a construct, i.e. how we define the corresponding variables. We use field data in Chapter 4 and experimental data in Chapter 6 to empirically test our propositions from Chapter 3 and Section 5.7. In Figure 1.2 the overall structure of the critical rationalistic approach—as it is used in this thesis—is sketched.

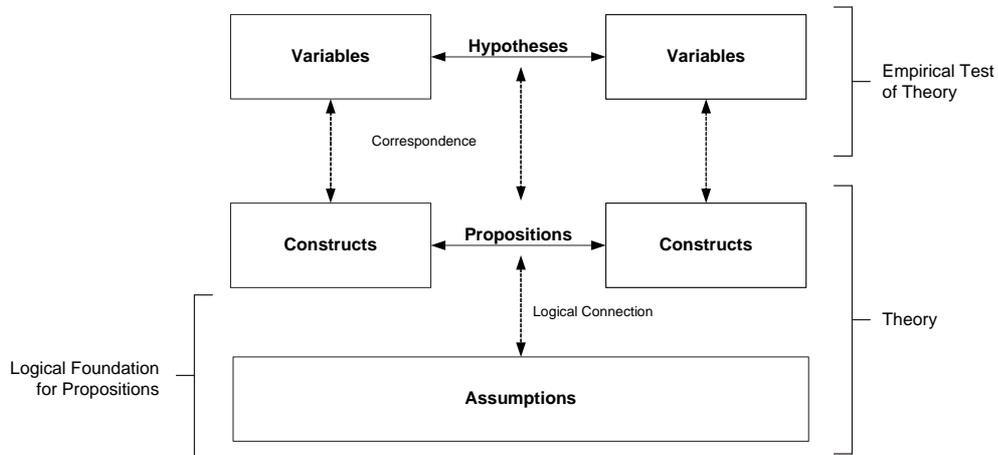


Figure 1.2.: Scientific Approach of Critical Rationalism, partially adapted from [19] and [35]

### 1.4.2. Design Science

The design science approach tries to “extend the boundaries of human and organizational capabilities by creating new and innovative artifacts” [90]. In this paradigm, “knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact” [90]. Artifacts include models, methods, constructs, and applications. The root of this approach lies in engineering. An artifact is evaluated against its usefulness rather than its truth [127]. In Chapter 5 a model for knowledge markets is presented, which includes methods for solving the specific problems of knowledge markets. In Chapter 7 we use UML models to further specify the IT aspects of the knowledge market model and build a prototype application.

### 1.4.3. Interplay of Critical Rationalism and Design Science

The interplay of both scientific approaches is sketched in Figure 1.3. In critical rationalism the main focus is on theory building and hypotheses—in our case on the behavior of users interacting with knowledge sharing and trading mechanisms. The goal is the understanding of knowledge sharing and trading behavior through the justification and testing of theories. Therefore, we try a gradual convergence to the truth—a thus far accurate, testable model of a part of the reality. This understanding

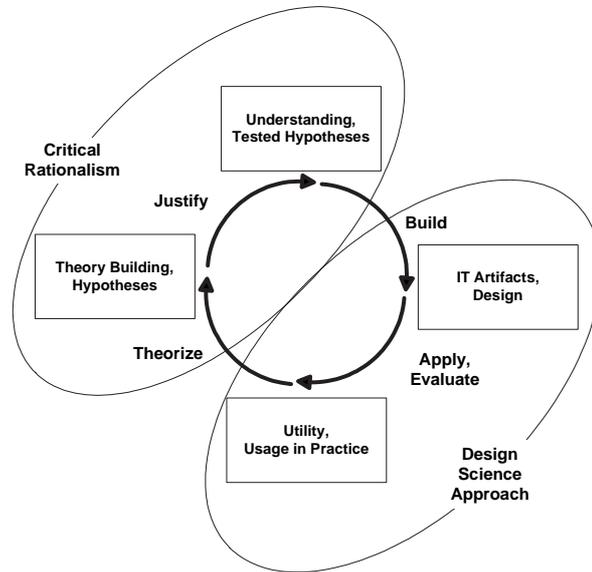


Figure 1.3.: Interplay between Critical Rationalism and Design Science Approach, partially derived from [144]

of knowledge sharing and trading behavior can then be used to design and build IT artifacts, in our case a model and a prototype of electronic knowledge marketplaces. These artifacts should then be applied in practice to generate a value for the relevant stakeholder. An IT artifact in use is the origin for theorizing about the behavior of the participants of the system. Therefore, both scientific approaches are suitable for our scientific goals of the thesis: to understand knowledge sharing and trading, and to design a model for knowledge markets.

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