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Bringing Innovative Developments for Geographic Information Technology

Report: Electronic GI Marketplaces

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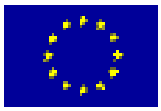

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Abstract:

Research in internet-based marketplaces for geographic information targets a generic, innovative approach to exploit the technological innovation, as developed in BRIDGE-IT, in business processes.

We suggest an extended cooperation of providers in business networks. And we introduce internet-based marketplaces for geographic information as a tool for its cooperation and coordination. Our goal is support the sale of component-based GI products in general economy.

This document consists of four mayor building blocks:

A. **Introduction and problem statement**
B. **Concepts of GI marketplaces**
C. **Validation of concepts**
D. **Discussion of results, summary, and outlook.**

To be put on BRIDGE-IT homepage by CETIR. Optionally to be put on IfGI homepage by UM. To be announced and distributed to partners and EC by S&DE.

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EXECUTIVE SUMMARY

The market for geographic information (GI) lags behind its expected market growth. For example in Germany, (Fornefeld, Oefinger et al. 2003) estimate a potential GI market volume of 8 billion €, but only 1.2 billion € are currently exploited. We suggest electronic marketplaces for geographic information as tools for coordination and cooperation of customers, and geospatial value chains in order to support the exploitation of the GI market potential.

Section 1 describes the need of economic strategies in order to improve marketing of innovative technologies as developed in the BRIDGE-IT project.

Section 2 points out the need of business networks that replace outdated monolithic business models of companies offering all types of GI services, from data production, data integration, software development, to training of employees in new GI systems. Special requirements of the GI market result from the structure of GI products. Mostly GI products are not ready-to-use as for example a book. Instead, complex GI-products (= information services) have to be generated by human, organizational, and institutional services applied on the raw products geographic data and software. Research on complementation of technological developments by economic models is few and not sufficient so far.

Based on our methodological approach of

- Evaluation of existing spatial and non-spatial marketplaces (section 3)
- Metaphorical design (section 4)

we derive general concepts of GI marketplaces.

The institutional and organizational framework of GI marketplaces (section 5) describes an organization that is open to various players and roles of the GI value chains. The challenge is to keep the balance between

- Providing mechanisms and standards in order to stimulate the market
- Avoiding over-regulation, stimulating the self-organization of the individual players, and keeping the infrastructure of co-ordination open to new products and providers (Merz 1999).

Services of GI marketplaces (section 6) target six groups: matching buyers and sellers, support co-operation within the geospatial value chain, facilitation of transactions, marketing, provision of an institutional, organizational, and technical infrastructure, and provision of additional services.

After developing general concepts for GI marketplaces, we will design a specific, vertical GI marketplace for potential and potent customers of GI: the branch of financial service providers. A scenario of a bank requiring a typical GI product serves as a setting for validating the feasibility of GI marketplace concepts.

The typical GI product required by financial service providers is a complex information service, composed of various technological, human, organizational, and institutional GI services (section 7). Currently, there is a severe mismatch between demand and offer (section 8). A test of existing GI

internet platforms showed that almost only geographic data were offered. Contrary to the offer, the demand mostly addressed additional GI services (in the scenario 90 % of the costs of the required GI product were due to additional GI services). The potential customer did not get sufficient information about the price, benefit, or even existence of the required GI product.

Section 9 describes a mixed-mode model for business processes on a vertical GI marketplace for financial service providers. The mixed-mode model focuses on collaboration processes, but also integrates transaction processes.

On the implementation level, a key requirement is to integrate technological and human GI services by a semantic enabling description language. Section 10 validates that OWL-S (formerly DAML-S) is capable to describe service chaining of technical and human GI services.

A business plan for the realization of a vertical GI marketplace for financial service providers (section 11) demonstrates the financial feasibility of its realization. We estimate the risk of the realization of the GI marketplace as medium - high. However, it provides the opportunity to exploit the GI market potential and significantly increase the sale of GI products. In addition, the pilot initiative realizing a vertical GI marketplace can affect the establishment of further vertical GI marketplaces with lower costs.

Section 12 discusses the achieved results. We think it crucial that improvements in GI technology and interoperability as performed by the BRIDGE-IT project are complemented by the economic perspective and new marketing strategies. In the concrete example of BRIDGE-IT technologies, their interoperability was validated in the pilot application. Therefore, we recommend the BRIDGE-IT partners to leave the “normal” ways of marketing and distribution of the new products. In contrary, we recommend to exploit the chance of interoperability by addressing new application fields and new customers. We conclude that electronic GI marketplaces

- Can improve GI economy
- Can be executed in terms of business processes
- Can be implemented by existing technologies
- Can be financed by public funding and public-private partnership.

Further work (section 13) addresses the practical realization of a GI marketplace.

1. INTRODUCTION

1.1. AIM

Research in internet-based marketplaces for geographic information targets a generic, innovative approach to exploit the technological innovation, as developed in BRIDGE-IT, in business processes.

We suggest an extended cooperation of providers in business networks. And we suggest the information services as GI products, which add human, technical, organizational, and institutional services to the raw products data and software.

We introduce GI marketplaces as tools for the GI market's cooperation and coordination. Our goal is support the sale of component-based GI products in general economy.

1.2. TOPIC

Too long geographic data and GIS were considered as usable products. Yet, they mostly do not fulfill the user requirements, because they are not ready-to-use. Human, technical, organizational, and institutional services have to be added to the raw products data and software. These we call *information services*, which we assume more successful on the market.

The technological step forward in GI is interoperability. The OpenGIS Consortium promotes the combination of technical GI services versus the ancient model of monolithic GIS. Within the BRIDGE-IT project, innovative and interoperable components are developed. One of the key issues of BRIDGE-IT is the proof interoperability in practice. BRIDGE-IT integrates a great variety of components in four different pilot applications all over Europe.

However, technological evolution forces economical evolution as well; interoperability has to be transferred from technology to business. She shift goes from single, monolithic companies to business networks. Business networks of several companies find together on users' demand; each company with its respective core competence provides one component of the desired end-product.

OpenGIS Consortium and ETeMII (Gisform 2002) illustrate a "toy example of a real marketplace, which exhibits a high degree of interoperability, from which we may draw analogies: The market which links hungry consumers to a chicken distribution site (otherwise known as a fried chicken restaurant) is at least as complex as this diagram. This market example is interoperable in that we might "unplug" a transport company and substitute it (rather quickly) with another offering better or cheaper service, without disrupting the flow (service chain) from suppliers to consumers. The same would be true for a chicken feed supplier or for the company which produces paper boxes in which the chicken is delivered. So what does this have to do with the GI market? Accepted rules (standards) among the various actors involved are essentially the glue, which holds the chicken market, and many other mature markets, together. Do these rules exist within the (European) GI market? It is safe to assume that the answer is no, or at least that sufficient maturity does not yet

exist. When the rules of collaboration among GI actors become clear, then an interoperable marketplace will emerge."

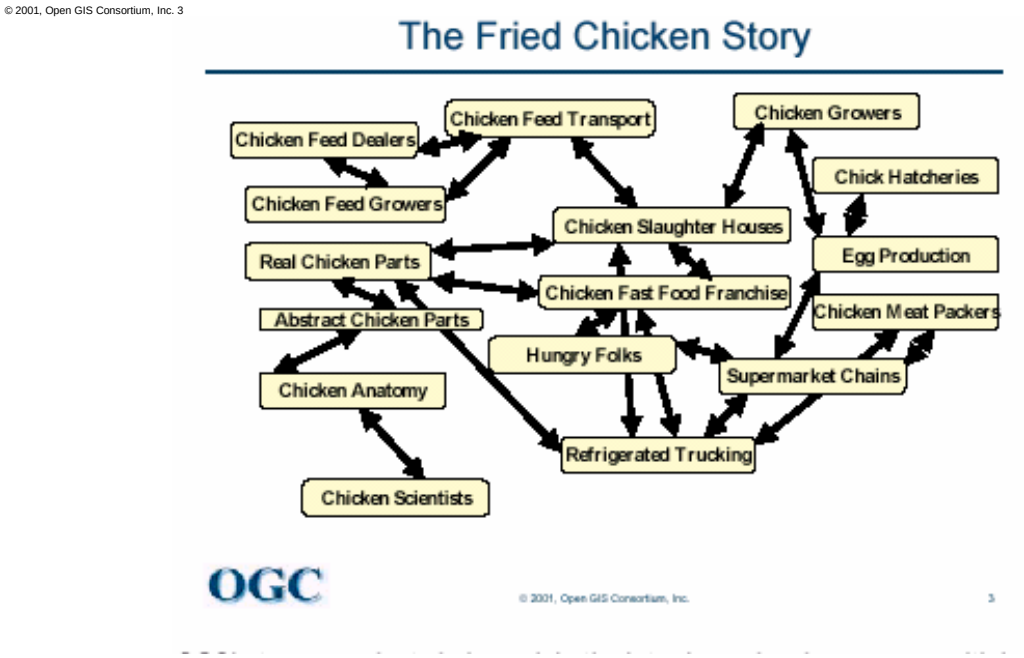

Fig. 1: The Fried Chicken Story (by OGC, 2001)

This report complements the technological developments of the BRIDGE-IT partners by research on the economic perspective of marketing interoperable, technical GI services. We suggest business networks as new business models for the GI market, and electronic GI marketplaces as tools for its coordination and cooperation.

1.3. STRUCTURE

This document consists of four overall building blocks:

A. Introduction and problem statement

B. Concepts of GI marketplaces

C. Validation of concepts

D. Discussion, summary, and outlook.

A. Introduction and problem statement:

Section 1 will introduce electronic marketplaces for geographic information. Section 2 will point out the need of business networks and GI marketplaces as well as highlighting the special requirements of the GI market. This section will conclude with evidencing our research approach.

B. Concepts of GI marketplaces:

Sections 3 and 4 will describe our methodological approach for the design of GI marketplaces and highlight key findings:

- Evaluation of existing spatial and non-spatial marketplaces (section 3)
- Metaphorical design (section 4).

The results will be described in the two following sections:

- Concept of an institutional and organizational framework of GI marketplaces (section 5)
- Concept of services of GI marketplaces (section 6)

C. Validation of concepts:

After developing general concepts for GI marketplaces, we will design a specific, vertical GI marketplace for potential and potent customers of GI: the branch of financial service providers. A scenario of a bank requiring a typical GI product will serve as a setting for validating the feasibility of GI marketplace concepts.

Section 7 will evaluate the demand of financial service providers for GI products. Section 8 will test how this demand is fulfilled by current internet solutions. Section 9 will describe the realization of a GI marketplace from the economic point of view. Section 10 will validate that OWL-S (formerly DAML-S) is capable to describe service chaining of technical GI services as well as of additional human, organizational, and institutional GI services. Section 11 will describe a feasible business plan for the realization of a vertical GI marketplace.

D. Discussion, summary, and outlook

Section 12 will discuss the achieved results. Section 13 will provide an outlook on further work. Section 14 will acknowledge external contributions to this report. Section15 will list the references.

1.4. APPLICABILITY

Technology Watch Report 7.2.5 provides an overview of the status quo of research in GI marketplaces. The targeted audiences are BRIDGE-IT partners as well as world-wide, GI-related companies, state authorities, researchers, organizations, and initiatives, which target the exploitation of technological improvements of GI in general economy.

2. WHY DOES THE MARKET FOR GEOGRAPHIC INFORMATION NEED BUSINESS NETWORKS AND MARKETPLACES?

This section describes the need of marketplaces as new business model of the GI market. Business networks are essential for a cooperation of providers and providers as well as users and providers (section 2.1). Section 2.2 transfers examples of marketplaces from general economy to the GI market. Section 2.3 points out the specific requirements of GI. Section 2.4 evidences the relevance of the chosen research approach.

2.1. THE NEED OF BUSINESS NETWORKS

Geographic Information (GI) potentially is a valuable resource of economy. But too often it cannot be used in business and decision processes. For too long a time geographic data sets have been considered as a solution for providing successful products. Selling raw data implies that the user has the expertise to use the data. This is often not the case and the producer is forced to find new ways to enter the market. The solution is a product that is ready-to-use (Brox and Kuhn 1999; Brox and Kuhn 2001).

In the past, the technical innovation was to add technical, interoperable services to the raw material of geographic data sets. Due to the standardization efforts of International Organization for Standardization (ISO) and OpenGIS Consortium (OGC) we have made the step from monolithic systems to component based systems and interoperable services. Today's challenge is to use the technical innovation within economically successful business processes.

Despite of the technical innovation, most business models of the GI market are still monolithic. There are many examples for companies that cover all tasks of a geospatial value chain: produce data, adjust data, produce software, adjust applications to users' needs, integrate systems, consult users, and train users. A lesson we learnt from the technical aspects of monolithic systems is: these systems are technically capable, but can never provide exactly what users want. On many economic sectors we have learned that big companies split up into smaller companies (or at least into autonomous departments) with their specific core competences and core business. The future generation of products shifts from the traditional philosophy "One product equals one company" to a combination and integration of processes required for generating a product, and several small business units that are particularly capable of executing each process. Companies in the value chains of a specific economic sector cooperate in ad hoc projects in order to generate the desired product (Malone and Laubacher 1999).

The future generation of information services requires a networked cooperation of the entire geospatial value chains of producers, service providers, integrators, service enablers, and end-users (Niedzwiadek 1999). The GI market calls for e-commerce und e-business. This requires new forms of business models that we call *business networks* (Brox and Kuhn 1999). The term "business

networks" takes up the terms "business networking" and "process networks" of (Benz, Fleisch et al. 1999). Business networks require successful mechanisms for the communication and cooperation of buyers and sellers of geographic information. In addition, the specific requirements of the GI market have to be supported. A major tool for the unification of many companies and organizations in cooperation and competition are service-based *marketplaces for geographic information*.

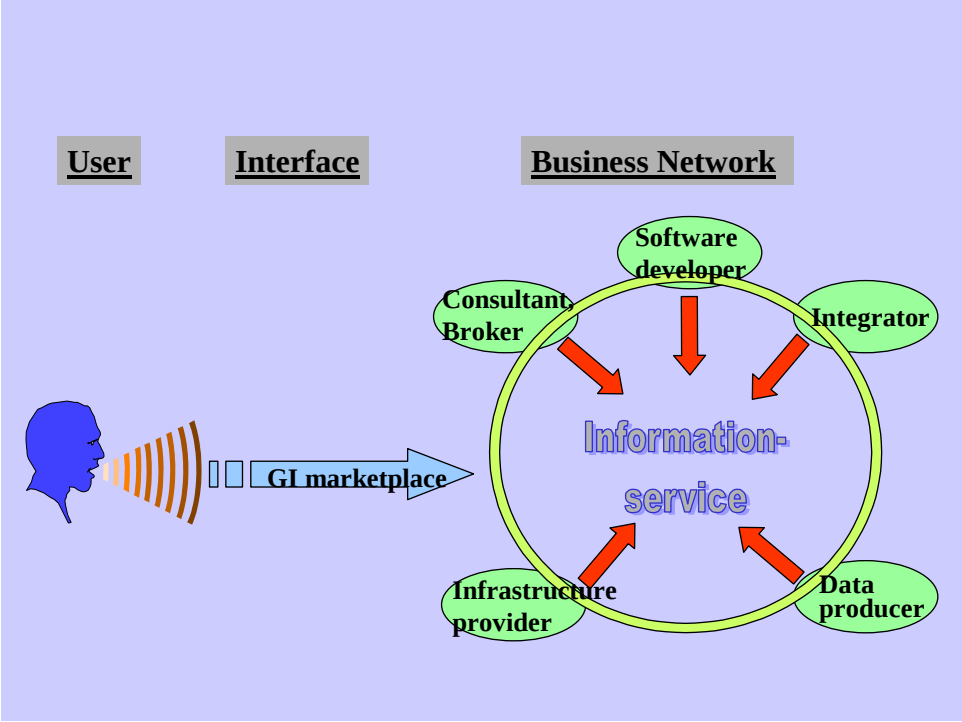

Fig. 2: Business networks

Business networks address two key issues:

- End-user-centricity is one of the most important success factors in economics (Plattner 1999). Also the GI market requires a more effective communication of buyers and sellers of geographic information by an optimized *interface*.
- Another trend in software economics will be adapted by the GI market. In the future the generation of products will be process-oriented (Malone and Laubacher 1999). Companies of the value chains of a specific economic sector find together in ad hoc projects in order to generate the desired product. This can be compared to the construction of a house by architects, bricklayers, electricians, banks, gardeners, etc., or the production of a movie. Similarly, in the GI market, specialized providers of the entire geospatial value chain will have to co-operate in *process-oriented business networks* in order to generate the required geographic information services.

2.2. THE NEED OF ELECTRONIC MARKETPLACES

In all economic sectors the transition to e-commerce and e-business is *the* success factor. Today's GI market targets e-commerce and e-business, but until now just a small percentage of the annual turnover is transacted via the Internet (Fornefeld and Oefinger 2001). Within the new internet-based business new tools for cooperation emerged, e.g., marketplaces, sell-side solutions, and portals.

Currently, the goal of the GI market in e-commerce and e-business is to search, order, deliver, and pay geographic data sets via the Internet. The challenge is to exploit the further potential of the medium Internet: the process-oriented production of services, the exchange and the integration of services to information services, and the coordination and cooperation of the business players of the GI market. In addition to pure information, marketplaces initiate transactions between buyers and sellers and offer mechanisms for transactions via the marketplace (Spiller and Wichmann 2000). Marketplaces can be considered as a middleware, particularly in an organizational sense but in the technical meaning as well.

In the general economy, solutions for business-to-business (B2B) e-commerce are more advanced than within the GI market. The focus is shifting from mostly sell-side solutions or buy-side solutions of single companies to the selling and buying of goods via B2B marketplaces. B2B marketplaces are successful and promising in businesses worldwide (Berlecon_Research 2000).

The most promising chances for marketplaces are expected in fragmented markets with many actors and low transparency (Spiller and Wichmann 2000). This is particularly true for the GI market, because geographic information is relevant and applied by many communities of interests.

Electronic marketplaces target the reduction of transaction costs. (Williamson 1991) describes a transaction as the occurrence when a good or a service is transferred across a technologically separable interface. We can describe the following transaction phases:

- Pre-sale (acquisition, information gathering, marketing, negotiation)
- Sale (contracting, fulfillment)
- After-sale (customer relationship management).

Cost reduction possesses two aspects. First is *price*. A simple example is, that sending a product offer by email instead of traditional mailing it is cheaper. Yet, another aspect brings in *quality*. Marketplaces enable providers to offer their products in a better way, e.g., by quicker access to information, enhanced usability of a catalogue. And, even more important, clients get a better access to the market, e.g., by retrieval of needed information and the possibility to compare products of various providers.

After the "marketplace hype" around the year 2000, we can observe a shift from exaggerated to realistic expectations concerning market share, and from pure transaction-oriented marketplaces to collaboration platforms. Both models and a mixed-mode will be discussed section **Fehler! Verweisquelle konnte nicht gefunden werden.**.

Marketplaces go along with cooperation and competition. On the one hand side, marketplace users profit by an enhanced transparency of the market, which affects lower prices and higher quality of offered products. On the other hand, providers profit as well. By the cooperation in an electronic marketplace, the critical mass of providers (data producers, software developers, integrator, consultants, brokers, infrastructure providers) is achieved. Clients are able to find the required product in appropriate way, which evokes an enhanced request for products.

2.3. WHAT'S SO SPECIAL ABOUT GEOGRAPHIC INFORMATION?

A typical example of a successful e-commerce solution is Amazon. The products are books, which are on stock and ready-to-use. In contrast, geographic data sets are often no products that could be readily accepted by the users, because they are

- Held in formats requiring specialized software
- Too complex to be easily browsed or combined with other information
- Marketed through pricing schemes that reflect production costs rather than value (Krek and Frank 2000).

To generate an information service, technical, human, organizational, and institutional services have to be added to the raw material geographic data set by providers, producers, and integrators of the geospatial value chain. Services added to data can be generated technically and automatically on the fly.

Geographic information is ubiquitous, applied in many specific domains for many different purposes. Compared to non-spatial markets there are many data formats, semantics, software systems, providers, and users with extremely different requirements (Abel 1997). The most important consequence is that GI products are often not ready-to-use but have to be generated on demand in ad-hoc processes from intermediate products, data and services. For example, an information service is generated by the automatic delivery of geographic base data, and the integration of non-automatic procedures into the workflow, e.g., the adjustment of the data set by a service provider, and consulting by an information broker for additional statistic data sets.

In addition, the GI market is very complex. Potential users cannot handle it properly, neither geographic information itself, nor it's techniques, nor it's providers. A typical example is the purpose of retailers to use geographic information for marketing processes. The solution the GI market could provide was: buy GIS, they can solve your problems. GIS were too complex to handle, and they could not be integrated into enterprise resource planning systems (ERP) and workflows of GI business users (Sliwinski 2001).

The reduction of transaction costs is one of the targets of marketplaces in general economy. GI marketplaces address even one step before: they enable interactions in business networks, and then reduce transaction costs. This evokes three specific requirements of the GI market:

- An extended cooperation of providers with providers

- An extended possibility of exchanging and integrating services (technical, human, organizational, and institutional), coordinated by an institutional, organizational, and technical framework, i.e., standards, access rights, usage
- An extended customizing of GI products by an easier access of buyers of geographically related products and services, and its providers.

2.4. RELEVANCE OF THE RESEARCH APPROACH

Our approach starts with the observation that the GI market lags behind the expected market growth. The GI market needs information services instead of the raw products data and software. We suggest transferring concepts of general economy to the GI market: business networks, and GI marketplaces as tools for their cooperation and coordination.

The evidence for the relevance of the research approach rests on three issues:

1. Relevance of the problem
2. Lack of previous work
3. Potential of the marketplace idea to solve the problems.

1. *Relevance of the problem:* The relevance of the overall problem, that GI is not sold according to its' potential, is generally accepted. An analysis of publications, geographic and non-geographic, shows the relevance of this problem, e.g., (Fornefeld and Oefinger 2001), (Frank 1999). In order to make business out of geographic information, the GI market needs to face its challenges: e-commerce and e-business, process-oriented business models, services, and the GI market's specific requirements.
2. *Lack of previous work:* Previous work has been done by Geospatial Infrastructures, e.g., in Australia, Germany, Netherlands, Portugal, United Kingdom, USA ((ANZLIC 1999), (InGeoForum 2000), (RAVI 1999), (CNIG 2000), (OXERA 1999), (NGDF 1999)). Within these infrastructures platforms for information and also sale of geographic information were created. However, some of them are still in a conceptual phase, others yet did not make a breakthrough. Improvements are due, for example, in the role of coordinating the GI market, and to ease the access of potential users by branch specific marketplaces.

   Recent publications improved the idea of marketplaces. The original idea of marketplaces is a mere shop, buying data via Internet. Further research added the idea of services, e.g., (Gaede 1997), (Gabriel and Wagner 2001). The improvement of our research approach is the shift from ready-made products, mostly data, to building blocks for generating products: intermediate products and services. But not all needed building blocks are ready-made and on stock. The users' requirements to geographically related products are extremely heterogeneous; the building blocks have to be adapted, or even created. This requires ad-hoc processes for generating information services and an extended need for cooperation of geospatial value chains.

Other publications focus on specific business aspects, e.g., pricing of geographic information (Krek and Frank 2000). This research is extremely valuable, but – by definition - does not cover the general problem of not using the potential of GI.

OCG is a protagonist for the realization of services on a technical level. Although the business aspects of a distributed, service-based environment, e.g., the cooperation of geospatial value chains (Niedzwiadek 1999) are recognized, solutions are due to be provided. Other publications focus on the technical and architectural aspects of a distributed, service-based environments, e.g., (Abel 1997), (Senkler and Remke 2001). In our opinion, the technical approaches do not neglect, but underestimate the business point of view "Design a business plan first, and then look for technical realizations".

Based on the analysis of previous work, the following key issues of the GI marketplace idea are improvements of previous work or mainly new:

- Marketplaces for geographic information integrate the ideas of e-commerce, process-oriented business networks, services, and the specific requirements of the GI market on a conceptual, organizational level into one tool.
- GI marketplaces are tools for coordination, communication, and cooperation within the GI market.
- Improvements start with organizational and business concepts; technical solutions are developed for realizing them - not the other way around "We know intelligent technical solutions; afterwards we will find a market for it".
- GI marketplaces integrate automatically generated products and services with additional services. We call the integration of data and technical, human, organizational, and institutional services information service.
- The building blocks for generating geographically related products (intermediate products and services) are not all ready-made and on the stock. They have to be adjusted or even created in ad-hoc business processes.
- GI marketplaces shift the idea of interoperability from technical to business processes.
- The future GI market is process-oriented. This requires business networks, where providers, producers, integrators, and consulters with specific core competences cooperate in order to generate the information service tailored to the users' needs.
- Branch-specific vertical marketplaces provide access to geographically related products and its' providers for specific branches.

3. *Potential of the marketplace idea to solve the problems:* The marketplace idea has the potential of solving the addressed problems of the GI market for three reasons:
    - Business address the need of generating information services instead of the raw products data and software (see section 2.1).

- Marketplaces are successful in non-spatial economic sectors (see section 2.2). The transfer of success factors is a common, justified, and promising approach.
- The transfer of concepts from general economy to the GI market integrates the specific requirements of the GI market (see section 2.3).

The research approach fulfills all three criteria for its relevance: The problem is relevant, the problem is not yet solved, and the idea of GI marketplaces has the potential to solve the different aspects of the problem.

The following two sections describe our methodology, and highlight key findings:

- Evaluation of existing spatial and non-spatial marketplaces (section 3)
- Metaphorical design (section 4).

This leads to a further specification of theoretical concepts of the institutional and organizational framework of GI marketplaces (section 5) and the services they need to provide (section 6).

3. EXISTING SPATIAL AND NON-SPATIAL MARKETPLACES

In general economy, solutions for business-to-business (B2B) e-commerce are much more advanced than within the GI market. The focus is shifting from mostly sell-side solutions or buy-side solutions of single companies to the selling and buying of goods via B2B marketplaces (Berlecon_Research 2000).

This report evaluates in the context of this GI marketing philosophy

- Non-spatial marketplaces, e.g., mySAP.com (http://www.sap-ag.de/germany/services/servsuptech/smp/)
- New marketplaces of the GI market, e.g., www.geomarktplatz.de
- The conception of a geospatial infrastructure in North-Rhine-Westphalia, Germany (Kuhn, Basedow et al. 2000).

Tab. 1: Evaluated marketplaces, portals, and sell-side solutions

Marketplace	**Link**
Non-spatial	
Altra Energy, US	http://www.altranet.com
Amazon, UK, Germany	http://www.amazon.com
BizWiz, US	http://clickit.com
Chemplorer, Germany	http://www.cc-chemplorer.com/ccp/controller.do
EBay, Germany	http://www.ebay.de/
mySAP.com, Germany/US	http://www.sap-ag.de/germany/services/servsuptech/smp/
Ricardo, Germany	http://www.ricardo.de
Vertical Net, US	http://verticalnet.com
(see also marketstudy "B2B marketplaces in Germany")	(Spiller and Wichmann 2000)
Spatial	
Comercio Electrónico Global, Spain	http://www.e-global.es
ESRI, US	http://www.geographynetwork.com/
Geocommunity, US	http://store.geocomm.com/
Geospatial Data Infrastructure North-Rhine-Westphalia, Germany	http://gdi-nrw.uni-muenster.de, http://www.cegi.de/iagent/upload/pdf/20020828103221.pdf, (Brox, Bishr et al. 2002)
Geoware, Germany	http://www.geomarktplatz.de/
Gisbizz, Germany	http://www.gisbizz.de/
InGeoIC, Germany	http://www.ingeoic.de/
OGETA, US	http://www.ogeta.com/objective.html
On-geo, Germany	http://www.sicad.de/pages/ueber_uns/news/2002/1303.html
Terramapserver, Germany	http://www.terramapserver.de/

These marketplaces have been evaluated against the background of our experience with the user and business requirements within the project of the Institute for Geoinformatics, University of Münster "Scientific Consulting of Geospatial Data Infrastructure North-Rhine-Westphalia (GDI)" (Kuhn, Basedow et al. 2000), (Brox, Bishr et al. 2002).

The term marketplace is used in different ways, some internet sites call themselves marketplaces, although they rather should be considered as portals or sell-side solutions. We use the terminology of (Spiller and Wichmann 2000):

- In contrast to sell-side solutions, and extranets of big companies, a marketplace includes many, also competing providers.
- In contrast to a portal, a marketplace offers internet-based transactions between users and providers.
- In contrast to C2C marketplaces, e.g., eBay, we focus on B2B marketplaces that connect (geospatial) value chains.

Key finding is that GI marketplaces evoke specific requirements. Non-spatial marketplaces often sell products that are ready-to-use, e.g., Amazon sells books. Consequently, many non-spatial marketplaces provide the following transaction mechanisms (Spiller and Wichmann 2000):

- Catalogue-based services
- Auctions
- Black boards
- Bursaries.

In analogy, existing GI marketplaces mostly sell geographic data. Yet, *data* are very often not the products that the user needs. He needs *information services*, which are ready-to-use (see 5.1) and consequently will be successful on the market.

Sections 5 and 6 evaluate existing marketplaces by answering following questions:

- What is the organizational and institutional framework of marketplaces for geographic information?
- What are the services provided by a marketplace for geographic information?

An additional input for these two concepts is metaphorical design. The following section transfers the mechanism of a city weekend market to electronic marketplaces for geographic information.

4. METAPHORICAL DESIGN

Metaphorical design is a method to transfer mechanisms of a source system into the context of a similar working target system. In linguistics, a metaphor can be considered as a concept from one linguistic category (the source) used about a phenomenon normally referred to by concepts from a different linguistic category (the target) (Madson 1994).

Moreover, metaphors are not only rhetorical flourish, but partially structure our everyday concepts (Lakoff and Johnson 1980). The following example "gives an idea what it could mean for a concept to be metaphorical and for such a concept to structure an everyday activity" (p. 4): It starts with the concept "love" and the conceptual metaphor "love is war" (p. 49).

> "LOVE IS WAR
>
> > He is known for his many rapid *conquests*. She *fought for* him, but his mistress *won out*. He *fled from* her *advances*. She *pursued* him *relentlessly*. He is slowly *gaining ground* with her. He *won* her hand in marriage. He *overpowered* her. She is *besieged* by suitors. He has to *fend* them *off*. He *enlisted the aid* of her friends. He *made an ally* of her mother. Theirs is a *misalliance* if I´ve ever seen one."

(Lakoff and Johnson 1980) argue that human thought processes are largely metaphorical.

Copying from nature (bionics) led to a new design of the wing tips of Airbus A 320 by the model of birds (red kite, Milvus milvus). Even nature itself uses this strategy, e.g., the tested arrangement of fins is transferred from the "system fish" to the "system mammals": dolphins adapt this form following the function of swimming.

Metaphorical design has been established for the development of user interfaces. Metaphors of well-known conceptions of users are transferred to a computer system. A popular example is the desktop metaphor of Microsoft, which creates a more usable design of Office products. (Kuhn 1993) identified metaphors as a method to develop spatial information theories serving users.

GI marketplace is a new and complex concept. Therefore, we chose the method of metaphorical design as a method of thinking and a method to enhance completeness of conceptual design. We chose a weekend market in Münster, Germany, as a model. Weekend markets are working systems since centuries. And they are well known to everybody.

Our goal was to derive categories of the organizational and institutional framework of GI marketplaces as well as the services they need to provide. We did not expect to transfer all items of the Münster weekend marketplace to GI marketplaces. In contrary, we expected the mismatches as the most valuable results.

4.1. TRANSFER FROM MÜNSTER WEEKEND MARKETPLACE TO GI MARKETPLACES

The following table evaluates the actors, and actions and interactions on the Münster weekend market, and transfers the metaphorical concept to GI marketplaces:

Tab. 2: Actors, their actions and interactions on Münster weekend market and GI marketplaces

Actions/interactions on Münster weekend market	**Actions/interactions on GI marketplaces**
Organizer: City of Münster	**Infrastructure provider**
Concept and creation	Business plan and realization
Selection of providers	Selection of providers
Organization of place	Provision of technical infrastructure
Standards for offered products	Definition of standards for offered products
Quality standards	Definition of quality standards
Marketplace rules	Definition of marketplace rules, business model
Division of marketplace into segments, e.g., cheese row, meat row, bread row, vegetable row, etc.; provides a quick overview of providers	Provision of horizontal and vertical marketplaces; Information about branches and providers
Marketplace controlling	Marketplace controlling
Marketing	Marketing
Provision of information for providers and clients	Provision of information for providers and users
Creation of synergy effects, e.g., the weekend market on Saturdays in combination with flee market, extended opening hours of shops, and city festival attract more clients than the respective single events	Creation of a critical mass by making a competent business network accessible to GI users
Farmer	**Data producer**
Production of vegetables, meat, fruits, etc.	Data production
Sale of products	Sale of products
Presentation of products in an appealing manner,	Provision of an easy access to products, and

market booster	marketing
Payment of marketplace fees	Payment of marketplace fees, business model
Comparison and adjustment of products and prices, market observation	Comparison and adjustment of products and prices, market observation
Communication with other providers, e.g., information exchange about products, clients' behavior, and business opportunities	Communication with other providers, e.g., information exchange about products, clients' behavior, and business opportunities by yellow pages, information site, discussion forum
Communication with clients	Communication with business users
Promotion of additional products	Promotions of additional products (cross selling)
Dealer (e.g., for tropical fruits and vegetables)	**Broker**
Finding and buying of cheap goods	Finding, possibly buying of data, software, and services
Offer and sale of goods	Offer and sale of goods
Addressing foreigners by providing their respective hometown foodstuffs	Provision of services for international users, e.g., English sites
Market boosting, market barker	Marketing
Payment of marketplace fees	Payment of marketplace fees, business model
Comparison and adjustment of products and prices, market observation	Comparison and adjustment of products and prices, market observation
Communication with other providers, e.g., information exchange about products, clients' behavior, and business opportunities	Communication with other providers, e.g., information exchange about products, clients' behavior, and business opportunities by yellow pages, information site, discussion forum
Communication with clients	Communication with business users, e.g., discussion forum
Promotion of additional products	Promotions of additional products (cross selling)
Snack bar provider	**Integrator**
Buying vegetables, bread, meat, etc., on the market	Buying raw materials (data, software, services) on the GI marketplace
Feedback on price and quality of farmers' and dealers' products	Feedback on price and quality of data producers' and brokers' products/services
Offer and sale of meals including services as serving the meal, and cleaning the dish	Offer and sale of data, software, and additional services

Market boosting, market barker	Marketing
Payment of marketplace fees	Payment of marketplace fees, business model
Comparison and adjustment of prices, market observation	Comparison and adjustment of prices, market observation
Communication with other providers, e.g., information exchange about products, clients' behavior, and business opportunities	Communication with other providers, e.g., information exchange about products, clients' behavior, and business opportunities
Communication with clients	Communication with business users
Promotion of additional products	Promotions of additional products (cross selling)
Tool provider (e.g., farming tools)	**Software provider**
Production of tools	Software development
Offer and sale of tools	Offer and sale of software
Market boosting, market barker	Marketing
Payment of marketplace fees	Payment of marketplace fees, business model
Comparison and adjustment of products and prices, market observation	Comparison and adjustment of products and prices, market observation
Communication with other providers, e.g., information exchange about products, clients' behavior, and business opportunities	Communication with other providers, e.g., information exchange about products, clients' behavior, and business opportunities
Communication with clients	Communication with business users
Promotion of additional products	Promotions of additional products (cross selling)
Aunt Martha	**Customer (end-user)**
Search of products, information about products, comparison of prices and quality	Search of products, information about products, provision of metadata
Ordering, buying, and paying products	Ordering, buying, and paying GI products
Arguing about prices	Negotiation about prices
Feedback on products to providers	Feedback on products to providers, need for customer relationship management
Feedback on products to Aunt Agatha	Personal contact amongst users, e.g., by discussion forum
Meeting Aunt Agatha and chatting about job opportunities for her son, cheap flights to Gran Canaria, and the weather	Communication with other end-users, request for additional services, e.g., job bursary, training opportunities, or "amusement"

Getting cooking tips by the farmer	Request for product information and/or hotline, possibly consultants are needed
Restaurant owner	**Business user**
Search of products, information about products, comparison of prices and quality	Search of products, information about products, provision of metadata
Ordering, buying, and paying vegetables, bread, meat, etc., for his kitchen	Ordering, buying, and paying GI products
Arguing about prices	Negotiation about prices
Feedback on products to providers	Feedback on products for providers, need for customer relationship management
Feedback on products to other restaurant owners	Personal contact amongst users, e.g., by discussion forum
Meeting other restaurant owner and chatting about job opportunities for his son, cheap flights to Gran Canaria, and the weather	Communication with other business users, request for additional services, e.g., job bursary, training opportunities, or "amusement"
Getting cooking tips by the farmer	Request for product information and/or hotline, possibly consultants are needed

4.2. CONCLUSIONS

The Münster weekend market is a useful metaphor for the design of GI marketplaces. Many actors' roles and interactions can be transferred; for example, the farmer providing tips to his clients how to fry his veal cutlet leads to the needed GI marketplace service of product information and/or providing a hotline.

The most obvious (or at least loudly) role on the weekend market has the market barker (in German "Marktschreier"). They provide services on the weekend market lacking in the GI market, e.g.,

- Create awareness
- Speak the language of the targeted audience
- Create personal bindings between buyer and seller
- Create a traditional, well-known, and therefore comfortable buying atmosphere for the client
- Mediate sold of products the client was not even thinking of before
- Inform about the offered product
- Negotiate prices

- Create trust and credibility
- Facilitate cheap and quick transactions.

Still today the role of the market barker on the weekend market is considered that important, that e.g., in Münster, there are market barker contests. The following figures illustrate the contest 2004 by two participating market stalls:

Fig. 3: Market barker contest, foto a, Münster, February 2004

Fig. 4: Market barker contest, foto b, Münster, February 2004

The findings give valuable hints for GI marketplace design and will be integrated into the institutional and organizational framework of GI marketplaces (see section 5) and its services (see section 6).

For the design of an institutional and organizational framework of GI marketplaces we derive five categories:

1. Offered products
2. Players
3. Horizontal and vertical marketplaces
4. Additional aspects of GI marketplaces
5. Open market and standards

For the design of services GI marketplaces need to provide we derive six categories, adapted from (Bakos 1998):

1. Matching buyers and sellers
2. Support cooperation within the geospatial value chain
3. Facilitation of transactions

4. Marketing
5. Provision of an institutional, organizational, and technical infrastructure
6. Provision of additional services

Yet, we observe significant mismatches between Münster weekend market and the needs of GI marketplaces. First, the products are different. On Münster weekend market products are mostly ready-to-use. Services are offered rarely. The example of a snack bar provider, who buys vegetables, bread, and meat on the weekend market, is not typical and not proofed. Second, the players are different. Consulters and integrators are very poorly represented; end-users are over-represented. Münster weekend market can be considered as a B2C marketplace.

The raw material of the GI market is geographic data. But these products are not successful on the market; human, technical, organizational, and institutional services have to be added (see section 5.1). Consequently, the GI market needs an enhanced service chaining in B2B marketplaces.

5. GENERAL CONCEPT OF AN INSTITUTIONAL AND ORGANIZATIONAL FRAMEWORK OF GI MARKETPLACES

Marketplaces for geographic information are tools for the co-ordination of the market for geographically referenced products. The challenge is to keep the balance between

- Providing mechanisms and standards in order to stimulate the market
- Avoiding over-regulation, stimulating the self-organization of the individual players, and keeping the infrastructure of co-ordination open to new products and providers (Merz 1999).

Key issue of each market is the products it is dealing with (section 5.1). The following sub-sections describe the players of B2B GI marketplaces, horizontal and vertical marketplaces, additional aspects of GI marketplaces, and an open markets and standards (Brox and Kuhn 2001).

5.1. INFORMATION SERVICES AS PRODUCTS

(Beckwith 2000), a marketing expert and internationally acclaimed business speaker, points out the difference of product and service. His example is a concert of Laura Nyro. He visited the concert, and the product – the songs – was perfect. But he was very disappointed and will never visit a Laura Nyro concert again. What had happened? Laura Nyro had entered the stage, sat down on a chair, sang for ninety minutes, and – nothing else. No move, no contact with the audience, no good vibrations at all. Not only the quality of the product matters. Everything else – presentation, connection, and human contact matters. The "more" is the difference between product and service.

The situation within the GI market looks similar. For a while the "perfect product geographic base data" was considered as the breakthrough in the use of geographic information. The next approach was to add services to data – in a technical sense. The idea is to add functionalities, e.g., data selection or payment via Internet, to data sets. This is considered to be the "perfect product", product in the sense of Beckwith. The idea of generating products from components, with data and technical services as building blocks, is a big improvement. But for five reasons it is not sufficient:

- The products cannot be "perfect", because the state-of-the-art is not that far. Interoperability of data and technical services yet is rarely solved, architectures for a service-oriented distributed computing environment still have to be improved, and semantic problems have to be solved.
- Users of geographic information need a wide range of different products. All necessary building blocks for generating all needed products cannot be on stock. Data and technical services will often need adaptation to the users' needs; even new building blocks will have to be created.
- Human knowledge and human work have to be added, e.g., a consulter advises an insurance company which data sets are appropriate to support their marketing

decisions, or an integrator adapts a geo-software application to the business system.

- Organizational services have to be added, e.g., information. How can a potential user buy a geographically related product if he does not know where and how? Or can he buy GI, if he even does not know, that he needs GI?
- Institutional services have to be added, e.g., standardization. Data and services cannot be interoperable without them. The GI market needs institutional means for coordination.

The future market for geographic information is not a market of data but a market of *information services* (Brox and Krek 2002; Brox and Kuhn 2002). Geographic data are the raw material of the market, equivalent to Beckwith's term "product". The improvement of adding technical services leads to *information*. Sometimes, this information is exactly what the user needs. Very often the information does not answer the users' questions, it is the wrong information, or not delivered in an appropriate way. Organizational services have to added in order to create an information service. Our definition of information service is equivalent to Beckwith's term "service". An information service answers specific questions of a user. It is tailored to specific users' needs. According to the definition within the report, an information service is generated by

- Applying *technical* services
- *Human* services
- *Organizational* services
- And *institutional* services
- On *data* sets.

In simple cases, applying only technical services on data sets can generate an information service. This can be possible, if *all* needed services are automated and implemented in (technical) services. Today, most of the needed information services have to be generated by several components.

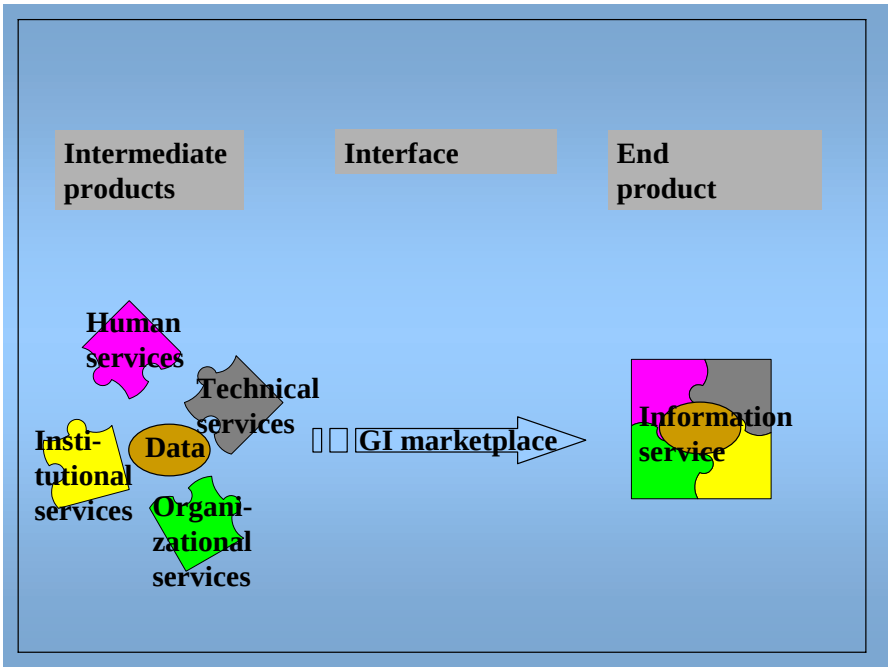

Fig. 5: Applying services on data

We call the complex end product, tailored to the user's needs, *information service*. Consequently, the products to be offered within a GI marketplace cover a broad spectrum. The GI market is a highly fragmented market with a great variety of buyers, sellers, systems, formats, users, and user requirements. Marketplaces for geographic information address a framework and business tool for the integration of data with technical, human, organizational, and institutional services.

5.2. PLAYERS OF B2B MARKETPLACES

The idea of marketplaces extends traditional forms of e-commerce. Traditional approaches are, for example, making the catalogues of *single* companies available to the client in the web (shop solutions), providing information and access (portals), or buy-side-solutions of big companies (extranets). Marketplaces integrate *various* buyers and sellers into a single framework. In addition to pure information, marketplaces initiate transactions between buyers and sellers and offer mechanisms for transactions via the marketplace (Spiller and Wichmann 2000).

We know business-to-business (B2B), business-to-consumer (B2C), and consumer-to-consumer (C2C) marketplaces. As for marketplaces for geographic information, we think it crucial to focus on the following players:

- Sellers of GI products, business and government
- Buyers of GI products
  - Buyers of intermediate products for further refining and finishing within the geospatial value chains, business and government

- Buyers of end products (end users), business and government (e.g. insurance companies, banks, telecommunication).

The consumers, e.g., people using a car navigation system, are targeted indirectly by enabling the geospatial value chains to serve them.

Therefore, we see a marketplace for geographic information as a B2B marketplace, assuming governmental organizations as business players. For specific reasons, e.g., marketing initiatives, it might be useful to add services directly targeted to consumers. For this, we will optionally describe additional services of a GI marketplace (see section 6.2).

5.3. HORIZONTAL AND VERTICAL MARKETPLACES

Two types of B2B marketplaces can be differentiated (Spiller and Wichmann 2000):

- Horizontal marketplaces target the requirements of several sectors. They are completeness-oriented.
- Vertical marketplaces target the requirements of a specific sector. They are community-oriented and are based on a deep knowledge of the specific sector.

Over the last years the internet has achieved a critical mass that makes an external co-ordination of activities in distributed environments much more efficient than a centralized co-ordination (Merz 1999). At the same time, the GI market achieved a complexity and a critical mass, and a centralized co-ordination becomes a business model of the past. Therefore, within the GI market we see a need for both, horizontal and vertical marketplaces.

- Horizontal marketplaces are already initiated within the GI market, e.g., InGeoForum (InGeoForum 2000) and Geospatial Data Infrastructure North-Rhine-Westphalia (Brox, Kuhn et al. 2000). They reflect the need of a framework that connects all players of the fragmented market for geographic information. These initiatives are essential for the co-operation of providers of base products, which cover the general requirements of a wider market, e.g., geographic base data, essential software tools for selection or presentation of geographic data, or metadata server. The users of horizontal marketplaces for geographic information will mostly be experts of companies in the GI-business.
- Our experience with project partners, e.g., insurance companies or planning agencies, continues to show that geographic information is often needed but cannot be used. Business partners as insurance companies, banks, telecommunication companies, or public utility organizations are not experts in geographic information. Therefore, a completeness-oriented horizontal marketplace will not match the requirements of the non-GI-business partners. They require vertical marketplaces for geographic information, where their language is spoken and where insight knowledge and sector-specific solutions will be provided.

5.4. ADDITIONAL ASPECTS OF GI MARKETPLACES

Geographic information is different to products like books marketed in Amazon. Geographic information, to be successful on the market, has to be offered in the form of an information service consisting of data and services (see section 5.1). Mostly such an information service is not on stock and not ready-to-use but has to be generated by human, technical, organizational, and institutional services of various players in the GI market. Therefore, the key concern of the design of a new business model is a support of cooperation in business networks. There is an extended need for business networks compared to general economy, or at least a critical need for pulling up.

5.5. OPEN MARKET AND STANDARDS

Marketplaces have to be open for new providers and new products, i.e. services. Especially within the GI market connected value chains for the generation of information services are missing. It will be crucial to integrate a critical mass of providers within the marketplaces for geographic information. Therefore, the impediments for new providers to enter the GI market and to participate with the marketplaces have to be kept as low as possible (Merz 1999), furthermore, the integration of new providers and new products has to be actively facilitated.

An open market corresponds with the need for standards, e.g., technical agreements, and rules, e.g., legal regulations about offering products within marketplaces. Too little standards and rules will not allow for a successful co-operation of providers and providers or providers and customers. A too high degree of standards and rules will increase the costs and the organizational efforts for the business within a GI marketplace and could prevent the integration of new, innovative companies and products (Merz 1999).

6. GENERAL CONCEPT OF SERVICES OF GI MARKETPLACES

The definition of a marketplace is given by the services it offers (Brox and Kuhn 2001). We describe categories of services and services themselves to be offered by horizontal or vertical marketplaces for geographic information. We give an overview about mandatory and optional services of any GI marketplace on a strategic level. This provides the basis for the (re)design of a specific marketplace for geographic information which will be addressed by case studies in future work.

6.1. CATEGORIES OF SERVICES

More than 60 % of B2B-marketplaces outside the GI field offer black boards and some kinds of exchange transactions, 41 % offer auctions, and 31 % catalogues (Spiller and Wichmann 2000). Because of its special requirements, such services alone will not satisfy the needs of the GI market (see section 2.3).

Conformant to the needs of the GI market is the general trend of non-GI marketplaces to extend their services to fulfillment services, logistic services, Enterprise Resource Planning (ERP) Systems – CRM (Customer Relationship Management), consulting, content, newsletter, marketing, public relations, and addressing international clients (Spiller and Wichmann 2000).

We identified services needed for buyers and sellers of GI marketplaces in the following categories:

- Firstly, the market has to support *matching buyers and sellers.* Main components are determining product offerings, search, and price discovery (Bakos 1998). The focus of this category is on information.
- A particular requirement of the GI market is to *support co-operation within the geospatial value chain*. For this, a GI marketplace should provide mechanisms and services for the connection various providers to geospatial value chains and their co-operation.
- Marketplaces offer, in addition to the services of shop solutions or portals, the *facilitation of transactions.* A GI marketplace facilitates B2B transactions between buyers and sellers of geographically referenced products. B2C transactions might be included for special reasons, e.g., marketing initiatives (see section 6.2).
- *Marketing* within a GI marketplace covers two aspects. Firstly, a GI marketplace provides services for the marketing of the products offered by the companies and organizations. Secondly, we think it crucial to initiate marketing initiatives for the GI market and the GI marketplace. This includes an extended awareness of customers to the potential use of geographic information and an extended co-operation of business partners within the GI marketplaces.

- The GI market consists of a great variety of players, is fragmented, and lacks standards and tools for cooperation. To improve the use of geographic information, the co-operation of business networks, and transparency of the market, GI marketplaces need to *provide an institutional, organizational, and technical infrastructure*.
- The *provision of additional services* extends the marketing of products by future-oriented initiatives. For example, the significance of international co-operation increases; the bigger non-geospatial marketplaces in Germany employ 25 % of its personnel abroad, smaller marketplaces employ at least some staff in a foreign country (Spiller and Wichmann 2000).

6.2. SERVICES OF GI MARKETPLACES

We give an overview of possible services in the six categories for any GI marketplace. In addition, we weigh their relevance for horizontal and vertical marketplaces by a the following classification:

- m = mandatory (service has to be provided)
- o = optional (service could be provided).

Tab. 3:Services of marketplaces for geographic information

Services	Relevance
Matching buyers and sellers	
1. Create and maintain catalogue of offered products (services and information services)	m
2. Provide query mechanism for products (search and discovery) 2.1. (Meta-)metadata of data, services, and information services 2.2. Facilitate price determination 2.3. Information about reference projects.	m
3. Publish requests for information services on a Bulletin Board	o
4. Visualize of geographic data	o
5. Publish providers' profiles and advertisements	o
6. Establish and maintain news group/discussion forum	o
7. Provide call center/hot line and consulting	m
8. Execute quality control of offered products, e.g., certification, and publish this information	o
Support co-operation within the geospatial value chain	
9. Inform about technical and organizational services of companies within the GI marketplace	m
10. Provide mechanisms and tools for partner search 10.1. Yellow pages 10.2. Notification service for companies about requests for complex information services which need the co-operation of several business partners	m
11. Provide mechanisms and tools for the co-operation of providers with providers, e.g., by co-ordination and support of forming business networks	m
12. Provide mechanisms and tools for the pricing of complex information services	m
Facilitation of transactions	

13. Provide a usable, user-friendly navigation and support	m
14. Facilitate one step business transactions between any users of the GI marketplace	m
15. Facilitate one step business transactions between any users of the GI marketplace	m
16. Enable access to and retrieval of products (information services, technical processing services, human services (organizational, consulting)) by the marketplace user interface 16.1. Ordering 16.2. Dissemination 16.3. Payment 16.4. Authentication and security services (not excluding direct communication with providers)	m
17. Support integration of geographic information in user systems by technical tools, consulting, or mediation of services	m
18. Supervize and control of projects	o
Marketing	
19. Attract traditional and new users of geographic information by information about its opportunities and chances, e.g., by providing free geographic information for customers	m
20. Attract traditional and new providers, i.e., SME's, as components of the marketplace, e.g., by providing information (helpdesk) for potential participants of the marketplace	m
21. Lobbying in politics and economics	o
22. Initiate monitoring and trend scouting within the GI market, initiate studies and pilot projects	o
23. Inform about sector news, trends, projects, scientific research	m
24. Offer various internet services, e.g., 24.1. Provide tools for customer relationship management 24.2. Career service/recruiting of employees 24.3. Office information 24.4. Traveling 24.5. Events 24.6. Entertainment	o
Provision of an institutional, organizational, and technical infrastructure	
25. Initiate and stir consensus processes about standards and specifications	m
26. Define, maintain, and inform about standards and specifications for information services 26.1. Metadata 26.2. Offered products (data sets, technical, human, organizational, institutional services, information services) 26.3. Legal aspects (access rights, copyright, usage, contracts between business partners) 26.4. Security 26.5. Workflows and processes within the marketplace	m
Provision of additional services	
27. Provide multilingual services	m
28. Initiate and maintain international co-operation	m
29. Provide education and training	o

Tab. 3 provides a list of services any GI marketplaces *might* provide. Our goal is to provide tool support for the decision on which services to include in the conception of a marketplace for geographic information. In the design of a specific marketplace these services have to be checked for relevance, detailed, and additional services for the specific needs of the targeted users have to be added.

7. DEMAND OF FINANCIAL SERVICE PROVIDERS FOR GI PRODUCTS

The preceding sections identified impediments of the GI market, discussed the need for GI marketplaces, and developed general concepts of the organizational framework of marketplaces and services they have to provide. The following sections focus on the branch of financial service providers (banks and insurance companies). This branch is a valuable potential customer of the GI market: Financial service providers need geographic information, and they have the financial resources to pay for it (Fornefeld and Oefinger 2001).

This section will investigate the demand of financial service providers for GI products. We will describe a case study evaluating the specific demand of an insurance company in Münster, Germany (section 7.1). Case study 2 will evaluate existing GI products for banks provided by a Swiss GI company (section 7.2). Finally, we will summarize the results and conclude requirements for implementing a vertical GI marketplace (section 7.3).

Mayor results of this chapter are published in Brox and Kuhn (2004): Demand of Financial Service Providers for GI Products and Electronic Marketplaces. GSDI-7, February 2-6, 2004, Bangalore, India, www.gsdi7.org.in.

7.1. CASE STUDY 1: INSURANCE COMPANY

The case study focuses on the demands for GI products of a big insurance company in Germany. Our approach was to lead personal interviews in order to evaluate the demand for GI products:

1. Two ifgi staff members interviewed 90 minutes the vice-director of a consulter and software development company for insurance companies. This company is a 100% daughter company of the insurance company. Thus, it has insight into the insurance company as well into other insurance companies in Germany and Switzerland. The interview was not structured. The goal was to define demands of insurance companies for GI products. The interview minutes were checked and commented by the vice-director. The result was a list of GI products usable for insurance companies.
2. The insurance company was investigated within a high-level students' course in cooperation of ifgi and Department of Information Systems, University of Münster. Ten students had investigated the insurance company's profile, products, clients, workflows, and existing use of geographic information. In a structured interview (two hours, ten students with supervisors, six employees of the insurance company) the students provided suggestions for GI application in the insurance company's business. These suggestions were discussed concerning their usefulness. Then, the students asked the employees for additional GI products to be used in the insurance company. The interview minutes were checked and commented by the marketing chief officer. The result was a list of GI products usable for the insurance company (Ahmann, Becker et al. 2002).

The first result was a general observation: GI could be usable for insurance companies, but they use it rarely. A typical statement was: "We tried to find out if we could use a geographic data set. But we gave up, because we had no idea if the data set is usable for our purposes, matches our quality requirements, or how it could be integrated into our data and software system." There was a lack of information about the access to GI products and how insurance companies could produce added value.

The following GI products/GI applications were demanded within the insurance company case study:

1. Consulter and software developer for insurance companies:
   - The company requested a *geographical user interface* on top of its own software. They targeted to fulfil a concrete request of an insurance company. The insurance company wanted to realize a regional map for entering the internal data warehouse.
   - The success of insurance companies depends on space. An insured risk represents the relation of an insured object with its distribution of risks in space. Consequently, an insurance company needs a *tool for risk predictions* of potential clients, e.g., for floods and storms.
   - Insurance companies need a better evaluation of its branch offices. *A tool for spatial analysis of distribution of branch offices*, distribution of potential clients, and trading areas as well as the spatial analysis of existing internal clients' data would support this evaluation.
   - Acquisition of clients and marketing initiatives require a detailed knowledge of targeted customers and areas. A *geo-marketing tool* would optimise these actions. E.g., in an advertisement campaign would be much more cost effective, if leaflets are distributed in streets or quarters with young people of high income instead of those of low income.
2. Insurance company (Ahmann, Becker et al. 2002)
   - *Optimisation of trading areas*: The business success of insurance companies often depends on the spatial distribution of their branch offices. Tools for spatial analysis can optimise the trading areas of branch offices and its distribution, e.g., by comparing and evaluating information about competitors, buying power, age pattern, and distribution structures of the branch offices' trading areas.
   - *Micro-marketing:* Micro-marketing supports grouping of potential clients to homogeneous segments. In these segments, clients' requests as well as their measure of quality can be identified. Thus, the cross-selling potential can be exploited. Losses due to non-selective advertising can be minimized. The insurance demanded a geo-marketing tool for their marketing department.
   - *Location based services:* Claims and loss processing can be supported by location based services. For example, a broken-down car can be localised by mobile phone or GPS. By this, police and towers can exactly be directed to the customer. Side services, e.g., information about closest hotels, garages, or doctors, can be added.

- *Route planning for clients and employees:* Route planning for clients, i.e., how to get to the insurance company or its dependencies, has become a wide-spread means of customer relationship management. In addition, this service would help the field-staff visiting their clients. An integration of public and private transport is targeted.
- *Fare rates for car insurances:* Besides current criteria for offering discounts, e.g., discount for garage owners, pay scales based on geographical and individual criteria, would help to make them more transparent and fairer. Indicators as weather effects, time of day of usage, and location of usage should be integrated into the pay scale.
- *Control of accumulation of risks:* Insurance companies need to have an exact knowledge about the worst-case of their insured risks. Else an insured risk would ruin the company. Geographic analysis of historic damage events or simulations of future damage events, e.g., floods, provide a more precise calculation. Based on this, reinsurances and tariffs could be calculated more precisely.

We conclude the following key findings of the case study:

- The case study proofed the demand for GI products. The limitation of the evaluation was the focus on the demand, independent of the costs. Consequently, not all demanded GI products can be realized on a cost-neutral basis. However, most of the GI products already have been realized in similar contexts. This evokes two conclusions: a. the demand is economically justified, because other companies already have paid for a similar product. b. even if needed GI products do exist, the insurance did not buy them.
- The insurance company was little aware of the potential benefit of using GI products. If there was awareness, the first step of a transaction was already interrupted: The insurance company did not get sufficient information in order to decide whether to buy or not to buy a GI product. For example, the insurance company wanted to buy a geographic data set, but it could not receive information about quality and usability in their business environment.
- There was little demand for raw products (geographic data, software). The focus was on establishing more or less complex GI solutions adapted to the company's workflows. The demanded GI products were complex information services, which add human, organizational, institutional, and technical services to data and software.

7.2. CASE STUDY 2: BANK

This case study uses a different approach. We evaluate existing GI products for banks. The idea is that the need for these products is shown best by its realization, because banks were willing to pay for it. Endoxon AG is a Swiss GI company with a broad spectrum of GI products: data, data adoption, software, software adoption, GI consulting, integration, and training. A key client is Credit Suisse, a blue chip bank in Switzerland. The partnership of Suisse Credit and Endoxon AG bases on a master agreement, which figures Endoxon AG as a non-exclusive geo-competence

center for the bank's GI projects (Widmann 2001). The master agreement covers questions of data delivery, information and functionalities, technical requirements, licenses, development, and implementation.

We evaluate the online descriptions of reference projects (www.endoxon.com, July 10, 2003). Additional information came from a presentation of S. Widmann, Endoxon AG, at the InGeoIC conference "Use of geographic data for the branch of commerce, banks, and insurance companies", 2001 (Widmann 2001). Endoxon AG has offered and delivered the following products to banks:

1. The real estate platform of Credit Suisse Bank (https://entry.credit-suisse.ch/csfs/p/rb/de/hypo/index.jsp) is a tool for locating the right property in the right place. Various views of the surrounding area together with important utilities and services enable the potential client to assess suitability.
2. The service portal of New Aargauer Bank (http://www.nabhome.ch) enables users to make informed decisions when searching for a property in the canton of Aargau.
3. The branch locator of Credit Suisse (www.creditsuisse.ch) visualizes Swiss branch offices of Credit Suisse Group by photos and city maps.
4. The GIS tool for real estate analyses for Credit Suisse Research & Consulting provides macro- and micro scoring, risk classification, and automatic reporting. It contains typical tools of Geomarketing, e.g., analysis of service infrastructure (schools, shops, public transport), and demographic trend analysis (http://www.endoxon.com/en/kno/kno_mar.asp).

We conclude the following key findings of the case study:

The master agreement with Suisse Credit shows the business realization of one of the core thesis of the author: Banks need GI solutions instead of data or software. They need additional GI services as GI consulting in order to get access to the GI market and to pay for its products. The products provided by Endoxon AG support this idea. The delivered products are not data or software. They are systems in terms of business solutions. They integrate many GI products to an information service, which is ready-to-use for the bank and provides services to their clients.

7.3. SUMMARY AND CONCLUSIONS

Two case studies of an insurance company and a bank proof the demand of financial service providers for GI products. The findings support the idea of "information services". Geographic data sets and software are not the required type of products. Financial service providers require GI solutions to be established in their information systems and workflows. GI services (human, organizational, institutional, technical) have to be added to data and software in order to provide GI products which will be successful on the market.

The findings also support the general concepts of GI marketplaces. However, they put a more urgent emphasis on the following services of a GI marketplace:

- Marketing, in order to create awareness of the potential benefit of GI
- Information about GI products, in order to enable access to and transactions of GI products
- Interoperability of intermediate GI products, in order to support the provision of information services
- Connecting GI providers, in order to support cooperation of business networks.

8. ACCESS OF FINANCIAL SERVICE PROVIDERS TO GI PRODUCTS

Section 7 identified the demand of financial service providers for GI products. This section tests how this demand is fulfilled by existing internet solutions.

Mayor results of this chapter are published in Brox and Kuhn 2004: Demand of Financial Service Providers for GI Products and Electronic Marketplaces. GSDI-7, February 2-6, 2004, Bangalore, India, www.gsdi7.org.in.

8.1. APPROACH

Our starting point is to develop a scenario of a user who requires a typical information service of the GI market (section 8.2). Within the scenario we identify tasks, which have to be added to the raw material of geographic data sets in order to generate the desired information service.

From the tasks of the scenario we derive categories of services that the GI market needs to provide (section 8.3). As a result we want to demonstrate a principle, not a complete catalogue: The generation of an information product requires a great variety of services as intermediate products and the involvement of different types of players of geospatial value chains (data producer, software provider, service provider, integrator, end user).

Then we design a test in order to proof if and how the required GI products are provided by existing internet solutions (section 8.4).

Section 8.5 describes the test results. Section 8.6 provides a summary and conclusions.

8.2. SCENARIO

The use of scenarios is a method to develop, test, and demonstrate a theoretical concept. Focusing on a small, practical, and known example facilitates the understanding and analysis of a complex problem. First, we define the tasks of the bank in order to integrate geographic information into their business processes. Then, we define the profile of the tested bank, as well the profile of the targeted user who requires GI products.

8.2.1. Tasks of a bank

We develop a scenario where a bank evaluates locations of its branches. The evaluation targets a priority list of existent and planned localities by the comparison of costs and market potential. The final goal is to decide about improvements of branches, shifting or closing of existing localities, and opening new ones. The evaluation is based on enterprise and demographic data, and it shall be supported by geographic information. The bank repeats the evaluation every year. Therefore, the bank needs a tool and working processes for an in-house execution.

The generation of the desired end product includes the following tasks:

- Define requirements and goals within the bank
- Find business partners
- Define needed information from marketing and GI perspective
- Define needed data sets, geographic and non-geographic
- Define needed functionalities, geographic and non-geographic
- Elaborate project plan (detailed definition of end product, processes, milestones, responsibilities)
- Search data sets
- Select needed data from data sets
- Order and pay data
- Buy geographic analysis tool
- Adjust geographic analysis tool to needed functionalities and integrate tool into enterprise system
- Execute the evaluation of existing and planned locations of the branches
- Train employees with the new tool and processes.

8.2.2. Bank profile

We define the following profile of the bank:

• Employees	3000
• Annual turn-over	1.1000.000 €
• Branch offices	60
• Employees of branch office evaluation	1 IT specialist, no GI experience; 2 marketing experts, expert IT user, no GI experience
• Hardware	sufficient (Internet, Intranet), possibly a server for GI has to be purchased
• Software	SAP, Oracle, no GIS
• Internal data	Customers data, addresses, business data
• Current workflows	internal cost analysis of branch offices; external customers analysis, external market analysis; internal benchmarking

8.2.3. User profile

Within the test scenario we define an executive manager of the bank as a user and test person. His task is to evaluate costs and benefits of the in-house use of geographic information; he has to decide if the bank should start a pre-project of introduction of GI or not. The bank manager has a deep knowledge of the targeted evaluation processes. He is an expert IT user, but he has no experience with GIS.

8.3. CATEGORIES OF GI PRODUCTS

The tasks of the scenario imply numerous intermediate products in order to generate the desired information service as a GI end product. In economic theory the term "product" is often used in a generic sense referring to both, the product (or good) and the service.

The bank in the scenario requires the following two intermediate products in the narrow sense: data sets and a software tool. Such physical products are considered as one category of products of the GI market.

The scenario demonstrates the necessity of a great variety of additional services. Based on the tasks of the scenario, we derive services that are essential for the generation of the desired end product. We classify these services into four additional categories of products (technical, human, organizational, and institutional services) and the following sub-categories:

Tab. 4: Service-based categories of GI products

Tasks of scenario	Technical service	Human service	Organizational service	Institutional service
Define in-house requirements and goals			Provision of knowledge about possibilities of GI (marketing)	
Find business partners	Provision of information		Information about GI products and GI providers, Communication	Establish-ment of business network of potential partners, Quality assurance of business partners
Define needed information from marketing and GI perspective		GI consulting, Marketing consulting		
Define needed data sets, geographic and non-geographic		GI consulting, Marketing consulting		
Define needed functionalities, geographic and		GI consulting, Marketing consulting		

non-geographic				
Elaborate project plan (detailed definition of end product, processes, milestones, responsibilities)		Integrative consulting		
Provide data sets	Data provision		Provision of Internet access	Standardization of data, Rules for the use of data, Security
Search data sets	Data search			Standardization of functionalities
Select needed data from data sets	Data selection			Standardization of functionalities
Order and pay data	Data ordering, Data payment		Provision of tools, Security assurance	Standardization of functionalities
Buy geographic analysis tool			Sale of software tool	
Adjust geographic analysis tool to needed functionalities and integrate tool into enterprise system	Adjustment of software tool, Integration of software tools	Adjustment of software tool, Integration of software tools	Adjustment of software tool, Integration of software tools	
Execute the evaluation of existing and planned localities of its dependencies in Germany	Execution of analysis	Execution of analysis		
Train employees with the new tool and processes.		Training		

Already this single scenario shows the complexity of needed services and the contribution of various players of the geospatial value chain to the generation of an information service.

8.4. TEST DESIGN

The test goal is to prove if a bank executive manager can decide whether or not to introduce geographic information into the bank's workflow. The test was carried out within a students' block courses in May, 2003, at University of Münster, Germany. The author supervised the course, using the scenario described above.

The participants were students of Geoinformatics (diploma) between 6th and 8th semester. Two students screened the internet for existing GI marketplaces. They used "Google" and entered relevant key words, e.g., "marketplace", "geographic information AND marketplace", "geographic information", "GI services", "bank AND geographic information". The internet results were compared with the criteria of being marketplaces or not (see section 3). Three GI marketplaces or similar internet-based solutions were chosen to be tested (Tomberge 2003).

Three students served as test persons. They got the task to evaluate marketplaces in the role of a bank executive manager. Each test person tested one marketplace for one hour. The test executives provided questionnaires for evaluation. The questionnaires contained questions of three categories (Gossilin 2003):

- Website (layout, navigation, usability, help, search functions)
- GI products (information about data, data quality, data categories, data formats, providers, data distribution, price, software, integration support, consulting)
- Marketplace services (payment, contact, help, costs).

8.5. TEST RESULTS

Section 8.5.1 describes the evaluation of GI marketplaces as test objects. Section 8.5.2 shows the result of test persons evaluating the test objects. Section 8.5.3 analyzes the limitations of the test.

8.5.1. Evaluation of GI marketplaces

Screening of the internet for GI marketplaces resulted few hits. Most of providers of GI products (data, software, services) related to the scenario were single companies. Only some internet solutions met at least some of the criteria of GI marketplaces (see section 3):

- Virtual matching of buyers and sellers
- Openness to many providers and many clients
- No portal, sell-side solution, or extranet
- B2B marketplace.

In addition, we were looking for marketplaces that offer all types of GI products, data and software as well as GI services.

We evaluated five candidates for testing:

1. www.geodaten-online.de is run by the company con terra. They market geographic data sets of their business partners, i.e., authoritative organizations. They offer services for searching and buying geographic data.
2. www.geodatenzentrum.de is an initiative of German authorities (Bundesamt für Kartographie und Geodäsie, BKG). They provide authoritative topographic-cartographic data. They also provide a metadata information system. Targeted clients are authorities and others.

3. www.geomarktplatz.de claims to be "Europe's first geomarketplace". They target the marketing of GI and geodata management. They offer online search and ordering as well as help and contact for non-GI experts. They want to link providers and users of geographic data.
4. www.ingeoic.de serves as a portal for geographic data. The core is a metadata information system, which informs the potential user about attributes and quality of data sets. In addition, they target gaining information from geographic data.
5. www.terramapserver.de serves as a "platform for geodata". They provide services for data users (search, Web-services, services for geodata integration) as well as for providers offering their geodata.

The business model of www.geomarktplatz.de fulfilled the criteria of a GI marketplace, and is supposed to provide GI services required in the test scenario. Consequently, it was chosen for the test. Terramapserver (www.terramapserver.de) does not completely fulfil the criterion of providing GI services needed in the test scenario; their business model focuses on geodata. But the lack of alternatives and the services for acquiring additional data provider made them relevant for being integrated into the test.

www.geodatenzentrum.de and www.geodaten-online.de can be considered as sell-side solutions. Although marketing data sets of different providers, those are limited to authoritative organizations of a similar business background. The criterion of openness to many providers does not seem to be fulfilled. In addition, the clear focus on data excluded the providers from being chosen for the test.

www.ingeoic.de clearly claims a non-marketplace business model. Still we chose the internet portal for testing. One reason was the lack of alternatives. Another reason is the portal's statement of "making geoinformation from geodata" and the internally known cooperation with InGeoForum (www.ingeoforum.de). Both encouraged the estimation that the portal could also provide additional services to their core competence in geographic data relevant for the test scenario.

8.5.2. Test results

The following paragraphs show the detailed test results of www.ingeoic.de, www.terramapserver.de, and www.geodatenmarkt.de. Finally, we present an overview table of the results.

www.ingeoic.de (based on (Janowicz 2003c)

Website:

Layout and navigation in the website were evaluated good to satisfactory. Positive were the clear structure, negative the requirement of using JavaScript and many pop-up menus. The usage of the website was evaluated sufficient. The navigation bar could be handled intuitively. Negative were long time for loading, mistakes in map functions, and the lack of background information for non-GI experts. The search functions were described well, but the functionalities were evaluated sufficient. Negative were missing catalogues, unclear content information, and results.

Product offer:

In the context of the scenario, the product offer was not satisfactory. Mostly, the product offer consisted of data sets. Metadata data were available, but very different in quantity, quality, and presentation. The quality of data sets was partly good and up-to-date, and the delivery was evaluated very well. But sometimes important information, e.g., contact, information about use, were missing. Quite few providers were present on the platform, and different application fields of geographic information were hardly covered. Prices for data and services were not available. There was no information about software, software services, and additional services, e.g., data integration.

Services of internet platform:

The services were evaluated satisfactory. Contact information and contacting were good. The customer was supported sufficiently in searching data. The billing modalities were evaluated negative.

Summarized results, in German school notes from 1-6 (Gossilin, Janowicz et al. 2003):

Website: 3,2

Product offer: 4,25

Services of Internet platform: 2,5

Total: 3,4

As a final result, the test persons could not get sufficient information for the decision of introducing GI into the bank or not.

www.terramapserver.de (based on (Knieper 2003)

Layout, navigation, and usage of the website very evaluated well. Positive were the clear structure, intuitive navigation, and few requirements to user software. Sometimes, the map server was not working reliably.

The product offer was evaluated not sufficient. The offer focused on data. Geodata were mostly offered by surveying authorities, and the lack of competitors was criticized. The coverage of data was very different, rarely Germany was completely covered. The marketplace offered some thematic data, e.g., socio-demographic data, which were relevant for the scenario, and German-wide available, but again the lack of competitors was criticized. In addition, most of the geodata were offered in TIFF format, which cannot easily be integrated in the offered socio-demographic data. A non-GI-expert as the bank manager of the scenario was not able to evaluate needed data sets. Some software products were offered, which were not relevant for the scenario. Additional services, e.g., data integration, or links to GI service providers were not offered.

The services of the Internet platform focussed on selling data. In this sense, it was evaluated satisfactory. Information about products, help functions as the map server were good. Negative were unclear or missing contact options. In the context of the scenario, the services were not satisfactory, e.g., links to additional GI providers were missing.

Summarized results, in German school notes from 1-6 (Gossilin, Janowicz et al. 2003):

Website: 2,8

Product offer: 3,4

Services of Internet platform: 3,5

Total: 3,3

As a final result, the test persons could not get sufficient information for the decision of introducing GI into the bank or not.

www.geomarktplatz.de (based on (Koch 2003)

Layout, navigation, and use of the website were evaluated satisfactory, especially for the clear structure and intuitive operations. Search functions looked quite usable, but during the test they were not available.

Theoretically, the GI marketplaces offered the broadest variety of GI products, including additional services, e.g., data adaptation, converting, and integration. But during the test, the marketplace was not working. By email the provider provided the information that the marketplace was subject of re-structuring.

As a final result, the test persons could not get sufficient information for the decision of introducing GI into the bank or not.

Overview:

The following table provides an overview of the criteria and results of the tested internet platforms using German school grades from 1 (best) to 6.

Tab. 5: Test results overview (based on (Janowicz, Knieper et al. 2003)

Criteria (Weight of criterion in %)	**www.InGeoIC.de**	**www.terra-mapserver.de**	**www.geo-marktplatz.de**
Webdesign/Layout (25%)	3,2	2,8	4,4
Layout and navigation (20%)	2	2	2
Usage (20%)	4	3	3
Help functions (20%)	2	3	5
Search engine (40%)	4	3	6
Product offer (40%)	4,25	3,4	6,0
Quality (50%)	3,5	3,0	6,0
Metadata (50%)	3	4	6
Data quality (50%)	4	2	6
Quantity and range (50%)	5,0	3,7	6,0
Scale/format (10%)	3	5	6

Provider/assortment (10%)	4	3	6
Delivery (10%)	1	2	6
Price of data (20%)	6	2	6
Software and related services (20%)	6	4	6
Support integration services (30%)	6	5	6
Marketplace Services (35%)	2,5	3,5	5,7
Billing (10%)	6	5*	6
Contact options (30%)	1	4	5
Help for data search (40%)	3	2	6
Registration (20%)	2	5*	6
Total	**3,375 (3,4)**	**3,3**	**5,495 (5,5)**

* Website without registration

8.5.3. Limitations of the tests

For testing, we chose three internet solutions, which differ by their business models. For example, www.geomarktplatz.de claims to be a geomarketplace, while www.ingeoic.de is a portal. Thus, we did not compare three times the same thing. A negative test result was not necessarily negative in terms of internet providers' own business models. For example, www.ingeoic.de claims to be a portal. Not selling geographic data sets is an obvious part of a portal's business model. The test results strictly refer to the test scenario and the task of a bank manager to decide whether or not starting the introduction of GI in his/her business environment. Still we chose the approach testing three "marketplace-similar" providers because a lack of alternatives, and to give some hints to the providers for adding services in order to acquire additional customers.

A limitation was time. The test focussed on a limited time for testing websites. The test neglected the (sometimes more, sometimes less obviously offered) contact options via email or phone. However, we considered the approach justifiable, because executive managers require information in limited time. The setting is relevant for the all-day working practice.

On first sight, a weakness of the test was that students played the roles of bank managers as test persons. For U Münster's students of Geoinformatics you could have argued that their GI knowledge was too high to play the role of a non-expert in GI. However, the key test results based on the observation that required marketplace services, i.e., product information, and GI products were almost non-existent. We considered the test results that explicit that the original plan acquiring real bank managers as test persons was cancelled.

8.6. COMPARISON OF DEMAND AND OFFER

The screening for internet-based GI products and services for its access resulted that most offers are provided by single companies. The disadvantages are obvious: The customer does not get a market overview, he cannot compare prices and quality, and probably products will be offered to him/her, which are not the best and cheapest ones according to his/her requirements. For example, a company with a business partnership with Autodesk will not easily sell another GI software, even if another software would be better or cheaper. The same disadvantage occurs with the sell-side solutions www.geodatenzentrum.de and www.geodaten-online.de. They provide a distinct set of data sets. Thus the market does not get transparent to a potential user; he/she will not be informed about alternative products. And within the test scenario he/she will not be informed about the other required GI products – GI software and GI services.

Within the test scenario of a German bank, the screening of the internet resulted only two providers that can be considered as GI marketplaces (www.geodatenmarkt.de and www.terramapserver.de) and one GI portal (www.ingeoic.de).

The test results for website design, navigation, were satisfactory (Janowicz, Knieper et al. 2003). The providers invested ideas and resources in order to design professional websites. This and the internet-based offers of sell-side solutions and single companies proved that e-commerce has started in GI business.

However, the three tested providers lacked content, which was required for the test scenario. The offer of GI products as well as the access to them was not sufficient (Janowicz, Knieper et al. 2003):

1. *Data:* The tested providers focused on selling geographic data sets, i.e., authoritative topographic-cartographic data. They provide search and buy functions, and some information about quality (metadata). However, we observed the following impediments:
    - For a non-GI-expert it is difficult or impossible to decide about needed data sets and its quality and usability
    - The geographic data do not necessarily cover the targeted area.
    - The thematic data sets are not necessarily provided.
2. *Software:* There was little information about needed GI software, its utility and prices.
3. *GI services:* There was almost no information about additional GI services, neither about the product offer nor the access to them. There was a severe lack of information about fulfilling the tasks of the scenario, e.g., GI consulting, integrating data sets and software into the bank's system and business work flows, and training of employees on the new GI environment.

The overall test result is that the bank executive managers could not decide whether or not starting the introduction of GI products. He/she could not even calculate a rough estimation of costs and benefits. He/she could not calculate the costs because he/she did not even knew the needed

products. He/she could not calculate the benefits, e.g., higher workflow efficiency, or improved quality of evaluation processes. Benefit information, e.g., reference projects using GI, were not presented.

Offer and demand differ widely. The following calculation compares the marketplaces' offers of GI products with the costs of bank introducing them. We exemplarily specify GI products needed within the bank scenario. Cost estimations base on prices of online offers and estimations of the author:

Tab. 6: Offer of GI products and costs of their introduction for the bank

GI products	**Offer of GI marketplaces**	**Product specification**	**Estimated project costs (€)**
1. Data	Some information, order and pay functionalities	• Topographic data, 1:25.000 (TK 25), 300 km^2 (Münster, Germany)	300
		• Socio-demographic data (GfK data for Münster, Germany)	2.000
		• Purchasing power data (GfK data for Münster, Germany)	2.000
2. Software	Some information	Single ArcView licence	3.000
3. GI services, e.g.,	Almost no information		
• GI consulting		20 person days	30.000
• Project planning and controlling for GI introduction		20 person days	30.000
• Integration of data		5 person days	7.500
• Adaptation and integration of software		10 person days	15.000
• Integration of into business workflows		4 person days	6.000
• Training of employees		Two employees, one-week training	4.000

Subtotal			92.500
Total	**-**		**99.800**

Still data sets are marketed as THE GI products. Most information offered by GI marketplaces deals with data. Functionalities for search, order, and payment of data exist. However, data only make less than 5 % of the costs of the GI system. The bank of the scenario did not get information about the most expensive part of its targeted introduction of GI (> 90 %).

The table neither contains the additional costs of the bank for internal personnel introducing the new system within the GI project, nor future costs for data and software updates, system maintenance, and personnel costs of employees working with the system. Including these costs would even enhance the cost relation of GI services vs. data and software.

In contrast to the offers of existing GI marketplaces, the generation of the needed end product requires the integration of various services. The bank does not want and cannot put all these pieces together. The combination of data and services ("interoperation") is a key concern to develop a GI business. The future market for geographic information is not a market of data but a market of *information services.* Applying technical, human, organizational, and institutional services on data sets generates an information service. Marketplaces of geographic information mediate this process.

The test scenario of a bank is generic. New business customers of the most promising branches for selling GI products (GI applications, navigation, geomarketing, emerging markets (Fornefeld and Oefinger 2001)) will rather introduce a GI environment. They require information services instead of buying data. Neglecting this demand will mean neglecting potential and potent GI customers.

9. THE DESIGN OF A GI MARKETPLACE

The GI industry is characterized by a high degree of market fragmentation, low product and price transparency, several "monolithic" GIS providers, and under a strong influence of governmental regulation or the influence of public sector information providers. All these characteristics lead to a lack of open market competition. Therefore, it is essential to get active competition before designing a marketplace.

In this chapter we will analyse the GI industry in greater detail in order to come up with insights of a) how to nurture market competition and b) how to develop an appropriate marketplace design for GI products for the financial services industry.

In doing so, we firstly provide a brief overview of characteristics of the GI industry in order to assess whether the current situation of the GI industry facilitates or impedes electronic marketplaces (section 9.1.1). In section 9.1.2 we show current trends of electronic marketplaces.

In section 9.2 we present the main building blocks of an electronic GI marketplace. Two opposing scenarios – collaboration-oriented and transaction-oriented marketplaces – are discussed in sections 9.3.1 and 9.3.2. We assume that a combination of both scenarios is the most promising approach. Hence, we introduce the concept of a mixed-mode marketplace in section 9.3.3.

An electronic marketplace is not a "black box" that facilitates matching of buyers and sellers, but comprises a number of design alternatives and offers business opportunities for various intermediaries. Therefore, we elaborate on design parameters of GI marketplaces in section 9.4. In section 9.4.1 we discuss the impact of process standardization on transaction costs. Afterwards, we sketch briefly that electronic marketplaces are a playground for a plethora of intermediaries that are looking for business opportunities (section 9.4.2). Finally, we suggest regarding electronic marketplaces as inter-organizational systems and present several factors and determinants that have an impact on the success and adoption of electronic marketplaces (section 9.4.3).

9.1. MARKETS IN THE GI INDUSTRY

The current situation in the GI industry impedes rather than facilitates the emergence of electronic markets. Large parts of the GI industry seem to be oligopolistic and lack true market competition. Therefore, there is a need to foster competition before introducing a marketplace for GI products.

In this chapter we firstly depict the current industry characteristics of the GI industry. Although the status-quo impedes rather than facilitates competition, there are several indicators that an industry transformation is taking place towards a more competitive setting resulting in a vivid market for GI intermediate and finished products and services in the near future. Secondly, we provide an overview of two different types of electronic marketplaces: transaction-oriented and collaboration-oriented. Although they differ significantly in their underlying economics, both types might have an entitlement in the GI industry.

9.1.1. GI industry characteristics

The status-quo of the GI industry lacks open competition and impedes the emergence of markets for GI products and services (Fornefeld, Oefinger et al. 2003). In Germany, for example, the public administration acts both as a supplier and service provider for geospatial data, frequently in a quasi-monopolistic fashion. The absence of regulation of legal access to public information and geospatial data and the lack of clear responsibilities within the federal structure hamper a prospering GI market. Furthermore, GIS companies offer products that are based on available data rather than on customer demands. Tab. 7 contains the main factors that might hinder the emergence of a vivid GI market in Germany.

Tab. 7: GI industry characteristics in Germany

Level	Characteristics
Channel	• High fragmentation of supply/data provisioning • Low degree of market transparency • Allocation inefficiencies • High degree of market concentration (several big players, public administration) • Value chain structure ("monolithic" GIS providers/public administration cover the whole value chain) • High degree of price volatility (consultancy projects) • Distortion of competition due to governmental policy (non-aligned business models of different local authorities, lack of regulated information access)
Product	• High product complexity • Unique service offerings (limited availability of mass products, limited reusability of GI solutions) • Varying data quality • Limited possibilities of product bundling and/or configuration

Geospatial information is supposed to be of great importance in many parts of the economy. Today's GI applications are used in various business functions such as logistics, operations or marketing for supporting data visualization, decision support, specialized analyses, and strategic planning (Keenan 2004). However, the GI market is non-transparent and fragmented thus resulting in a limited market volume. If the market becomes more transparent, flexible and customer-oriented the total market volume might increase. Obviously, an open and transparent market will threaten the traditional business of several GI companies and will probably reduce their relative market share. However, the loss of the relative market share might be superseded by an increase of the total business volume.

Only if there are companies offering similar products or services, a vivid GI market can emerge. Furthermore, potential customers must be aware of existing products and services. Currently, there is no central access to geospatial information, applications and solutions. Therefore, customers

have to conduct a market study for detecting appropriate suppliers, which is a crucial and cumbersome process, resulting in high transaction costs for searching and information gathering. Hence, the current situation in the GI market is not very attractive for risk-averse companies, for example SMEs, to engage in GIS. Thus, the requirements to proliferate the GI market are as follows:

- A commoditization of geospatial data and products
- Cross-border availability of high quality geospatial data
- Established intermediaries with regulated access to geospatial data
- Broad appropriation of technical standards for interoperability and semantic standards for describing/classifying products and services
- Lean GI modules that support interoperability and can be combined flexibly
- Increased market transparency

Two recent developments provide the basis for a commoditization of GI products. On the one hand the construction of a Geographic Data Infrastructure (GDI) is spurred by various national and international institutions (e.g. IMAGI in Germany or INSPIRE on the EU level). On the other hand technical standards are proliferating (e.g. OGC Web Services), enabling a seamless composition of geospatial data and technical services stemming from different sources. GI products still lag behind this development, but thanks to new technologies such as web services it can be assumed that next-generation GI products can be combined similar to geographic data. Moreover, technical standards for a semantic description of products and services (e.g. DAML-S) are already available. Thus, the technical level is not hindering the emergence of a GI market.

A major concern for GI applications is the cross-border (nation-wide or pan-European) availability of geospatial data. In Germany, for instance, municipalities are major providers of geospatial data. Although there are some initiatives to establish a GDI on national and on federal state level, there is still no centralized access to these data. Even worse, Germany is the only EU member state that has not regulated the legal access to public information (Fornefeld, Oefinger et al. 2003). If a GI application provider needs a fine-grained map of Germany, he has to contact more than 80 municipalities and official institutions, and each of them provides a different pricing and licensing model.

There is a variety of organizational arrangements between markets and hierarchies (Malone, Yates et al. 1987). A number of monolithic GIS companies cover the whole range of the value chain. However, GI companies are facing an increasing environmental pressure (changing customer needs, globalization, market uncertainty, faster time-to-market cycles, etc.). Relying on the traditional “monolithic” organizational structure and maintaining complex products might lead to inefficiencies in product development and distribution and to inflexibility regarding market requirements. Therefore, similar to other industries GI companies might begin to concentrate on what they consider to be their core competencies, including the outsourcing of activities that are not core to the business, and the foundation of more of less independent subsidiaries or divisions.

Finally, these trends can lead to a disaggregation or virtualization of the value chain. Furthermore, since various GI companies have started to make their products interoperable, the same could happen on the organizational level. On the other hand a number of innovative and flexible SMEs with specialized products and services are evolving, co-operating with each other in order to offer complex products and services to their customers (e.g. the Bridge-IT consortium). Both trends are indicating a shift towards a more networked industry (Fig. 6).

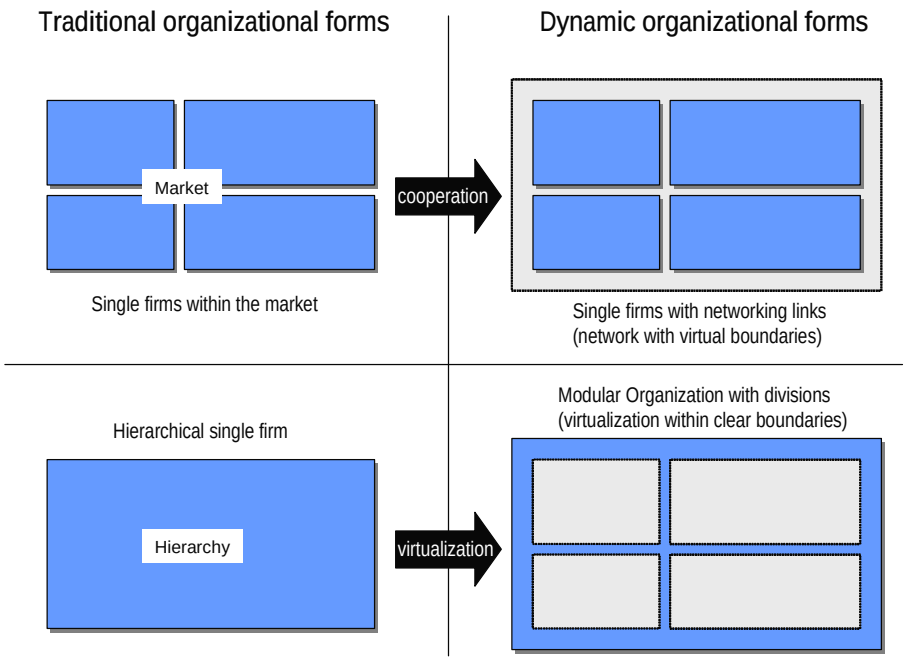

Fig. 6: Formation of business networks (according to Sydow 1999)

The existence of technical standards for interoperability and product and service description does not automatically increase market transparency. Customers must be aware of the potentials and benefits of geographic information. Moreover, in order to reduce the transaction costs for customers, a centralized access point to GI products and services is necessary. Although a number of portals and marketplaces already exist, none of those has yet achieved a wider acceptance of either GI providers or customers for various reasons. Most marketplaces, for instance, are selling geographic data (e.g. maps). Customers, however, are typically looking for problem solutions or answers to specific questions (Fornefeld, Oefinger et al. 2003). Thus, simply buying maps and finding answers themselves do not meet customers' needs and expectations.

A marketplace is one option to establish a central access point to GI products and services (one-stop shopping). However, since liquidity and reaching a critical mass are necessary preconditions for sustainability, a marketplace has to be attractive for buyers and for sellers. In recent years, a number of electronic marketplaces did not fulfill this basic requirement. Therefore, a customer-focused business model that also takes into consideration the needs and requirements of the sell

side is necessary. The next section gives an overview over current developments of electronic marketplaces, followed by a discussion of a potential design and business model for a GI marketplace.

9.1.2. Trends in electronic marketplaces design and utilization

Advances in information and communication technology (ICT) enable companies to co-operate more extensively and more intimately with network partners, both in horizontal and vertical arrangements. Contemporary e-Business solutions such as transaction-oriented electronic marketplaces, however, mostly focus on automating transactions and thereby increasing market transparency and reducing transaction costs for both buyers and sellers.

Although the concept of transaction-oriented electronic marketplaces seems to be promising (Malone, Yates et al. 1987), in practice they failed for a number of reasons (e.g. Wise and Morrison 2000; Day, Fein et al. 2003; Ranganathan 2003):

- They were often based on off-the-shelf software that did not provide any competitive advantage,
- They provided low value to marketplace participants,
- They did not consider the needs and requirements of important stakeholders, and
- The management teams, in particular of independent marketplaces, lacked business skills and industry-specific knowledge.

Moreover, two core assumptions of some flawed business models were misleading: firstly, not all goods and services can be exchanged on electronic marketplaces and secondly, not all existing business relationships can be replaced by transactional, arms-length ones. Therefore, there was a shakeout in electronic marketplaces (Day, Fein et al. 2003).

In contrast to the public perception, electronic marketplaces flourish in several industries and the use of - specialized forms of - electronic marketplaces (e.g. e-procurement systems or collaboration-oriented marketplaces) has gained momentum. In general, large enterprises are stronger users of electronic marketplaces than SMEs and more often involved in marketplaces operated by industry consortia of buyers and sellers (B2B Expert Group 2003). Tab. 8 gives an overview of the number of active electronic marketplaces in the world, in North America and in Europe.

Tab. 8: Estimated number of active B2B marketplaces (source: B2B Expert Group 2003)

Active in	Berlecon Research		eMarketServices	
	2002	2003	2002	2003
World	1060	889	1189	1015
North America	669	556	619	459
Europe	381	324	540	524

Transaction-oriented marketplaces are normally understood as spaces where buyers can search for products and their prices by means of electronic catalogues, auctions or exchanges, and IT-capabilities that support negotiated pricing (Bakos 1998; Kambil, Nunes et al. 1999). Thus, electronic marketplaces aggregate products and act as intermediaries between buyers and sellers. The potential economic benefits are a higher price transparency and likely lower prices for products traded on the marketplace. In recent years, beside transaction services an increasing number of electronic marketplaces augmented their core service offerings with interaction or collaboration services such as planning capabilities, product life cycle management, capabilities for collaboration around new product design or supply chain support (Gurbaxani and Whang 1991; Schlüchter 2001; El Sawy 2003). Christiaanse and Markus (2003) predict that collaboration services will provide 40-50% of the total revenues of collaborative electronic marketplaces. Therefore, we expect that collaboration-oriented marketplaces will become as important as transaction-oriented marketplaces.

Since the emphasis of collaboration-oriented marketplaces is on fostering collaboration between companies with existing business relationships, we argue that their economics and potential success factors are different from transaction-oriented marketplaces, where the emphasis is on attracting a large number of independent buyers and seller as well as on providing simple access with low entry barriers to the marketplace. Thus, collaboration-oriented marketplaces are more relation-specific and tend to be deeper embedded in organizational and social structures than transaction-oriented electronic marketplaces. Tab. 9 gives an idealized comparison of transaction-oriented and collaboration-oriented electronic marketplaces.

Tab. 9: Transaction-oriented vs. collaboration-oriented electronic marketplaces

	Electronic marketplace	
	Transaction-oriented	**Collaboration-oriented**
Platform characteristics	Transaction services, negotiated pricing (catalogues, auctions, exchanges, bidding), spot trading	Collaboration services, planning support (VMI, CPFR) and product life cycle management (coordination and integration of inter-organizational processes and transactions)
Market orientation	Horizontal, vertical	Mainly vertical
Service portfolio	Lean service portfolio, focus on efficient price formation/price discovery and settlement	Broad service portfolio (ranging from data format conversion to virtual project management)
Business functions	Purchasing, procurement, distribution	Not determined, but often supply chain focus
Number of participants	High (necessary for critical mass and market liquidity)	Low - Medium

Membership stability	Dynamic, high fluctuation	Stable
Openness for new entrants	Open	Closed (network-specific)
Participant relationship	Arms-length/transactional relationship (“market”)	Co-operative/relational relationship (“network”)
Success factors	Simple access, low entry barriers, back-end integration facilities depending on transaction frequency	Expectation management, asset specificity, lock-in/dependency, trust/commitment among participants

Marketplaces may be one possible solution to overcome the “interconnection gap” between companies, i.e. to enable electronic integration in a standardized manner. Traditionally, inter-organizational application systems are – at least at the beginning of their life cycle - often implemented as bilateral solutions (Li and Williams 1999; El Sawy 2003) and thus require high relation-specific investments. In contrast, marketplaces act as a standardized connection hub between several companies.

According to (Zwass 1996) an electronic marketplace consists of three layers (called meta-levels), each building on the one below it. The top layer encompasses the marketplace functions (e.g. coordination of delivery of products and services, matching buyers and sellers, product life cycle support, etc.). The intermediate layer is that of business services facilitating the exchange of business documents using EDI or XML standards and inter-organizational communication (e-mail, instant messaging, video conferencing, etc). The bottom layer is the infrastructure, delivering the functionality of World Wide Web over the Internet and other value-added networks, providing the connectivity of marketplace participants.

Normally, electronic marketplaces apply common standards and protocols and offer a number of interfaces (e.g. web interfaces, back-end integration or support of various data formats). These interfaces enable companies to interlink their systems although they use heterogeneous IT systems. Companies do not have to establish and maintain a plethora of individual, proprietary solutions, but ideally only one link (Sherer and Adams 2001).

From a technical perspective, an electronic marketplace functions as clearing center: a company using a marketplace has to build and maintain the link to this particular marketplace and will then be able to reach all those trading partners who also use the marketplace without bothering about setting up bilateral connections.

9.2. BUILDING BLOCKS OF A GI MARKETPLACE

Electronic marketplaces provide a broad range of design alternatives. They can be owned by suppliers, buyers or intermediaries, direct or cybermediated, catalogue- or auction-based, of public or limited access, providing trading-only or a range of services, etc. Moreover, further design opportunities exist at every stage of the transaction process: searching for partners, negotiating terms and conditions, settlement, after-sales services, etc. (Zwass 2003).

In the remainder of this section we focus on the top layer of electronic marketplaces, the application level. The intermediate layer is partly addressed in the following chapters. Specifically, we study services and product offerings of the electronic marketplace destined for the financial services industry.

A GI electronic marketplace for the financial services industry consists of four building blocks. According to the distinction between transaction-oriented and collaboration-oriented electronic marketplaces we differentiate between transaction-oriented and collaboration-oriented features. Both building blocks define the core activities of the electronic marketplace, i.e. the necessary functions and services of the application system "marketplace". The third building block addresses the institutional structure of electronic marketplaces, and the fourth additional services that do not directly belong to the core marketplace activities, but that might have a strong impact on the marketplace success. Tab. 10 provides an overview of the building blocks of an electronic marketplace.

Tab. 10: Building blocks of an electronic GI marketplace

Building block	**Marketplace features and services**
Transaction	• Matching buyers and sellers o Determine product offerings (product features offered by sellers, aggregation of different products) o Search (price and product information, matching seller offerings with buyer preferences) o Price discovery (Process and outcome in determination of prices) • Facilitation of transactions o Logistics (Delivery of information, good, or service to buyer) o Settlement (Transfer of payment to seller) o Trust (Credit system, reputation, rating agencies)
Collaboration	• Value chain configuration o Search (appropriate data providers, consultants, and integrators) o Project management (monitoring) • Managing network of relationships o Trust (reputation) o Assessment • Facilitation of collaboration between customers and GI consultants o Project management (planning, monitoring)
Institutional	• Institutional regime

Structure	o Legal (commercial code, contract law, dispute resolution, intellectual property rights) o Regulatory (rules and regulation, monitoring, enforcement) o Security (Authentication) • Generative regime o Performing meta-activities for amendment/enforcement of institutional regime
Others	• Marketing o Promotion of electronic marketplace • Support services o User support, user training

We will elaborate on the core activities of an electronic marketplace (building blocks: transaction and collaboration) in more detail in section 9.3. In the remainder of this section we focus on the institutional and additional building blocks.

Since marketplace transactions cannot be carried out in a vacuum, an institutional regime or governance structure that defines a legal and regulatory framework for conducting business is necessary (Reimers 1996). The legislative body and the judiciary define and enforce large parts of the institutional regime. But there are many cases in which the economic system in general or the marketplace in particular itself must create an appropriate amendment of the institutional regime.

One important objective of electronic marketplaces is the reduction of transaction costs. During a transaction a large amount of ex-ante and ex-post transaction costs occur (Williamson 1985): searching information about products and sellers, negotiate prices, monitoring contracts, etc. Hence, it is necessary that there is an institutional regime defining and enforcing general rules and regulations for carrying out transactions at comparatively lower costs than in a hierarchical or hybrid arrangement. Examples of those regulations are membership rules, classification schemas, quality assurance, standardization of contracts and mechanisms for transaction processing (Reimers 1996). Beside the institutional regime there is also a generative regime. The generative regime performs meta-activities for the amendment and enforcement of the institutional regime. It must be legitimated by all marketplace participants. In the electronic GI marketplace this could be, for example, an industry consortium such as CeGi (Center for Geoinformation) or the OpenGIS consortium.

Beside the definition and configuration of core activities and the establishment of an institutional regime various activities are necessary to promote the marketplace and to provide “community integration services” (El Sawy 2003). An important shortcoming of existing GI marketplaces is the lack of visibility on customer side. Customers of the financial services industry, for instance, are not fully aware of the opportunities a GI solution can offer. IOS research has stressed that marketing has a positive affect on IOS adoption (Reich and Benbasat 1990; Cavaye and Cragg 1995). Therefore, it might be beneficial to promote the marketplace to its potential customers as *the* access point to GI solutions for the financial services industry.

Another important issue for accompanying services is the establishment of so-called "community integration services" (El Sawy 2003). The integration of buyers and sellers does not only require appropriate hardware and software, but also systematic procedures and skilled operations staff for managing and coordinating the deployment of the technical infrastructure as well as user training, user support and consultancy services.

9.3. SCENARIOS FOR GI MARKETPLACES

In section 9.1 we presented two opposed models of an electronic marketplace: the transaction-oriented marketplace and the collaboration-oriented marketplace. In this section we elaborate on these two models in more detail. Both marketplace models have several shortcomings. Therefore, we propose a third marketplace model: the mixed-mode marketplace. This model attempts to combine the strengths of transaction-oriented and collaboration-oriented marketplaces and to limit the shortcomings of either marketplace.

9.3.1. Transaction-oriented marketplace

Transaction-oriented marketplaces are the original form of electronic marketplaces emerging in the late 1990s (Reimers 1996; Schmid and Lindemann 1998). Their main aim was to support buying and selling transactions by the means of information and communication technology. The benefits of a transaction-oriented marketplace are (Kambil, Nunes et al. 1999):

- Reduced transaction costs, due to lower costs of search, information sharing and monitoring, increased standardization
- Improved decision making due to increased visibility of real supply and demand
- Increased supplier innovation, due to increased competition

However, market coordination not suitable for every kind of trade transaction (Coase 1937). The following list of attributes and instances describes conditions under which markets are regarded as the most efficient form of coordination or more precisely have comparative advantages over networks and hierarchies (Malone, Yates et al. 1987):

Tab. 11: Attributes benefiting market coordination

Level	Characteristics
Transaction attributes	• Low asset specificity, i.e. partner specific investments • High uncertainty • High level of information asymmetry • High frequency of transactions
Product and market characteristics	• Low complexity of product descriptions • High price volatility

	• Low price transparency

For carrying out trade transactions on an electronic marketplace there are two requirements regarding the number marketplace participants and the product characteristics. Basically, a marketplace requires the absence of a monopoly (only a single seller of a product) and a monopsony (only a single buyer of a product) in order to determine "market prices". A prospering marketplace therefore demands competition on the buyer and on the seller side. It is obvious that competition might emerge if there are homogeneous products and services traded on the marketplace broadly targeting at customers of the financial services industry. However, most GI products and services are not that similar or comparable. Thus, it is a necessary precondition for "market-ready" GI products and services that products and services can be described in a standardized manner, i.e. that their attributes and properties are standardizable. In doing so, products and services can be classified according to their properties allowing customers to identify and compare suitable products and services, although they are not homogenous.

As we already mentioned earlier, transaction-oriented marketplaces are not only a means for supporting basic trade processes but they also must establish an institutional regime, in which basic trade processes can be carried out efficiently (Fig. 7).

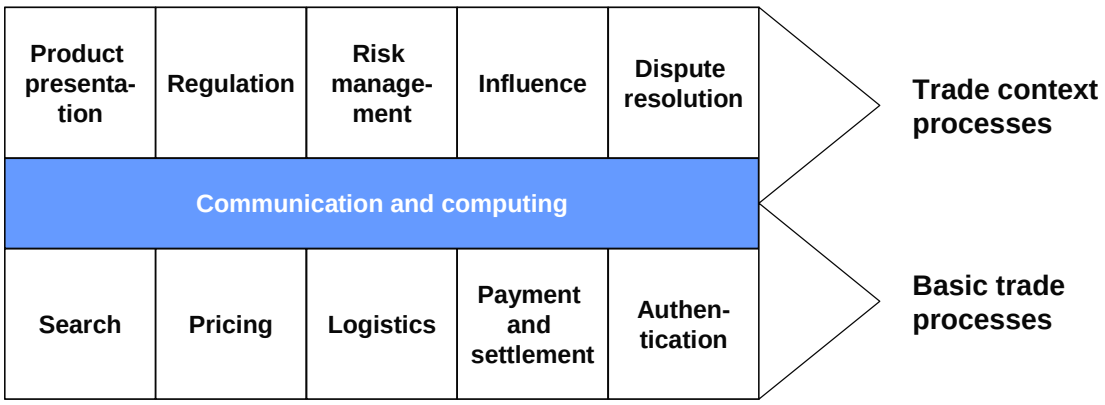

Fig. 7: Key processes in GI marketplaces (Kambil and Heck 2002)

Electronic marketplaces provide a regulated environment for standardized business transactions. Their efficiency is based on the assumption that the standardized contracts and processes provided by the marketplace suit the business partners. The trading partners can conduct their transactions within the market environment for relatively low transaction costs without having to negotiate contracts, manage risk, resolve dispute, etc. themselves, i.e. on a bilateral basis (Kambil and Heck 2002).

Contemporary transaction-oriented marketplaces normally provide the following functionalities and services:

- Information provisioning (in some standardized way) and search capabilities for products, services, suppliers, integrators (yellow pages)
- Products: selling basic GI modules and technical services, ready-to-use products/components, off-the-shelf software, commodities; examples: geospatial data (street maps), itinerary service, etc.
- Various price-detection mechanisms: fixed-price catalogues, auctions, request for quotations, etc.
- Transaction process: information, negotiation (standardized contracts), settlement

The notion of electronic marketplaces distinguishes between the marketplace as a coordination mechanism (matching buyers and sellers efficiently, providing and institutional regime) and the marketplace as a business model for the marketplace provider (value proposition, revenue models). On the one hand, an electronic GI marketplace for the financial services industry is a means for efficient resource allocation. On the other hand however, a marketplace is an enterprise with certain aims, objectives, strategies, etc. From this perspective, the marketplace has to be managed like every other business organization. Hence, as much as an electronic GI marketplace succeeds to establish standards for product descriptions, product components and contracts (including licensing etc.) it could succeed to mobilize a significant amount of support from the currently fragmented players (information owners/ providers). This in turn, is a precondition for marketplace liquidity.

Since most GIS solutions are complex and customer-specific, they do not fulfil the basic requirements of market coordination. Therefore, the "business obstacles" of the GI industry does not only lie in an efficient resource allocation and processing of basic trade transactions, but also in fostering the cooperation and collaboration between GI companies and their customers on the one hand and among GI companies on the other hand. Thus, it can be assumed that there is a need for collaboration-oriented marketplaces. The next section deals with the notion of a collaboration-oriented marketplace and assesses its strengths and weaknesses.

9.3.2. Collaboration-oriented marketplace

A number of transaction-oriented marketplaces have transformed their business model into a rather collaboration-oriented one (Raisinghani and Hannebeck 2002). Collaboration-oriented marketplaces are supposed to be successful, if the emphasis does not lie on the execution of simple trade transactions but on stabilizing or tightening relationships among suppliers and/or buyers. Collaboration-oriented marketplaces provide functions and services that are beyond simply automating procurement processes, aiming at transforming traditional relationships into competitive ones. These services range from establishing a common technical infrastructure (a "messaging hub") to facilitating collaborative actions (e.g. joint planning or engineering using virtual desktops).

Usually, GI solutions for the financial services industry are complex geospatial information systems (GIS) accompanied by a set of additional consultancy and support services. Furthermore, most GIS differ somehow among each other. Typical GI solutions show a high degree of customer

specificity and demand extensive customization efforts. Therefore, the GI business is a project business rather than a product business.

Especially, SMEs might not be able to fulfill those customer demands themselves and are dependent on the assistance and resources of other companies. Moreover, they require support of specialized tools and applications. A collaboration-oriented GI marketplace might strengthen SMEs by supporting the formation of dynamic business networks in order to compete with traditional GIS providers. Hence, a collaborative marketplace needs to focus on those mechanisms which facilitate the set-up of project teams/consortia in order to fulfill specific customer demands.

As we position collaboration-oriented marketplaces between transaction-oriented markets and networks, the study of specific network structures helps us to identify factors that need to be added or modified to transaction-oriented markets. In order to explore the organizational challenges of collaboration-oriented marketplaces we use and apply the model of the virtual factory (Göransson and Schuh 1997). The virtual factory is a specific instance of a virtual organization. Even though developed in a different setting and for a different purpose, its properties provide insights into the structural and organizational options for the configuration of complex products.

The virtual factory is a popular inter-firm arrangement supporting the ad-hoc establishment of value chains (Fig. 8). It generally consists of SMEs collaborating to carry out projects which would not be possible without cooperation. The members aim at achieving “virtual size” while maintaining their small firm flexibility at the same time. The individual partners build a stable and mainly trust based structure, which is called the “pool“. The pool is covering a wide range of competencies, while each member concentrates on particular core competencies.

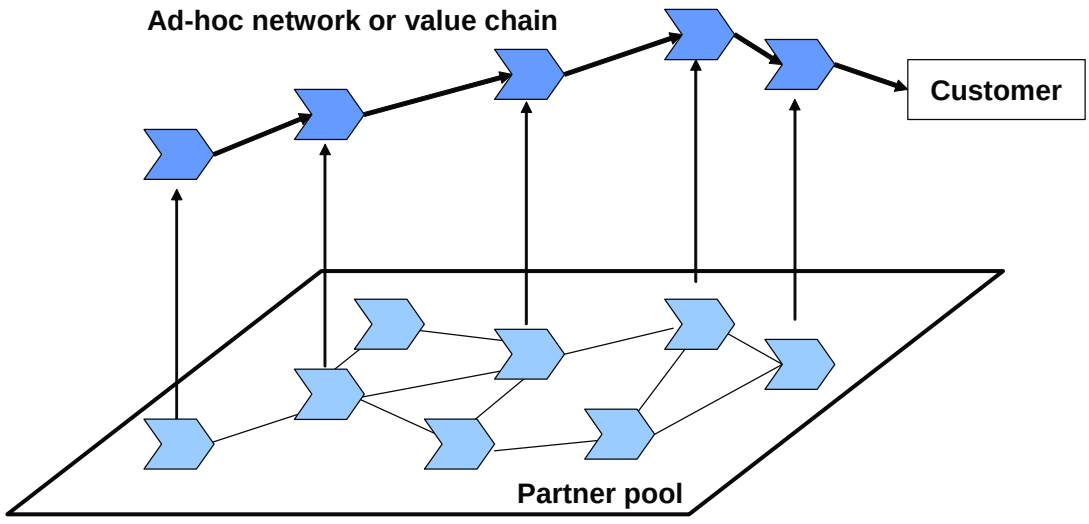

Fig. 8: The virtual factory model

The virtual factory provides customer individual products. In case of a customer order a specific network is formed to process the order. This “project network” is limited in time and is decomposed after finishing the project. The virtual factory can be characterized as a mainly vertical

cooperation where each partner concentrates on its core competencies. But it also has horizontal characteristics, since there can be several partners with the same or similar competencies to guarantee sufficient capacities. This leads to a so-called co-opetition in the pool.

Actually, the pool of the virtual factory model consists of about 20 to 30 participating companies in order to be manageable by one coordinating actor (the "broker"). The broker ensures "one face to the customer". Moreover, it maintains tight and stable relationships among the companies. The GI marketplace adaptation necessitates various changes to this model. Firstly, the pool consists of all marketplace participants (GI consultants, data providers and data integrators). The relationships among the participants are mostly loose. Secondly, there is a number of coordinating actors (GI consultants, GIS provider, etc.) accessing the "pool" and configuring dynamic value chains.

The value chain configured by a coordinating actor has vertical and horizontal characteristics. On the one hand, it is obvious that the value chain covers adjacent steps of the value chain (e.g. data providers, data integrators and consultants). On the other hand, there might be also horizontal structures. For example, if there are two data providers one provides maps of North Rhine-Westphalia and the other one maps of Bavaria, they reside on the same step of the value chain. However, since they cover different geospatial areas they are not competitors in this value chain.

The development of GI solutions for the financial services industry demands cooperative activities on two levels that both can be supported by a collaboration-oriented electronic marketplace. On the one hand, the offering process could be supported: identifying companies that can deliver appropriate (intermediate) products, services, components, data, etc., negotiating prices with subcontractors, calculating the offer, concluding the contract, etc. On the other hand, the actual development process could be supported: monitoring the project progress, cost calculations, joint development, etc. However, since it can be assumed that the offering process is probably more generalizable and occurs more often than the development process, it seems to be more promising to support the offering process than the development process in the first instance.

Similar to the transaction-oriented electronic marketplace the collaboration-oriented is not capable to support all kinds of transactions. The formation of an ad-hoc value chain, for instance, might necessitate the application of market coordination (e.g. a request for quotation for selecting appropriate value chain members), which is not part of a collaboration-oriented marketplace. Therefore, we suggest a synthesized marketplace model – the mixed-mode marketplace – which combines elements of transaction-oriented and collaboration-oriented marketplaces. The mixed-mode marketplace model is introduced in the following section.

9.3.3. Mixed-mode marketplace

The mixed-mode marketplace brings together two opposing worlds: transaction-oriented and collaboration-oriented marketplace. Both marketplace scenarios can be combined in a certain way. Raisinghani and Hannebeck, for example, expect an increasing coalescence of transaction-oriented and collaboration-oriented marketplaces (Raisinghani and Hannebeck 2002). Moreover, existing marketplaces prove that both modes of operations can coexist and can even be a pillar of marketplace vitality and prosperity. SupplyOn, a marketplace in the automotive industry founded

and operated by first tier suppliers, for instance, supports both simple trade transactions and more complex collaborative interaction between buyers and suppliers. SupplyOn provides tools and services for process integration and automation (e.g. a Web-EDI interface, Vendor Managed Inventory, etc.) as well as transaction-oriented features like business directories, product catalogues, support for quotation processes, auctions, etc.

Similar to other industries, the GI industry facilitates the existence of transaction-oriented as well as collaboration-oriented marketplaces. The complexity of GI products and services requires a collaboration-oriented marketplace. But there is also a need for market coordination, for example during the formation of ad-hoc value chains, searching for appropriate GI companies and products, etc.

Depending on specific customer demands and product characteristics a mixed-mode marketplace can aggregate various transaction mechanisms. Mixed-mode marketplaces are also named “all in one-markets” (Kambil, Nunes et al. 1999). A mixed-mode GI marketplace for the financial services industry could feature, but is not limited to the following product offerings and transaction mechanisms:

1. Simple trade transactions: Customers can buy catalogue products such as maps in a specific data format or bid for usage rights of geospatial information.
2. Product aggregation and bundling: Intermediaries aggregate catalogue products, services, etc. and offer them as integrated products (e.g. a map of Europe that contains standard ground values of all major cities).
3. Request for quotation: Customers can carry out requests for quotation for developing a new GIS. The quotation process is depicted in Fig. 9.
4. Configuration of GI solutions: Customers can design and customize desired GI solutions themselves. The marketplace provides company directories in which the customer can search for certain products and services offered by the GI companies.

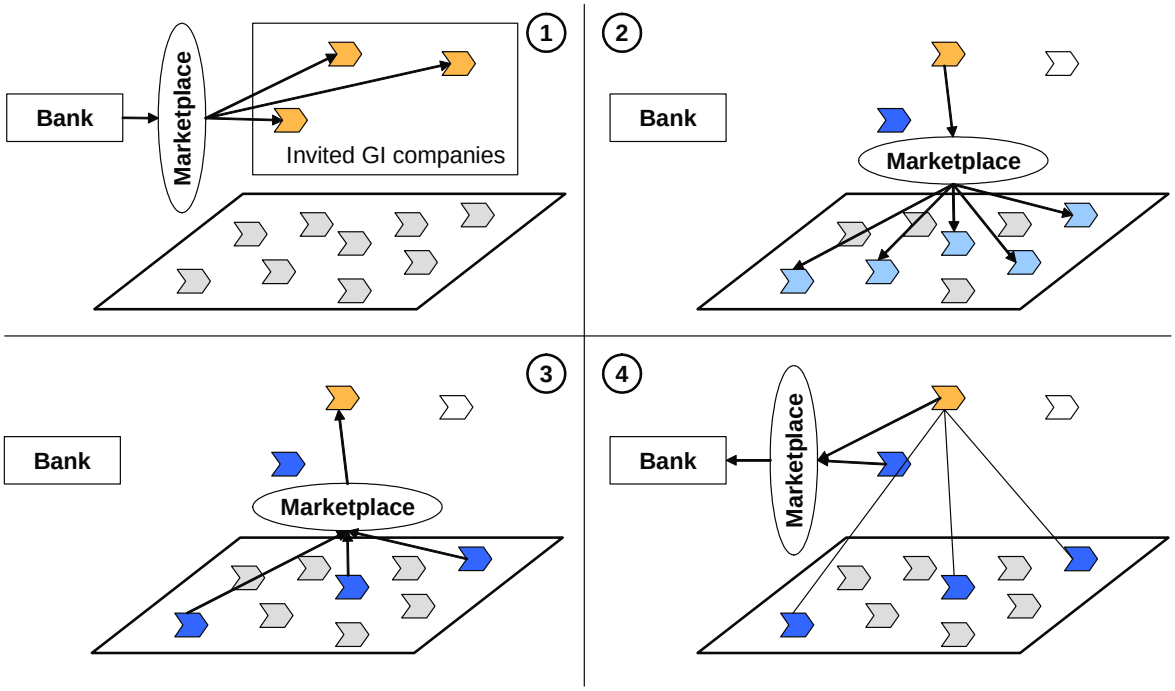

Fig. 9: Processing a customer order

The following scenario exemplifies the processing of a request for quotation (Fig. 9).

1. *Customer's request for quotation*
   A bank publishes a request for quotation for a real estate GIS of North Rhine-Westphalia on the electronic marketplace. In doing so, the bank can decide to conduct an open or closed quotation process. If the quotation process is closed, the bank has to explicitly invite the GI companies that are allowed to participate in the process. In this scenario three GI companies participate in the quotation process (yellow shapes).

2. *Selection of suitable GI companies*
   One company, a traditional GIS provider, is able to carry out the project itself (blue shape). The other two companies are GI consultants (or network brokers). They have to configure a dynamic network for fulfilling the request. One GI consultant decides not to participate in the quotation process (white shape). The other GI consultant selects suitable marketplace participants in order to establish a "project network". The GI consultant either knows appropriate companies or he uses the company directory of the marketplace for searching for suitable candidates. In this scenario the GI consultant contacts five companies (light blue shapes): two companies offer maps of North Rhine-Westphalia, two companies can integrate the geospatial data, and one company provides geo specialists data.

3. *Configuration of the business network*
   Since there are potential network members with the same resources and capabilities, the GI consultant conducts two additional requests for quotation. After selecting appropriate GI companies (blue shapes), the GI consultant forms an interim value chain that is capable to

process the customer's order. Using standardized contracts and licensing models, the GI consultant can calculate an aggregated offer.

4. *Provision of offers*
   The GI consultant and the GIS provider submit their offers and the bank terminates the quotation process. Afterwards, the bank evaluates both offers and selects the most beneficial. Finally, the winner of the quotation process – the GI consultant or the GIS provider – manages the development of the real estate GIS.

The scenario shows that the marketplace supports the interaction between customers and GI companies for doing business, and between GI consultants and marketplace participants for coordinating activities. Although a mixed-mode marketplace provides transaction-oriented and collaboration-oriented features, the emphasis of the marketplace is on processing transactions and coordinating activities efficiently. Thus, the transaction-oriented features of a mixed-mode marketplace might dominate the collaboration-oriented features in the first instance.

9.4. DESIGN PARAMETERS OF GI MARKETPLACES

In section 9.3 we discussed different scenarios of how to align an electronic GI marketplace for the financial services industry. We argued that mixed-mode marketplaces combining transaction-oriented and collaboration-oriented features seem to be promising to fulfil the demands of marketplace participants. In this section we elaborate on two issues that have an impact on the success of electronic marketplaces in more detail: transaction and coordination support and the role of intermediaries. Finally, we point out that electronic marketplaces are complex-socio technical systems that are far beyond a technical infrastructure consisting of hardware and software. We indicated that an appropriate marketplace design needs to take into consideration the needs and requirements of potential marketplace. Therefore, we suggest to regard marketplaces as being inter-organizational systems (IOS).

9.4.1. Transaction and coordination support

In section 9.3.3 we concluded that transaction-oriented features might dominate collaboration-oriented features on mixed-mode marketplaces for the financial services industry. Thus, these kind of mixed-mode marketplaces are mainly a means for processing trade transactions and coordinating activities efficiently, aiming at reducing transaction and coordination costs for marketplace participants. Many electronic marketplaces attempt to reduce transaction costs by an increasing market transparency and the automation of price generation. Both aspects can lead to lower product prices. But a high amount of transaction costs occur during the information (e.g. determination of complex products and services) and contract negotiation phase.

Marketplace efficiency is a result of a strong institutional regime (section 9.2). In order to attain transaction efficiency, a standardization of transactions is necessary. We discussed the standardization of products and product attributes in section 9.3.1. Standardized product properties are a precondition for efficient market coordination, but they do not guarantee low transaction costs.

The information phase brings together buyers and sellers. A buyer, for example a bank or an insurance company, has a certain demand and searches for sellers that can meet this demand. If the buyer requests an "off-the-shelf" product, he can use a product catalogue which provides various search mechanisms and classification schemes that helps to deliver the requested information (product description, product price, etc.). However, most GI solutions are not "off-the-shelf" products, but are complex products that have to be designed and implemented according to specific customer demands. Therefore, the buyer might search for companies (e.g. GI consultants) that offer a certain kind of service or posses specific capabilities. In section 9.3.3 we introduced the concept of a business directory which contains information about GI companies and their products, services, and capabilities. However, developing an appropriate classification scheme or ontology for GI services and capabilities is a challenging process. The business directory should "speak" the language of the buyers. Thus, the ontology has to be jointly developed by GI companies and financial services providers. At the end of the information phase the buyer should have identified GI companies that could fulfil the requested demand.

During the negotiation phase potential sellers attempt to deliver offers that meet the demands of the buyer. The negotiation process can be supported by negotiation support systems. If the buyer and the seller agree on the project, a contract has to be drawn up determining terms and conditions of GIS development and implementation. The negotiation of contracts is a time-consuming and cumbersome process. Therefore, a standardization of contracts is desirable. The marketplace, for example, could provide standardized contract template that can be simply adapted for a respective project. Moreover, standardizing licensing and revenue models of geospatial data could also reduce the complexity of contract negotiations. The application of standard contracts or contract templates might lower transaction costs significantly.

During the settlement phase the transaction is processed. Transacting parties that apply standard contracts facilitates the monitoring of contracts at lower costs than with bilateral negotiated regulations. Thus, the application of standardized contracts has a strong impact on the level of transaction costs.

9.4.2. Roles of intermediaries

Electronic marketplaces act as intermediaries between buyers and sellers. They facilitate market transactions and buyer-supplier communication, provide a technical infrastructure, define and enforce market rules, etc. Since electronic GI marketplaces have little in common with, for example, financial markets (e.g. stock exchanges) they do not aim to automate transaction processing. Therefore, GI marketplaces mainly attempt to reduce transaction costs by supporting the information and negotiation phase (section 9.4.1).

Due to a number of industry, market and product characteristics, efficient transaction processing requires more intermediary or marketplace services than simply matching buyers and sellers (Fig. 7). A GI marketplace requires both market services that facilitate transaction processing and the coordination of dynamic business networks.

According to Baily and Bakos, efficient transaction processing on electronic marketplaces demands four roles of market intermediaries (Bailey and Bakos 1997):

- *Matching*
  Obviously, the main objective of markets is to match buyers and sellers efficiently in order to facilitate marketplace liquidity. The marketplace can provide a business directory that contains rich product and service descriptions accompanied by various search and classification capabilities. Moreover, the market can provide marketing information to sellers (e.g. customer preferences). In doing so, sellers can apply they products and service offering to specific customer segments.
- *Aggregation*
  The market aggregates buyer demand and seller products to achieve economies of scale or scope, to reduce bargaining asymmetry, and to provide a "one stop shopping". It is assumed that aggregated or bundled products deliver higher value to customers than selling the products separately.
- *Trust*
  The market protects buyers and sellers from the opportunistic behaviour of other participants by providing legal contracts, authentication and communication security.
- *Facilitation*
  The market provides an infrastructure for the efficient exchange of messages between buyers and sellers, for electronic negotiation support, electronic payment, etc.

The marketplace and intermediary services fulfil various functions and processes of transaction-oriented marketplaces. Fig. 10 gives an overview of how the distinct marketplace roles cover the basic trade and context processes.

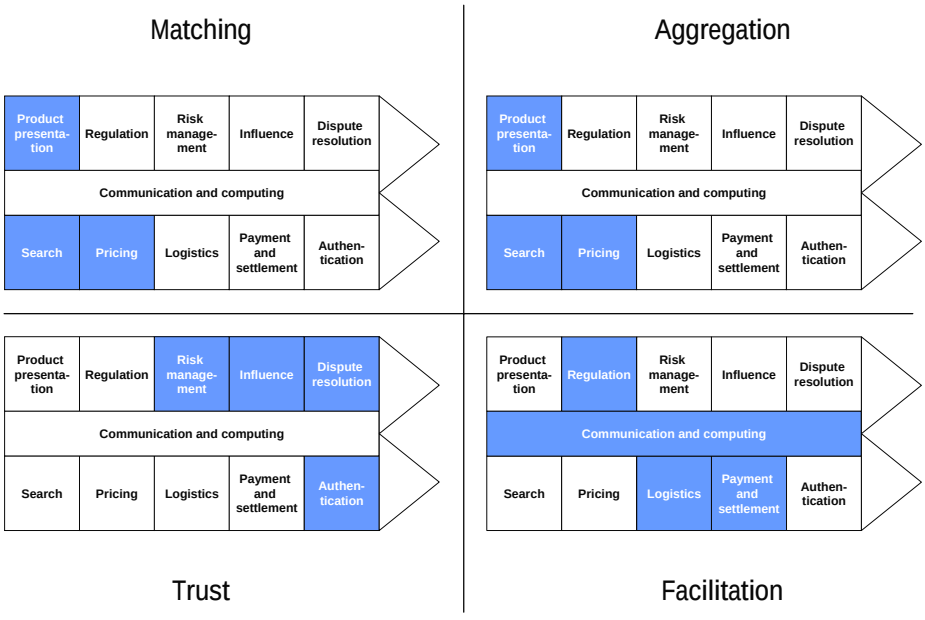

Fig. 10: Marketplace roles and functions

In contrast to transaction-oriented marketplaces where the relations between participants are mostly competitive, the participants electronic of the GI marketplace maintain tighter, cooperative relationships. Therefore, there is also a need for intermediary services that facilitate and support the coordination of dynamic business network and the collaboration among network participants. In this chapter we stress the importance of one role:

- *Project management*
  The market provides coordination and collaboration mechanism for configuring dynamic value chains. A project manager coordinates GIS projects that are processed by dynamic networks of marketplace participants. He is responsible for order transaction, process management and if necessary project planning and management.

The assignment of marketplace roles and intermediary services to distinct marketplace actors is a crucial and challenging issue. What tasks should be provided by the marketplace provider and what by independent marketplace actors facilitating competition between intermediary service providers? A successful market economy necessitates a strong institutional regime. Therefore, we suggest assigning basic marketplace services (matching, trust and facilitation) to the marketplace provider (or to an actor that is appointed by the marketplace provider). On the other hand, intermediary services such as aggregation and network management can be taken over by special marketplace participants.

The intermediary services are not limited to the core marketplace processes. Wise and Morrison, for example, suggested four intermediary scenarios that accompany and augment the traditional marketplace model (Wise and Morrison 2000). Whereas the marketplace provides an infrastructure for the execution of transactions and for buyer-supplier communication, a number of innovative business models are necessary to bridge the flaws and shortcomings of the marketplace model. They identified specialist originators (standardize the buyer decision-making process for more complex products), e-speculators (gaining real-time information in order to take direct or derivative market positions), solution providers (embedding the product sale in a suite of unique, valuable services) and sell-side asset exchanges (gaining efficiency by swapping and reselling orders among a closed set of suppliers). In particular, the business model of the specialist originator and the solution provider might take over the role of a project manager mentioned before.

9.4.3. Marketplaces as inter-organizational systems

Since marketplaces are complex institutions, a marketplace design cannot be limited on an infrastructural or technical level. Electronic marketplaces are inter-organizational systems that execute transactions, permit information access to other organizations and enable new forms of collaboration (Li and Williams 1999). In particular, the collaboration-oriented side of an electronic GI marketplaces support or enable inter-firm collaboration and electronic integration (El Sawy 2003; Markus and Christiaanse 2003).

Inter-organizational systems are socio-technical systems consisting of three elements: humans, tasks and technology (Fig. 11):

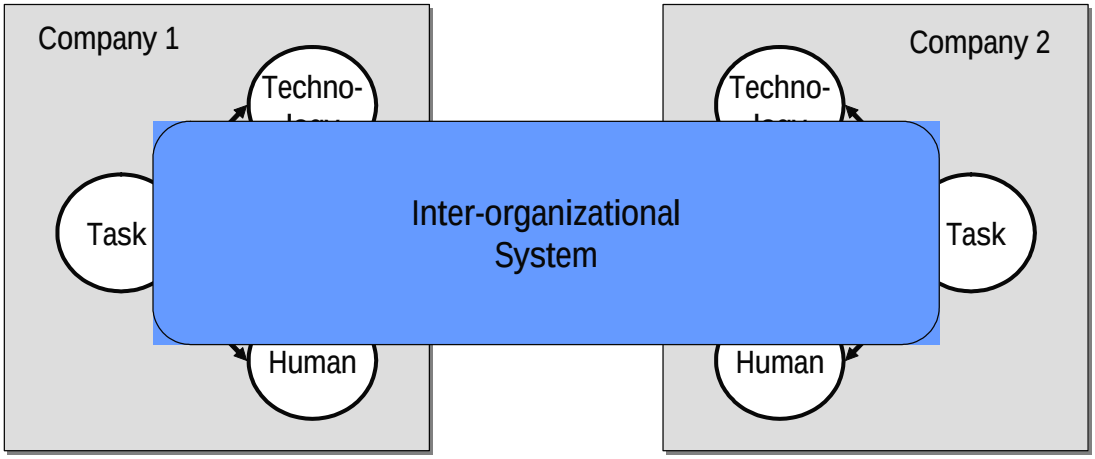

Fig. 11: Elements and structure of inter-organizational systems (Gaugler 2000)

- Humans fulfil tasks in different business functions, design information systems, use and maintain them.
- Business tasks within business functions are fulfilled by humans with the support of technology.
- Information Technology supports humans in fulfilling their tasks.

Each element of an inter-organizational system is an entity of its respective network (Fig. 12). The humans are part of a social network. The social ties and interactions among them lead to several social networks. The tasks are part of the organizational network facilitating inter-organizational workflows and processes. Finally, the technical systems that are needed within the processes for the completion of tasks and used by the humans determine the technology network.

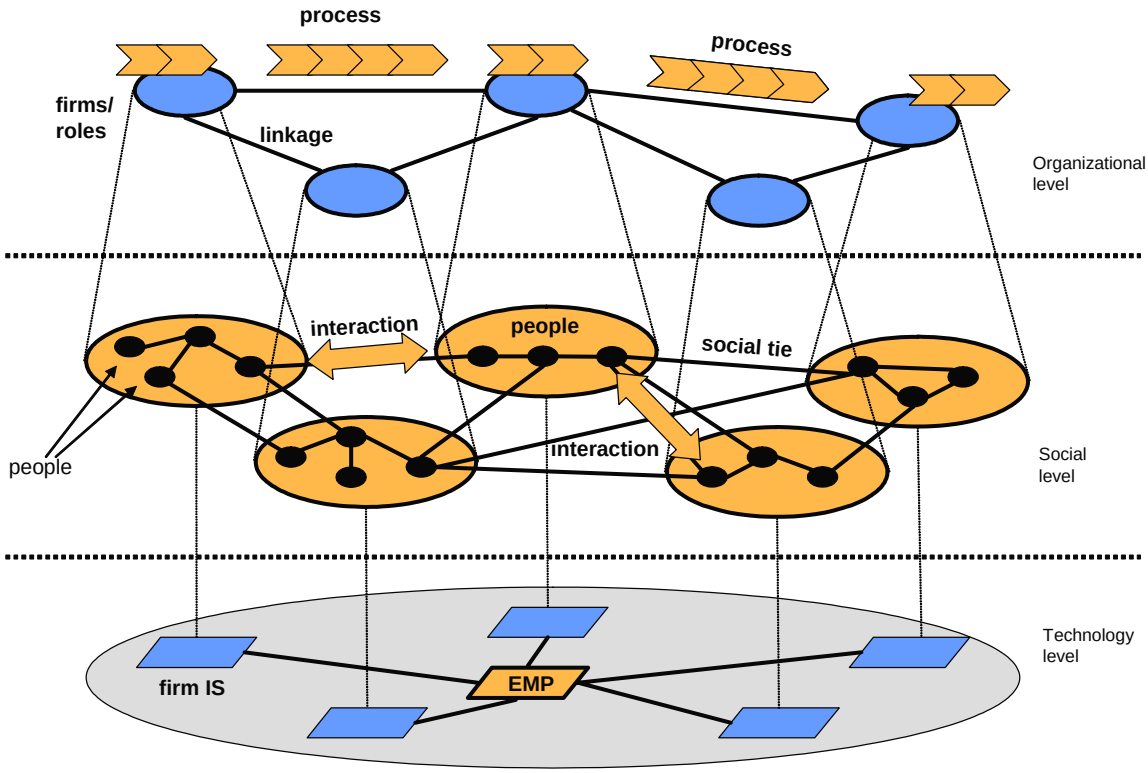

Fig. 12: Multi-level perspective on business networks

Appropriately designing a GI marketplace for the financial services industry is very crucial and challenging, since there are a huge number of factors that determine the success and failure of an electronic marketplace. Despite the necessity of certain industry, market and product characteristics that facilitate market coordination as discussed in sections 9.1 and 9.2, various factors have to be appropriately taken into consideration (Tab. 12).

Tab. 12: Success factors of an electronic GI marketplace

Level	**Factors**
GI Industry	Availability of industry standards: (Cavaye 1995) Behaviour of company's business partners: (Damsgaard and Lyytinen 1998; Markus and Christiaanse 2003) Power of business partners: (Damsgaard and Lyytinen 1998; Chwelos, Benbasat et al. 2001; Markus and Christiaanse 2003) Economic necessity: (Cavaye and Cragg 1995; Kurnia and Johnston 2002) Recognizing the marketplace potential: (Cavaye 1995)
Marketplace	Financial resources: (Cavaye 1995; Cavaye and Cragg 1995; Kumar, van

	Dissel et al. 1998; Chwelos, Benbasat et al. 2001) Support of key stakeholders: (Cavaye and Cragg 1995; Kumar, van Dissel et al. 1998) Marketing of system: (Cavaye and Cragg 1995)
Technology	Perceived benefits: (Cavaye and Cragg 1995; Chwelos, Benbasat et al. 2001; Kurnia and Johnston 2002) Perceived risks: (Kurnia and Johnston 2002) Maturity of technology: (Cavaye and Cragg 1995; Kumar, van Dissel et al. 1998)

First of all, there must be the awareness of the necessity and incentives to participate in an electronic marketplace. Two important preconditions are the perceived economic necessity and the availability of industry standards. The high degree of market fragmentation and the availability of technical standards for interoperability and semantic standardisation of products and services comply with the preconditions.

A next step is to promote the necessity and benefits of an electronic marketplace in order to convince key stakeholders to participate in the development process and act as marketplace sponsors. On the one hand, key stakeholders might provide financial resources needed during the development process. On the other hand, they can motivate potential marketplace participants that are still hesitant and unsure of the marketplace benefits. Promoting the marketplace idea in an industry consortium such as the OpenGIS consortium or CeGi might be a good starting point, since those consortia consist of major actors of an industry that can be seen as key stakeholders.

Another important aspect is the appropriation of information technology. It is obvious that information technology is important to establish an electronic marketplace. However, it seems to be promising to use mature rather than the latest technology, since potential users are familiar with the risks and benefits of this kind of technology. An efficient transaction processing does not mean that the execution of transactions has to be automated. Especially in the GI industry, successful GI solutions demand a variety of human services that simply cannot be automated. Moreover, the more complex a technical system is designed the more sources of failures exist. However, a stable and efficient technical system is a precondition of user acceptance. Therefore, we suggest designing the technical system as simple as possible in the first instance. When the marketplace is properly implemented and attained a sufficient liquidity, the marketplace can be augmented due to the demands and requirements of marketplace participants.

9.5. CONCLUSIONS

Electronic GI marketplaces for the financial services industry show a number of design options and alternatives. In section 9.2 we presented the building blocks of electronic marketplaces:

transaction-oriented features which support trade transactions, collaboration-oriented features which support more complex, collaborative interactions between companies, the institutional regime that provides a regulative environment for conducting transactions, and additional services such as marketing of the marketplace supportive services for marketplace participants. Since a GI marketplace for the financial services industry combines features of transaction-oriented and collaboration-oriented marketplaces, we introduced the concept of mixed-mode marketplaces.

Electronic marketplaces aim at reducing transaction costs. However, in contrast to the public perception that product prices are the main determinant of transaction costs, we argue that a standardization of transaction processes has a stronger impact on transaction costs. Hence, we propose on the one hand to provide business directories that classify product and service offerings according to a customer-specific ontology, and on the other hand, to provide standardized contracts or at least contract templates. The negotiation of contracts becomes more efficient if standardized contracts are applied.

An electronic marketplace offers business opportunities to various intermediaries. Examples of intermediaries are coordinators, information brokers, market makers, product aggregators, consultants and promoters. Every intermediary takes care that the marketplace is attractive for both buyers and sellers.

Electronic marketplaces are complex socio-technical systems. Designing and implementing a marketplace does not only mean to construct a technical infrastructure composed of certain hardware and software, but to develop an inter-organizational system that has to be embedded into a distinct institutional setting. Thus, an electronic marketplace design that is suitable for the financial services industry might not necessarily be appropriate for the retail industry.

The following chapters will elaborate on implementation aspects of electronic marketplaces in more detail. In Chapter 10 we will discuss how to standardize complex services, in particular human services in order to lower transaction costs in the information phase. Chapter 11 will deal with a business plan of an electronic marketplace for the financial services industry.

10. IMPLEMENTATION

Still the GI market steps behind the expected market growth (Fornefeld, Oefinger et al. 2003). E-business is emerging in the GI market in order to promote GI products, e.g., Terramapserver (www.terramapserver.de) and On-geo GmbH (http://www.on-geo.de/). However, currently e-business does not affect the crucial needs of a prosperous market: the provision of demanded products in an appropriate way.

A typical GI product required by a bank consists of a set of intermediate products: data, software, technical, human, organizational, and institutional services. Current internet platforms mostly sell data, but they offer few additional services integrated in business processes. This leads to interruptions of business transactions.

We have tested the mismatch of demand and offer in previous work (Brox and Kuhn 2004). In a scenario we investigated, if a bank manager could order a required GI product at three existing internet-based GI platforms. The demanded product was a GI system for an annual evaluation of its branches, to be integrated into the in-house system and business processes. The provision of the demanded end-product required several services as intermediate products, e.g., consulting, delivery of geographic data, GI software, integration of data, integration of GI software into the business system, and training of employees on the new system.

The tested internet platforms almost only offered data and software. On the other hand, the price of the demanded end products resulted by only ~ 10 % of the total costs of data and software. ~ 90 % of the total costs were due to additional human services. The mismatch between offer and demand prevented to start business. A bank manager did not get sufficient information about the costs and the benefit of the desired product. The business transaction was stopped at its first step: information retrieval.

This scenario proofed two major impediments of the GI market:

- The neglecting of the need of additional services in order to make usable end products out of the raw products data and technical services
- Outdated monolithic business models instead of cooperation of business networks, where different providers contribute with their specific core competences and intermediate products to the demanded, complex end product.

For the establishment and coordination of business networks, we previously suggested electronic GI marketplaces (Brox and Kuhn 2001). A GI marketplace provides organizational and institutional services for business customers and business providers, e.g., creating business networks, marketing for GI products, and defining standards for business transactions. Based on this framework, GI marketplaces enable and/or perform human and technical GI services, dependent on the GI marketplace's business model.

This paper addresses the ongoing challenge how to establish a consistent service chain on a GI marketplace, which results the required end product. A customer requires an internet-based

business process on a single platform. This affects the need of the integration of different types of services: technical services, e.g., "view map", have to be combined with human services, e.g., "evaluate data set appropriate to user's requirements".

In general economy, we observe the increasing use of semantic enabling languages, and ontologies. The first level is a semantic description of product catalogues, e.g., by (Angele and Erdmann 2001). The more advanced level is to handle more complex objects. Semantic enabling description languages are used for knowledge and content management. For example, the INKASS project (Abecker, Apostolou et al. 2003) targets the trade of knowledge on electronic marketplaces by using ontologies for the description of existing knowledge in the Web and, the more advanced step, adding services for enabling business processes.

In the GI world, we can observe a similar evolution. The need for semantics was firstly addressed to geographical objects in data sets. Then, the need for semantic enabling description of services became the next challenge (Kuhn 2002). Mostly, ontologies are used to describe and enable technical service chaining, e.g., (Janowicz and Riedemann 2003). Our paper addresses the ongoing challenge of integrating human services into business process in order to make GI economically more successful.

The integration of technical and human GI services in internet-based service chains needs a common language for web description and implementation. The most promising candidate seems to be OWL-S (formerly DAML-S) for two reasons:

- OWL-S fulfills the semantic enabling capabilities for technical GI service chaining (Janowicz and Riedemann 2003)
- OWL-S is quite advanced in general economy enabling web services, e.g., by the implementation of the DAML-S Matchmaker, "a Web services registry that enhances the UDDI registry with matching of capabilities of Web services to allow the location of Web services on the bases of what they provide rather than their name, port or other contingent information" (Paololucci, Sycara et al. 2003).

Our previous work showed that OWL-S enables service chaining of technical GI services (Janowicz and Riedemann 2003) because of enabling semantic description. If OWL-S would also be capable to sufficiently describe human GI services, and to integrate both types of services to a human-technical service chain, the provision of complex GI products could be implemented on an electronic GI marketplace. Our paper targets to clarify this question.

The following chapter will provide an overview on the capabilities of OWL-S for technical service chaining as a grounding of this paper. Then, we will analyze the capabilities of OWL-S for implementing integrated human-technical service chains: Our methodological approach will start with setting up a scenario in the third chapter. The scenario is a typical business setting where a bank manager receives the required end product – consisting of delivery and integration of human and technical GI services - via an internet platform. The following chapter will analyze on the basis of the scenario, if OWL-S fulfills the needs of a semantic web description of human services. Afterwards, we will analyze if OWL-S is capable to perform the integration of human and technical

GI services into an internet-based service chain. Finally, we will discuss the results and future work.

Mayor results of this chapter will be published in Brox and Janowicz 2004: Integration of Human Services into Technical GI Service Chains. AGILE conference, April 29 – May 1, 2004, Crete, Greece, www.agile-online.org.

10.1. SERVICE CHAINING OF TECHNICAL GI-SERVICES BY OWLL-S

This section provides the grounding of this paper. First, we will provide an overview of OWL-S concepts. Then, we will argue why OWL-S enables technical service chaining.

10.1.1. Concepts of OWL-S (DAML-S)

DAML-S is the acronym for DARPA Agent Markup Language for Services (DAML-based Web Service Ontology). It is developed by the DAML Group and its last version was 0.9. The recent version 1.0 of DAML-S is renamed to OWL-S because the Web Ontology Language (OWL) is now used to describe service ontologies (DAML-S-Coalition 2003b). This is an important step, because OWL is the ontology description language developed and proposed by the Word Wide Web Consortium (W3C). In this paper we will use the new name (OWL-S) but many tools and the already published literature uses the old term DAML-S. As indicated by the version number, OWL-S is not completely ready yet and there is still a lot of work to do (Sabou, Richards et al. 2003), (Janowicz and Riedemann 2003), for example the monitoring mentioned above is not described in the current OWL-S specification

A OWL-S service description consists of three parts: Service profile, service model, and service grounding. These aspects, also shown in figure 1, are described briefly in the following paragraphs:

The *service profile* is the part of a OWL-S service ontology that acts as a kind of yellow pages. It is important for the service discovery and answers the question what the services does. In addition to some fixed defined properties, e.g., a contact phone number or a URL, it is possible to define additional service parameters or use offered parameters as geographic radius. In addition to the informational descriptions, the service profile provides functional descriptions, e.g., the specification of the input and output of the service, and its effects and precondition.

The process ontology expresses the *service model* that defines how the service works. There are three types of processes: atomic, simple and composite. Atomic processes are those that cannot be decomposed in less complex ones and are executed in a single step. Simple processes are a method of abstraction and therefore cannot be invocated. Composite processes are those that are composed of atomic or other composite processes by the use of control constructs as loops or if-then-else constructs. The process description plays an important role for the service interoperation, and is also needed for a more precise discovery of complex services.

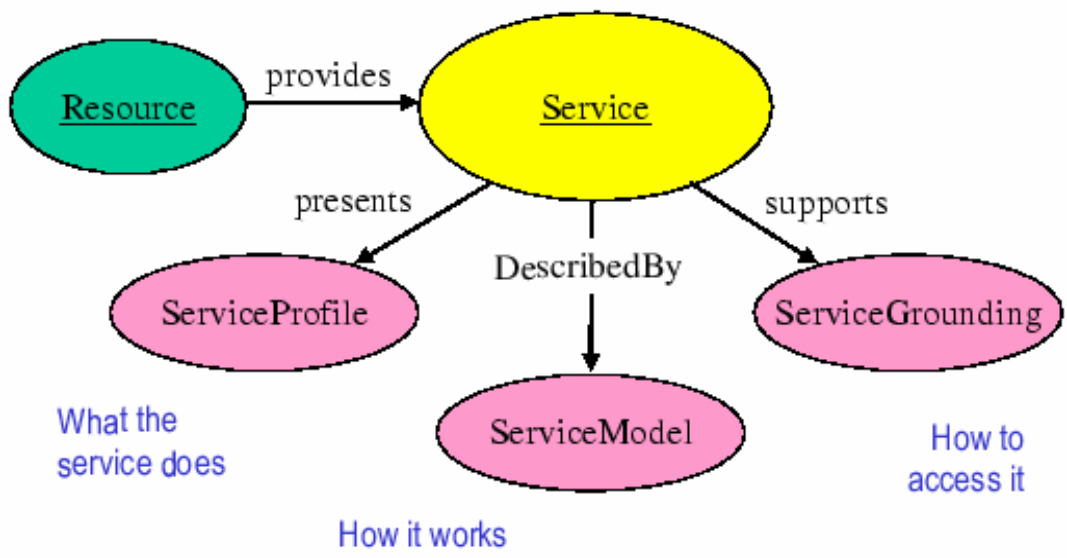

Fig. 13: DAML-S service ontology ((DAML-S-Coalition 2003b)

The *service grounding* is the part of a OWL-S service ontology that binds the abstract service specification to a concrete port, protocol etc. It describes how to access the service. Therefore it consists of two parts: a WSDL description and an ontology based description that relates the WSDL part to the service ontology. The service grounding is mostly important for the service invocation but plays a role in interoperability as well.

A service composition language must be able not only to express the concept of a composite service but also to specify how the parameters are bounded together and how the data gets from one part of the composite service to the next one. Up to now this still remains a problem in the OWL-S specifications. The current solution presented there seems to be a makeshift only.

10.1.2. Capabilities of OWL-S

There are several existing and upcoming technologies and frameworks to enable automatic service chaining. By using web description languages as BPEL4WS (Andrews, Curbera et al. 2003) or OWL-S (DAML-S-Coalition 2003b) it is possible to describe simple, atomic services and their composition to more complex ones. (Corcho, Fernández-López et al. 2001) provide an overview of the technical state-of-the-art in ontology technologies. (Otto and Waesch 2003) evaluates business frameworks as ebXML, RosettaNet, and BPEL4WS regarding requirements of inter-organizational business process integration.

Depending on the aim, each framework or language fulfils more or less the criteria that are needed for service chaining. We decide to use OWL-S here, for the following reasons:

First, OWL-S is an ontology based, semantic enabled markup language that claims to allow the automatic discovery, invocation, composition and interoperation, execution and monitoring of web services. Especially when thinking about complex service chains offered on a GI marketplace the importance of semantics becomes obvious: Without an explicit, shared understanding of the data

and services dealt with it is impossible to chain them together. For example, a service will not deliver reasonable results, if input data do not sufficiently specify how the required service should look like (Janowicz and Riedemann 2003).

Second, OWL-S supports the creation and usage of complex services (Paololucci, Sycara et al. 2003). As mentioned above it supports the discovery of simple and composite services e.g. within registries and catalogs. This is especially important on GI marketplaces, because the user must be able to choose a suitable product out of a high amount of products. Therefore an explicit human and machine understandable kind of yellow pages is needed, and this is in fact offered by OWL-S. To support the interoperation of services it is moreover necessary to describe the model behind a composite service, e.g. to describe which atomic services it is composed of or what effects arise while running the service. This kind of information can be described with help of the OWL-S service model. The next important aspect of service chaining it that it must be possible to track the service in a way that the user or an agent can detect the actual position of the service and can find out whether problems are arising or not. This requirement is as well covered by OWL-S.

Summarized, OWL-S is a semantic enabled markup language that covers the most important aspects of automatic, technical service chaining. But what about the human parts of a complex chain as described above?

10.2. SCENARIO

The use of scenarios is a method to develop, test, and demonstrate a theoretical concept. Focusing on a small, practical, and known example facilitates the understanding and analysis of a complex problem. The scenario focuses on the first critical step of a business transaction: information retrieval. Currently, internet platforms for geographic information are often not able to answer a simple customer's question (Brox and Kuhn 2004): What is the price I have to pay for the required product?

The overall scenario is a bank, which targets the evaluation of the locations of its branches. The evaluation targets a priority list of existent and planned localities by the comparison of costs and market potential. The final goal is to decide about improvements of branches, shifting or closing of existing localities, and opening new ones. The evaluation is based on enterprise and demographic data, and it shall be supported by geographic information. The bank repeats the evaluation every year. Therefore, the bank needs a tool and working processes for an in-house execution.

The generation of the desired end product includes different tasks, e.g., finding business partners, define requirements for needed data sets and GI software, integrate data and software into the bank's business system, and training of employees on the new system.

Within the overall scenario, we will separate a single business process of information retrieval of costs for buying and integrating a suitable data set (see figure 2): The business process starts with the request of a bank manager for an offer to evaluate, and integrate a suitable data set. The bank manager fills in his request in an electronic form provided by the GI marketplace. The GI marketplace addresses the request to three GI consulters, which – according to the GI

Marketplaces' database could potentially do the job. In addition, the GI marketplace evaluates by customer's request potential data providers and data integrators. This information the GI marketplace transmits with addressing the customer's request to the GI consulter.

Two of the addressed GI consulters internally decide not to process the request, one decides to do. The GI consulter checks potential data providers by viewing their data and relevant metadata information. After deciding for a suitable data set, the GI consulter addresses the customer's request for data integration to two data integrators. One of them sends back an offer for the integration service. The GI consulter evaluates all information and sends an offer for the required end product to the bank manager via the GI marketplace.

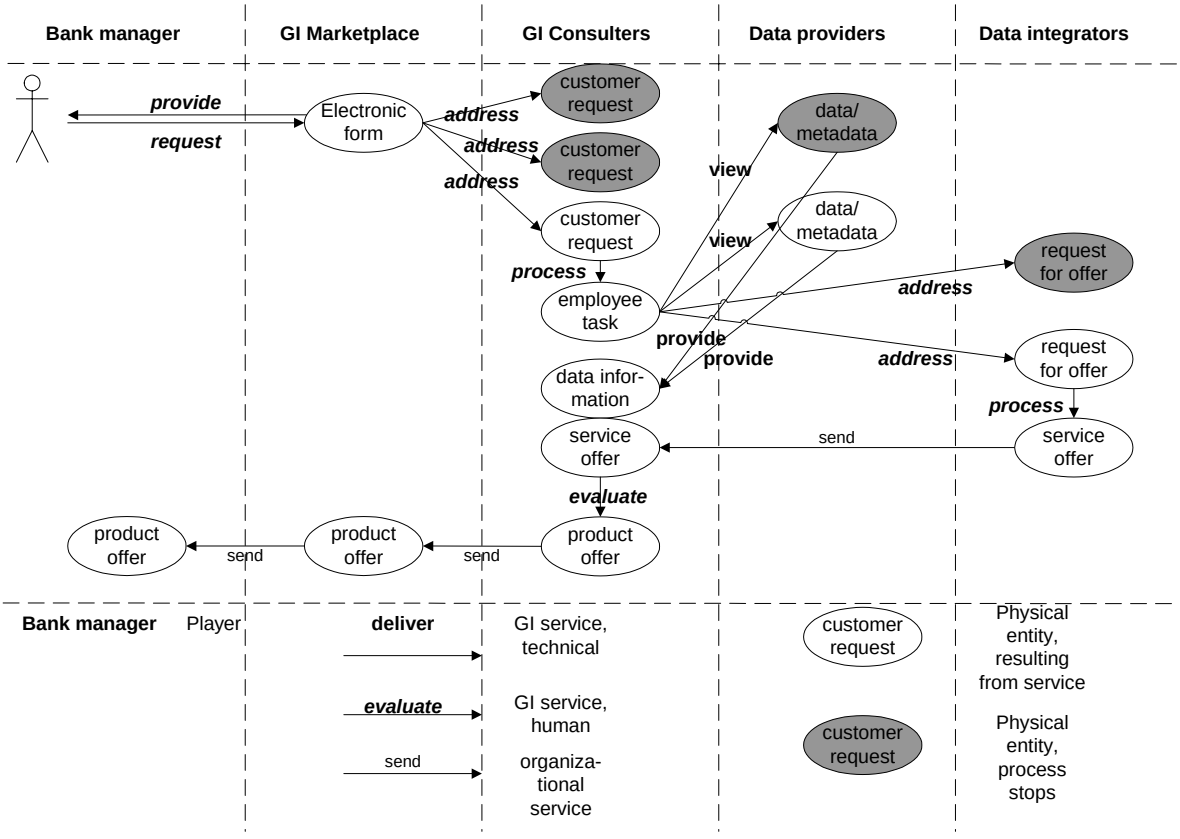

Fig. 14: Services for information provision about costs of buying and integrating a data set

The figure above shows different types of services. We classify them into three groups: technical GI services, human GI services, and organizational services. The latter are notification services of the players of the scenario in order to inform the business partners about the fulfillment of a request, e.g., by email.

We consider services as technical GI services if automated processing is state-of-the-art on the GI market, mainly when OGC specifications are available or planned, e.g., Web Mapping Services, Web Feature Services, and Catalogue Services.

On the other hand, human GI services are provided by human beings, e.g., processing a request for an offer for integrating a data set. However, differentiation becomes weaker in other cases. For example, nowadays a common business process of the GI market is thinking about data integrator who could potentially do the required job or looking for one in the internet. Our paper targets the automation of this process by matching specified requests for services with specified offers. Thus, we classify some GI services, e.g., "address", as human services because it is the state-of-the-art, although a successful implementation would turn them to technical GI services.

Is OWL-S capable to describe the business process of the scenario in an appropriate way? The following two chapters will analyze the requirements of web description and its fulfillment by OWL-S for

- Human GI services,
- And the integration of both types of services in human-technical service chaining.

10.3. INTEGRATION OF HUMAN SERVICES IN HUMAN-TECHNICAL SERVICE CHAINING BY OWL-S

This section describes the requirements of human services to be described by a web description language, and analyses how the requirements are fulfilled by OWL-S.

10.3.1. Requirements

In the scenario, we observe two groups of human services

- Internal processing of user request by employees of GI consulter and data integrator ("process" and "evaluate")
- Matching of user requests and potential providers ("provide", "request", and "address")

As an example, we take the human services of the GI consulter "process" and "evaluate". These services are very complex, and they involve the invocation of further services, addressing the technical service towards the data provider, and the human service addressing the data integrator.

However, the human services of the GI consulter have a defined, physical input (customer request) and output (product offer), as well as parameters of the human service itself. The precise, machine-readable description has to enable

- The integration of the human service in an internet-based business process
- And finding the service in the Web, matching it with the user's request, and thus addressing a "correct" GI consulter who is capable to do the required work.

A web description language has to describe the following parameters of a human GI service:

- offered services, possibly deviation from offered prices, e.g., rate of person hour Type, e.g., gather information, evaluate information
- Context, e.g., geographic data, socio-demographic data, data integration, GIS training
- Communities, e.g., providing GI services addressing banks, insurance companies, and local authorities
- Technical requirements for interaction, e.g., hardware requirements, software requirements
- Method of interaction, e.g., input and output, electronic form for customer request and product offer
- Price of required product
- Address of provider, e.g., town, street, telephone number, fax, email address
- Geographical position and possible limitation of service offers to regions
- Time, e.g., opening hours
- Language, e.g., national or international services
- Legal aspects, e.g., time limitation of offered product, location of responsible jurisdiction.

Is there a need for semantic for human services? Yes it is. Simplifying one could divide two types of semantic problems in human interaction. The first is the group of problems that arises when two persons have to communicate personally. This kind of semantic mismatching is not dealt with here because it is not a problem of computer semantics. The second group arises by the communication of human users with technical services. It must be clear to the user what kind of input the service needs and what output will result from it. This plays an important role in service discovery but also in the later interaction with the chosen service. For example it is not trivial to fill out even a form of a web interface without the needed community vocabulary. Therefore this vocabulary has to be defined in an explicit way, for example by using ontologies.

Consequently, a service chain of technical and human services has to be described in a semantic enabled way. Thereby the demands for a human service description are not as far away from that of technical. For example, a human service can also consist of some simple services. These services are also composed together by control constructs, e.g. if a GI-consulter is not able to find suitable data from a first provider, then he has to search at a second one. However, technical services have a concrete grounding to a communication protocol, port number etc.

We showed that matching user request and providers' offers need a semantic enabling web description language. OWL-S is the best candidate. Does it fulfill the requirements?

10.3.2. Fulfillment of requirements by OWL-S

The following paragraphs compare the three main parts of OWL-S service ontology with the needs of human services:

Service profile for human services

As described above the OWL-S service profile acts as a kind of yellow pages. Service parameter as geographic radius and phone number are also necessary for human services. More over it is possible to specify own, additional service parameters that are especially important for human users. For example the legal aspects of a service can be described as service parameter. Input, output, and preconditions are not the concepts we think of when talking about human communication, but we can assume that an interaction between a user and a consulter may look like this (simplified). For example the user describes his required product to the consulter as input; the consulter is looking for solutions and returns an offer as output. Human communication is much more complex and belongs of the first part of problems described above. This paper focuses on the description of input and output that a technical service submits to a human service or the other way around. That means that one of the communication partners is always a technical one. And in this case it is possible to speak form outputs and inputs in the way computer scientists do. Regarding to the scenario the service profile plays the most important role when the bank manager is trying to find a suitable GI consulter and when the consulter is looking for integrators and data providers.

Summarized, OWL-S service profile can be used for human services.

Service process for human services

The process description proposed by OWL-S is necessary for a more specialized discovery but mostly for the interoperation and composition of services to more complex ones. As mentioned above there are two types of human services. Human processes on the one hand and human to technical service interaction on the other hand. The scenario shows both types of services. The first one, for example when the GI consulter delegates a task to his employee, is not of interest for a representation of the service to third parties. In this case the human service can be represented by a OWL-S atomic process and a simple process can be used as abstraction that can act as a kind of black box to be expanded to a complex process if needed. The second type of human service can be also represented in this way. In this case the aspect of grounding becomes important and will be discussed below. Like argued above human services can also be composed be control constructs, this is true for both types of human services. For example the GI consulter can look as long for data integrators until he found one that is suitable to integrate a special data format like ATKIS. This is a kind of loop, which can be represented as OWL-S Repeat-Until control construct. In our opinion input and outputs can be defined in the same way as by technical GI services, especially if one of the both partners is always technical partner as shown in the scenario above.

The actual OWL-S specifications force grounding for atomic processes and therefore also for composite processes, this is a problem when trying to describe human services. Summarized, OWL-S service process can be used for human services, too.

Service grounding for human services

The third part of OWL-S service ontology is the grounding. Because OWL-S focuses on automatic service chaining the grounding is necessary to enable the communication between two technical services. The problems arising here for human services are mostly related to WSDL.

WDSL is a description language that describes web service interfaces in a syntactical way. The WSDL description is related to the service process of OWL-S by a special WSDL grounding class. Human services can not be grounded in a way like this. It is possible to describe the input and outputs of a human service by WDSL and also one can argue that a human service can be reachable through a web protocol or by a mail protocol like SMTP. This would mean that the service sends his output per mail to the human service (the GI-Consulter from our scenario) and the service is responding by mail or per web interface. On the first view this looks like a suitable way of grounding for human services, but most of the web services are not made for asynchronous communication like intended by SOAP as main communication protocol for web services (Simonis and Wytzisk 2003), for example an GI consulter is not available at every time seven days a week.

The OWL-S service grounding is the only part of the OWL-S description which is not on an abstract but concrete level. Because OWL-S is especially designed for automated (without human interaction) processing the grounding is the most problematic part of the specification, nevertheless also human services can be grounded.

10.4. DISCUSSION OF RESULTS AND FUTURE WORK

The scenario shows that complex GI service chains need human interaction. Consequently, the integration of technical and human GI services in internet-based value chains is crucial to enhance business in the GI market.

The first group of the scenario's human services consists of services in terms of internal processing of user requests. They hardly can be automated. These services, e.g., the GI consulter evaluating the required information in order to provide a product offer, will remain handicraft in the GI world. However, the evaluation of required information is an essential service for providing the desired end product and consequently has to be integrated into the service chain.

The second group of the scenario's human services matches user requests with potential providers in order to address potential providers that are able to execute the required service in an appropriate way. Nowadays, this is a human service in GI business. This service can be automated and implemented as a technical service; recent approaches as DAML-S Matchmaker (Paololucci, Sycara et al. 2003) demonstrate feasibility.

OWL-S is a semantic markup language that supports automated service chaining. By its concepts, OWL-S is capable to describe human-technical service chaining in an appropriate way. However, in the current version 1.0 it cannot be adapted one to one for the needs of human service description. As we have shown in this paper the requirements of human services are close to those of technical services. When the human services are chained with technical services, OWL-S service ontology can be used for their description. This is mostly due to the fact that the OWL-S description is made on a abstract level and only the grounding is on a concrete level.

The integration of human actors within such services will be the next steps to enabling the creation of complex, not trivial services that need human expert knowledge. OWL-S is focusing on automated services and is not made for human services, but it can be adapted to such needs.

OWL-S is still in an early phase of specification. With the change to from DAML+OIL to OWL it will come closer to the semantic web world and the W3C. This will make OWL-S to the leading standard for semantic service chaining. A lot of research groups are working on tools (Lab 2003), (Klein and König-Ries 2003) and frameworks (Klein and König-Ries 2003), (Sabou, Richards et al. 2003) for this language and will enable a more effective and comparable way of service annotation.

An OWL-S service ontology is only a first step to enable service chaining. Even more important is a clear and entire specification of the concepts of those objects that are used or manipulated by the services. For example the bank manager may have a completely different opinion about what maps or statistics are, than the GI consulter. While human actors are able to exchange their arguments and find a common definition for things like maps, this is not trivial for software agents and services. Therefore local ontologies are needed to specify the world view of each agent, service or provider (Uschold 2000). These ontologies must contain the specification of all resources (DAML-S-Coalition 2003) in a machine-interpretable way, for example using OWL. Only if this is done, the technical services will be able to interact in a sense full way, because they "understand" the world view of each other. In fact the problem is even more complex, because it is not enough to just know or understand the world view of another party to interoperate with it. Before communicating a service has to map his conceptualization to that of the following service of the complex service chain, so that they speak a common language. This mapping can be supported by relating the local ontologies to global ones (e.g. SUMO (http://ontology.teknowledge.com/). In this case it is possible to analyze in which neighborhood or relation the different concepts stand to each other.

Recently a lot of research is done in this area (Maedche, Motik et al. 2002; Magnini, Serafini et al. 2002; Silva and Rocha 2003) and a much further work is left. Information on the recent work in the context of "E-Business Interoperability through Ontology Semantic Mapping" can be found in (Silva and Rocha 2003).

Further work will focus on providing a prototypical implementation of the scenario with the OWL-S. Mayor challenge will be the ontology-based formalization of inputs and output of human services. Currently, the Web Service Matchmaker (follow up of the DAML-S Matchmaker mentioned above) is online (Kawamura, De Blasio et al. 2003). We plan to develop ontologies for the user request of the bank manager, human services of GI consulters, and data integrators as well of the technical services of data providers in terms of providing metadata. Afterwards, we will test if and/or how these services can be matched based on its semantics. The first step of semantic matching is measuring semantic differences. Research targets the further improvements of a recently published approach with mathematical-statistical methods (Pires and Brox 2003).

Many services involve a notification. However, mostly it is not a synchronous notification with basic request-response mechanisms. Notifications are more complex and need to handle delays and failures. (Simonis and Wytzisk 2003) provided an OGC conformant Web Notification Service (WNS). Although focused on technical GI services, in principal WNS can handle several types of notification, e.g., email, SMS, phone call, and letter. The WNS on in the OGC process becoming an

OGC standard. Therefore, such a standard should be integrated into the business processes on a GI marketplace.

11. BUSINESS PLAN OF A VERTICAL GI MARKETPLACE FOR FINANCIAL SERVICE PROVIDERS

A business plan forces the start-up organization to systematically proof business ideas and concepts (Heucher, Ilar et al. 1999). The following section will elaborate a business plan of a vertical GI marketplace for financial service providers in Germany. Being able to elaborate a logical and promising business plan validates the feasibility of a GI marketplace's realization.

The targeted GI marketplace bases on the concepts developed above. The key objective is to mediate business transactions between financial service providers and GI service providers, and among GI service providers forming business networks. The mayor advantages of the new business model against the current, traditional business model are

- Connection of geospatial value chains
- Improved access of potential customers to products and providers of the GI market
- Information about and delivery of information services as ready-to-use GI products.

The business plan will

- Present the business idea (section 11.1)
- Present the core ideas of services to be offered (section 11.2)
- Describe possible entrepreneurs (section 11.3)
- Design a marketing concept (section 11.4)
- Design an organizational framework (section 11.5)
- Conceptualize the realization of a vertical GI marketplace (section 11.6)
- Estimate a budget (section **Fehler! Verweisquelle konnte nicht gefunden werden.**) and
- Evaluate risks and opportunities (section 11.8).

Section 11.9 will summarize and discuss the results.

11.1. BUSINESS IDEA

The business idea is to create a vertical GI marketplace for financial service providers in Germany. The GI marketplace acts as an independent and non-profit organization, open to all players of the GI market. The key objective is to exploit the potential, and thus enhancing the market volume of the German GI market.

The GI marketplace provides marketplace services in order to achieve this goal.

11.2. SERVICES

This section describes the following aspects of the GI marketplace's services:

- Problem and approach
- Service offer
- Innovation.

11.2.1. Problem and approach

A recently published market study estimates that the GI market in Germany has a market potential of 8 billion €; however only 1.2 billion € are exploited (Fornefeld, Oefinger et al. 2003).

The GI market faces mayor impediments:

1. Potential customers *lack of information*. Some potential customers do not even know that GI could be of potential value to them. Others hardly will be able to quantify prices and benefit of a required GI product. In addition, the GI market is in-transparent. Potential customers hardly get access to GI providers and are rarely able to compare their offers.
2. We observed a *mismatch of offered and demanded products*. We tested the mismatch on the basis of a scenario, where a bank manager required a typical GI product of a GI supported evaluation tool for the bank's localities. The costs for data and software were about 10 % of the total costs, whereas the costs of additional human GI services, e.g., consulting, data integration, software integration, and training of employees on the new system, were about 90 % of the total costs. On the other hand, the offer mostly consisted of data.
3. Mostly, the GI market bases on *outdated business models*. Currently, we observe monolithic business models, where one provider offers many products of the geospatial value chain by its own, from data production, data integration, software integration, to training of employees. Non-focusing on core competences affects reduction in product quality. An up-to-date business model of regular economy in terms of business networks is not yet introduced.

We suggest an electronic GI marketplace for financial service providers as a tool for coordination and cooperation. The GI marketplace provides services that support transactions as well as collaboration between customers and providers, and providers and providers.

11.2.2. Service offer

The general concepts (organizational framework and services, see sections 5 and 6) can be adapted to a specific vertical GI marketplace. Differences to general concepts are:

- More details in organizational and institutional framework
- Prioritizing of services described in general concepts, i.e., marketing and information services

Key finding of the test of existing GI internet platforms (see sections 7 and 8) show the bottleneck in the first transaction step: information. Consequently, the vertical GI marketplace focuses on

providing services for an improved information retrieval. The following figure provides examples of services supporting business transactions and collaboration:

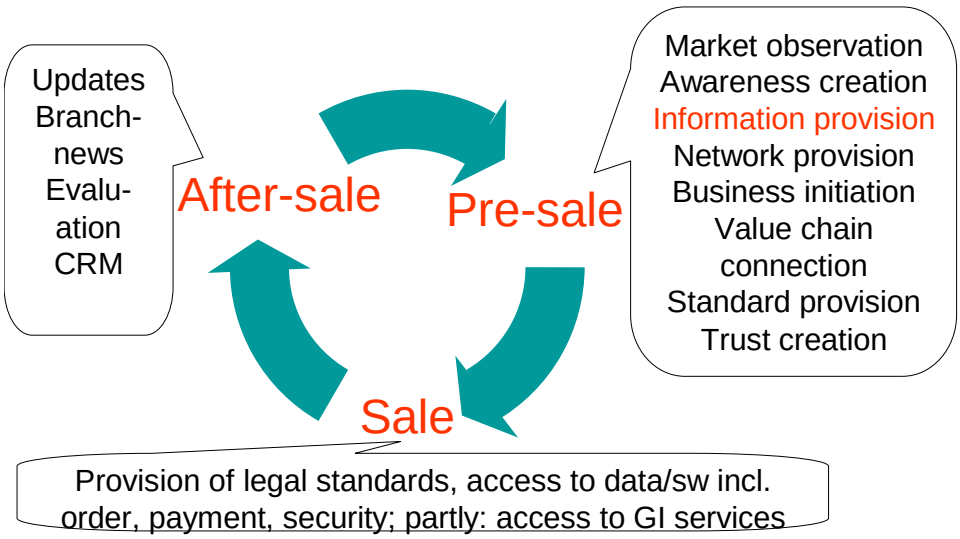

Fig. 15: Services of a vertical GI marketplace (Examples)

In addition, the GI marketplace mediates the process of generating information services. The vertical GI marketplace addresses a specific branch, thus adding the inside knowledge of the branch and mediate sector-specific solutions (Brox and Kuhn 2001).

Tab. 13 describes services of a vertical GI marketplace for financial service providers in more detail. Starting point are the tasks of the scenario (section 8.2.1) and the various technical, human, organizational, and institutional services (= intermediate products, see section 8.3) necessary for the generation of the scenario's information service (= end product). From this we derive services a vertical GI marketplace for financial service providers has to provide in order to support the generation of the scenario's information service (see Tab. 13).

For example, the bank has to find a GI consultant. The required intermediate product is a list of companies that could do the job. The GI marketplace supports the connection of business partners by information, e.g., by publishing yellow pages of GI providers, or by providing a list with company profiles of capable GI consultants.

Tab. 13: Services of a vertical GI marketplace for financial service providers

(t) = Technical service
(h) = Human service
(o) = Organizational service
(i) = Institutional service

Service (= intermediate product) of scenario (see Tab. 4**)**	**Service of vertical GI marketplace in order to support the generation of the information service**
Provision of knowledge about possibilities of GI (marketing) (o)	Advertise GI within the branch of financial service providers
Provision of information about GI products and GI providers (t)	Provide an information platform for access to information
Information (o)	Provide information, i.e. by electronic form for GI product request
Communication (o)	Run a call center
Establishment of business network of potential partners (i)	Establish business network of potential partners
Quality assurance of business partners (i)	Provide quality standards and quality assurance of providers of the GI marketplace
GI consulting (h)	Connect GI consultants with users, e.g., by a black board announcing user requests
Marketing consulting (h)	Connect Marketing consultants with users
Integrative consulting (h)	Connect integrator with users and business partners
Data provision (t)	Mediate users' access to functionality
Provision of internet access (o)	Provide internet access to functionality
Standardization of data (i)	Standardize data offered on the GI marketplace, e.g., metadata
Rules for the use of data (i)	Provide rules for the use of data within the GI marketplace
Security (i)	Provide security standards within the GI marketplace
Data search (t)	Mediate users' access to functionality
Standardization of functionalities (i)	Standardize functionalities offered on the GI marketplace
Data selection and adaptation (t)	Mediate users' access to functionality, Connect data adapter with client
Data ordering (t)	Mediate users' access to functionality
Data payment (t)	Mediate users' access to functionality
Security assurance (o)	Guarantee security for all transactions within the GI marketplace
Sale of software tool (o)	Connect software providers with client (end user of information service, or integrator; depending on the business process of putting the pieces together)
Adjustment of software tool (t), (h), (o)	Connect software adjuster with client
Integration of software tools (t), (h), (o)	Connect integrator with client

Service (= intermediate product) of scenario (see Tab. 4**)**	**Service of vertical GI marketplace in order to support the generation of the information service**
Execution of analysis (t), (h)	Connect integrator with user
Training (h)	Connect trainer with user

Tab. 13 points out how a GI marketplace can support the generation of an information service, produced by the integration of a great variety of technical, human, organizational, and institutional services. The GI marketplace

- Supports technical and human services by *mediation*. It provides information about services and providers, connects the end user with providers and providers with other providers, and facilitates transactions.
- *Can execute* organizational services. This depends on the business model of the GI marketplace. For example, the GI marketplace can run an order-and-payment platform for several business partners, or it can mediate the access to the order-and-payment services of each specific provider.
- *Should execute* institutional services. The GI market needs mechanisms and institutions for its regulation, e.g., by standards for data and functionalities within a business community, quality assurance for services, and assurance of security of transactions.

GI marketplaces are tools for the transfer from the technical innovation of interoperability to the interoperability for all kinds of services in a successful business model of the GI market.

11.2.3. Innovation

Innovation focuses on linking potential GI customers with GI providers, and establishing a modern business model of business networks. Thus, the vertical GI marketplace benefits the financial service providers as well as the GI providers:

1. Currently, a bank manager is not able to get sufficient information about price and benefit of a typical GI product within 1 h of internet recherché on an existing GI platform. The vertical GI marketplace provides electronic forms which can be filled in in less than an hour. The result is substantial information about the required GI product.
2. Currently, existing GI internet platforms mostly provide data as GI products. The vertical GI marketplace provides additional GI services, which proofed to be the most cost-intensive components of typical, complex GI products (= information services).
3. Currently, mostly monolithic companies offer all types of GI services from data production to training of employees. The vertical GI marketplace enables business networks as new business models. The GI marketplace provides call for tenders for different types of GI services as components of a complex GI product, where companies apply with specialized core competences, e.g., in integration of geographic data with internal bank data. Thus, the GI marketplace enables a differentiation of the GI market and an increase of the GI market volume.

11.3. ENTREPRENEURS

We see two possible entrepreneurs of the vertical GI marketplace:

- Spatial Data Infrastructure, or similar organization
- Data provider, e.g., mapping agency or private data provider as Teleatlas.

The GI marketplace is an independent, neutral organization, which is open to cooperation of various players and competitors of the GI market. In addition, we see the GI marketplace as a non-profit organization, which targets the improvement of the GI market.

SDIs fulfill this requirement by its self-definition (Nebert 2000). But also data provider could run the GI marketplace. If the data provider strictly attaches to its role, the GI marketplace can be the independent, neutral and non-profit oriented – apart from the entrepreneur's own role as a data provider. The financial benefit of a data provider investing in a non-profit GI marketplace is the return of investments by increasing the GI market volume, and thus increasing the use and sale of geographic data. In the following, we will focus on the SDI option.

11.4. MARKETING CONCEPT

This section will describe

- market environment and competitors
- targeted customers, and
- strategy and cost recovery

of the vertical GI marketplace for financial service providers.

11.4.1. Market environment and competitors

Although the GI market is expanding, its potential is even higher (Fornefeld, Oefinger et al. 2003). In addition, the branch of financial service providers is of high interest for the GI market (Fornefeld and Oefinger 2001): Geographic information is of great potential benefit for the branch, and the branch has the financial capacity to pay for it.

In principle, the GI products necessary for the provision of information services and thus feeding the vertical GI marketplace, are available, e.g., by the GI technologies developed in the BRIDGE-IT project.

The GI market is heterogeneous, fragmented, and in-transparent for potential customers. This situation makes marketplaces even more promising, because best chances for marketplaces are expected in fragmented markets with many actors and low transparency (Spiller and Wichmann 2000). Consequently, e-business is emerging on the GI market.

We observe three groups of potential competitors:

- GI companies with internet presence

- Electronic platforms of SDIs or similar organizations focusing on the entire GI market
- Electronic platforms focusing on financial service providers.

Many GI companies have established their internet presence. However, specialization in terms of core competences is still low. Although some GI companies, e.g., Endoxon AG in Switzerland (Widmann 2001) have key clients (in this case banks), they still offer a monolithic business model by providing all types of GI services from data production to training of employees. For the potential customer this affects a mayor disadvantage: The GI market is still in-transparent, and the customer is dependent on a single company, not able to compare quality and price of products.

SDI initiatives as InGeoForum (www.ingeoforum.de) and CeGi (www.cegi.de) target the improvement of the GI market, and have initiated internet-based platforms (www.ingeoic.de and www.terramapserver.de). These organizations execute valuable contributions by addressing marketing GI in politics, legal issues, connecting GI providers, and technological standardization. They also provide GI services, however we see the following impediments for addressing financial service providers as potential clients. The SDIs are

- mainly regional
- addressing all branches, providing few offers to the branch of financial service providers
- focusing on data instead of adding additional GI services.

With on-geo, www.on-geo.de, and Geoport, www.geoport.de, two new platforms emerged on the German GI market. They provide GI services for the real estate management. Although they address a specific branch, and provide innovative, complex GI services to their customers, the product offer is focused on one special type of GI service for valuating real estate objects. Financial service providers with other required products will hardly be satisfied.

Consequently, there is no competitor on the GI market that matches the profile of the vertical GI marketplace for financial service providers.

11.4.2. Targeted users

The GI marketplaces targets two groups of users:

- Financial service providers, and
- GI providers.

Financial service providers use the GI marketplace as a central platform for all business transactions in the context of GI. GI providers use the GI marketplace as central platform for marketing all their GI products addressed to the branch of financial service providers. In addition, GI providers could use the GI marketplace as a customer as well, e.g., a GI consulter ordering a data set for a client.

11.4.3. Strategy and cost recovery

The GI marketplace targets the link of the entire branch of financial service providers, and the entire branch of GI providers in order to achieve a critical mass. Consequently the GI market targets cooperation of as many players as possible.

Therefore, we foresee two main strategies to achieve the critical mass:

- The GI marketplace is a union of members as for example InGeoForum, www.ingeoforum.de, not a company.
- The GI marketplace starts with a preparation phase before operating the GI marketplace. In this preparation phase, the GI marketplace acquires customers and GI providers by information, workshops, and personal contacts, similar to the proceedings of the CeGi establishment (www.cegi.de). A key issue is to assure its acceptance. Therefore, we suggest procedures to create a consensus of members. For this purpose the concepts of the GI marketplace will be made public. The GI market players will be asked to give feedback. This feedback will serve as an input for the further work of the GI marketplace implementation.

Strategically advantages of a start-up in near future are prosperous business perspectives of a young and emerging GI market.

It is not sufficient to create a “high-quality product GI”. Strategic marketing initiatives, i.e. public relations, have to be executed and targeted on

- traditional and new users of geoinformation. They have to know about its opportunities and chances.
- Traditional and new providers as components of the GI marketplace.

The GI marketplace is a non-profit organization. In the preparation phase, we foresee cost recovery by public funding. In the operation mode, costs will be recovered by

- Annual fees of GI providers, and
- Cost percentages of the traded GI products.

In addition, we foresee the execution of funded projects (e.g., by EC, BMBF) in order to finance improvements of the GI marketplace, e.g., semantic matching of user requests and offered GI services.

11.5. ORGANIZATION

We see the following phases for the introduction of the GI marketplace

1. Project phase for GI marketplace implementation
    a. Preparation (12 months)
    b. Prototype implementation (6 months)
    c. Prototype testing, evaluation, and refinements (4 months)

d. Preparation of operation mode (2 months)

2. Operation mode

The GI marketplace is a *member-based organization*, open for all companies and organizations participating in the GI-market. It will be created by a consensus procedure performed during the preparation phase. The rules for a membership still have to be defined, but in general, the GI marketplace executives will be controlled by a member-based steering committee, in the project phase as well as in the operation mode.

The focus of the project phase is on implementation of the organization and technique in a consensus process. The focus of the operation mode is to provide the GI marketplace services described in section 11.2.2. For being an internet-based organization covering all Germany, the location of the GI marketplace is of no important matter.

The GI marketplace is a comprehensive approach for improving the GI market. This evokes the need of supporting partners, e.g., DDGI, SDIs, and government. In addition, universities have to contribute research results in order to solve technological and organizational challenges, e.g., semantic matching of user requests and offered GI products.

11.6. REALIZATION OF A VERTICAL GI MARKETPLACE

Before working in the operation mode, we foresee a 2-years project phase. The project phase has the following work packages and milestones:

Tab. 14: Work packages and milestones of GI marketplace realization (project phase)

Work package	**Milestone**	**Project month**
1. Project management (coordination, communication, project planning, controlling, documentation, evaluation, budgeting)	Project plan, four project reports, homepage	1, 12, 18, 22, 24, 1
Preparation		**1-12**
2. Analysis of user requirements (financial service providers, GI providers)	Report on user requirements	3
3. Acquisition of users (information, personal contacts, workshop)	Workshop, lists of expressions of interest, and user requirements	4
4. System design (organizational, technological)	System raw concept	6
5. Consensus process (information,	User workshop, agreement on raw concept, list of additional user	7

Work package	Milestone	Project month
personal contacts, workshop)	requirements	
6. Detailed system design (organization, technological)	System concept	11
7. Formal establishment of GI marketplace	Member workshop, agreement on system concept, list of additional user requirements	12
Prototype implementation		**12-18**
8. Implementation of business processes on internet platform	Executable prototype	18
Prototype testing and evaluation		**19-22**
9. User tests	Usability results	19
10. Refinement of prototype	Refined prototype	22
Preparation of operation mode		**23-24**
11. Establishment of organization	Engagement of personnel, creation of infrastructure	24
12. Establishment of technologies	GI marketplace online	24
13. Dissemination of results (advertisement, personal contacts, email-notification of potential users, publications, opening workshop)	GI marketplace opening workshop	24

11.7. BUDGET

This section estimates the costs of the project phase, and the costs and cost recovery of the GI marketplace in the operation mode.

11.7.1. Project phase

For the project phase we estimate the costs, according to the work packages (see section 11.6):

Tab. 15: Estimated costs of GI marketplace implementation (project phase)

Work package	Cost item	Costs (€)
1. Project management	24 person months, manager	140.000
	6 person months, secretary	18.000

Work package	**Cost item**	**Costs (€)**
Preparation (month 1-12)		
2. Analysis of user requirements	3 person months, science professional	16.500
	3 person months, associate science professional	9.000
3. Acquisition of users (information, personal contacts, workshop)	3 person months, business professional	16.500
	Workshop organization (secretary, 1 person month, locality)	8.000
4. System design (organizational, technological)	Business professional, 6 person months	33.000
	Engineering professional, 6 person months	33.000
5. Consensus process (information, personal contacts, workshop)	Information and workshop preparation, business professional, 1 person month	5.500
	Workshop organization (secretary, 1 person month, locality)	8.000
6. Detailed system design (organization, technological)	Business professional, 6 person months	33.000
	Engineering professional, 6 person months	33.000
7. Formal establishment of GI marketplace	Information and workshop preparation, business professional, 1 person month	5.500
	Workshop organization (secretary, 1 person month, locality)	8.000
Prototype implementation (month 13-18)		
8. Implementation of business processes on internet platform	Business professional, 12 person months	66.000
	Associate business professional, 12 person months	48.000

Work package	**Cost item**	**Costs (€)**
	Engineering professional, 12 person months	66.000
	Associate engineering professional, 12 person months	48.000
	Development system (hardware, software, data)	20.000
Prototype testing and evaluation (month 19-22)		
9. User tests	Business professional, 2 person months	11.000
	Research professional, 2 person months	11.000
10. Refinement of prototype	Business professional, 6 person months	33.000
	Associate business professional, 6 person months	24.000
	Engineering professional, 6 person months	33.000
	Associate engineering professional, 6 person months	24.000
Preparation of operation mode (month 23-24)		
11. Establishment of organization	Business professional, 4 person months	22.000
	Associate business professional, 4 person months	16.000
12. Establishment of technologies	Engineering professional, 4 person months	22.000
	Associate engineering professional, 4 person months	16.000
13. Dissemination of results (advertisement, personal contacts, email-notification of potential users, publications, opening workshop)	Research professional, 1 person month	5.500

Work package	Cost item	Costs (€)
	Workshop organization (secretary, 1 person month, locality)	8.000
Subtotal		**840.500**
5 % overhead, e.g., consumables, communication		42.025
Total		**882.725**

The cost estimation of 882.725 € bases on the usage of existing know-how and technologies. We assume that an existing organization or institution is executing the project, not affecting additional costs for infrastructure, e.g., office rent. Additional improvements, e.g., an automated semantic mapping of demanded GI products with offered GI services and providers, would result additional costs by side-projects.

11.7.2. Operation mode

For running the GI marketplace we estimate the following annual costs:

Tab. 16: Annual costs of the GI marketplace in the operation mode

Activity	Cost item	Costs (€)
Coordination, public relations, marketing	12 person months, manager	70.000
Secretariat	12 person months, secretary	36.000
Maintenance of online platform	Engineering professional, 12 person months	66.000
Consulting	Business professional, 12 person months	66.000
Consulting	Associate business professional, 6 person months	24.000
Rent infrastructure	Infrastructure (office rent, hardware, software)	30.000
Traveling	Travel costs	10.000
Subtotal		302.000
5 % overhead, e.g., consumables, communication		15.100

Activity	**Cost item**	**Costs (€)**
Total		317.000

For cost recovery we foresee two means: Member fees of GI providers and a percentage of the turn-over mediated by the GI marketplace.

The amounts of fees and turn-over percentage are subject of discussion, based on the detailed business models, consensus process of the members, and number of users. The following table provides several examples from worst case to best case:

Tab. 17: Cost recovery models in the GI marketplace operation mode

Number of members	**Member fees**	**Income (€)**	**Turn-over per year**	**Percentage of turn over**	**Income (€)**	**Annual cost recovery (€)**
50	500	25.000	500.000	2	10.000	35.000
100	500	50.000	1.000.000	2	20.000	70.000
150	500	75.000	2.000.000	2	40.000	115.000
200	500	100.000	4.000.000	2	80.000	180.000
250	500	125.000	**8.000.000**	**2**	**160.000**	285.000
50	1.000	50.000	500.000	5	25.000	75.000
100	1.000	100.000	1.000.000	5	50.000	150.000
150	1.000	150.000	2.000.000	5	100.000	250.000
200	**1.000**	**200.000**	**4.000.000**	**5**	**200.000**	**400.000**
250	1.000	250.000	8.000.000	5	400.000	650.000
50	2.000	100.000	500.000	10	50.000	150.000
100	**2.000**	**200.000**	1.000.000	10	100.000	300.000
150	2.000	300.000	2.000.000	10	200.000	500.000
200	2.000	400.000	4.000.000	10	400.000	800.000
250	2.000	500.000	8.000.000	10	800.000	1.300.000

The calculation of cost recovery shows that the GI marketplace requires acceptance on the market by a high number of GI providers as members and a high turn-over. Member fees of 1.000 – 2.000

€ affect 100-200 GI providers participating on the GI marketplace (see marked numbers). A percentage of 2-5 % of the turn-over affects a required annual turn-over of 4.000.000 – 8.000.000 € (see marked numbers).

11.8. RISKS AND OPPORTUNITIES

This section will estimate the risks of the GI marketplace realization on the levels of

- Time deviations in implementation
- Competitors
- Products/services
- Customers/partners
- Cost recovery

as well as the opportunities of a GI marketplace realization.

11.8.1. Risks

We will estimate the risks of GI marketplace introduction on various levels. The results will be summarized in Tab. 18.

1. *Time deviations in implementation*: The project phase is calculated with reserves in terms of personnel and time. A first version of the GI marketplace can be established on existing know-how and technologies. Therefore, we estimate the risk as low.
2. *Competitors*: There are no competitors on the GI market matching the profile of the vertical GI marketplace for financial service providers. In contrary, potential competitors, e.g., InGeoForum or CeGi, should be integrated. Therefore, we estimate the risk as low.
3. *Products/services*: In a first version of the GI marketplace offered products and marketplace services base on existing know-how and technologies. Therefore, we estimate the risk as low.
4. *Customers/partners*: We estimate the interest of financial service providers as high, their interest in GI as well as their interest in the GI marketplace providing access to GI products. We also estimate the interest of GI providers as high. For example, workshops of CeGi resulted the attendance of several hundreds of companies and institutions. Critical is the number of interested GI providers. First, the GI marketplace focuses only on one special branch. Second, the GI providers must be willing to pay for the GI marketplace services. Therefore, we estimate the risk as medium – high.
5. *Cost recovery*: The risk for the pilot phase is low, once acquired public funding for this phase. In the operation mode, there is a need of a high number of customers/partners and annual turn-over. We estimate the risk for acquiring 100-200 GI providers willing to pay for the GI marketplace services as high. On the other hand, current big GI projects easily have a turn-over of 500.000 €. Therefore, a GI marketplace turn-over of 4.000.000 –

8.000.000 € can be achieved with a relatively low number of users. In addition, the project phase offers the opportunity of a more detailed analysis of potential customers/partners and models of cost recovery. In the case of a negative prognosis, the operation mode can be cancelled, which reduces the risk. Therefore, we estimate the risk as medium – high.

The risk estimation on the levels of time deviation, competitors, and products/services are low. However, the risk estimations on the levels of customers/partners and cost recovery are critical. Therefore, we estimate the overall risk of the GI marketplace realization as medium – high.

Tab. 18: Risk analysis of the GI marketplace realization

Risk level	**Estimation of risk (high, medium, low)**
Time deviations in implementation	Low
Competitors	Low
Products/services	Low
Customers/partners	Medium-high
Cost recovery	Medium-high
Overall	Medium-high

11.8.2. Opportunities

The project phase will deliver valuable results for marketing innovative GI products, and exploiting the GI market potential. Even if the implementation of the GI marketplace operation mode would fail, the GI market would profit by this project.

The realization of the GI marketplace can implement new business models in the GI market, mostly common in general economy. This is a step forward in integrating GI in business processes of the free market. The GI marketplace realization is a chance to significantly increase the sale of GI products.

We see the realization of a vertical GI marketplace for financial service providers as a pilot initiative. It will enable the establishment of further vertical marketplaces for other potential branches with lower costs. This will provide an additional impact on the GI market, being able to implement further vertical GI marketplaces with lower costs.

11.9. SUMMARY AND DISCUSSION OF RESULTS

The economic interest in establishing a vertical GI marketplace is exploiting the GI market potential. The GI marketplace provides services in order to overcome

- Lack of information of potential customers about GI products and GI providers

- Overcome the severe mismatch of demanded and offered GI products by information services
- Replace outdated monolithic business models by business networks.

The GI marketplace is an independent non-profit member union. We suggest a 2-year project phase for the GI marketplace implementation. The project phase has to be financed by public funding (~ 880.000 €). The ongoing operation mode recovers its costs by member fees and a percentage of the turn-over mediated by the GI marketplace.

The business plan proofs the feasibility of the GI marketplace realization. However, we estimate the risk of the operation mode as medium – high. The risk has to be weighed versus the potential benefit of the GI marketplace realization.

We observe a severe mismatch between GI market potential and GI market exploitation for the reasons discussed in this report. The realization of the GI marketplace not only has the potential to increase the sale of GI products to the branch of financial service providers, but also to have a significant impact on the entire GI market. The project phase will provide a deep insight into new marketing strategies for innovative, interoperable technological GI products as developed in BRIDGE-IT. The GI marketplace operation mode can be considered as a pilot for the realization of further vertical GI marketplace, e.g., for transport/traffic, ecology, and authorities. Therefore, we think it justified to take the risk. Even in the case of failure of the full-cost recovery business model it is worth the discussion if the starting phase of the GI marketplace operation mode could be financially supported by public funding. The goal is to come closer to 8 billion € GI market potential from the current GI market exploitation of 1.2 billion € (Fornefeld, Oefinger et al. 2003).

12. DISCUSSION OF RESULTS

This section discusses the implication of the results for the GI market in general, and the BRIDGE-IT project in detail.

12.1. IMPLICATIONS FOR THE GI MARKET

A recently published market study estimates that the GI market in Germany has a market potential of 8 billion €; however only 1.2 billion € are exploited (Fornefeld, Oefinger et al. 2003).

The GI market faces mayor impediments:

1. Potential customers *lack of information*. Some potential customers do not even know that GI could be of potential value. Others hardly will be able to quantify prices and benefit of GI product. In addition, the GI market is in-transparent. Potential customers hardly get access to GI providers are able to compare their offers.
2. We observed a *mismatch of offered and demanded products*. We tested the mismatch on the basis of a scenario, where a bank manager required a typical GI product of a GI supported evaluation tool for the bank's localities. The costs for data and software were about 10 % of the total costs, whereas the costs of additional human GI services, e.g., consulting, data integration, software integration, and training of employees on the new system were about 90 % of total costs. On the other hand, the offer mostly consisted of data.
3. Mostly, the GI market bases on *outdated business models*. Currently, we mostly observe monolithic business models, where one provider offers many products of the geospatial value chain by its own, from data production, data integration, software integration, to training of employees. Non-focusing on core competences affects reduction in product quality. Up-to-date business of regular economy in terms of business networks is not yet introduced.

We suggest an electronic GI marketplace for financial service providers as tool for coordination and cooperation. The GI marketplace provides services that support transactions as well as collaboration between customers and providers, and providers and providers.

The GI marketplace report provides evidence for both, need for and feasibility of a vertical GI marketplace for financial service providers. Electronic GI marketplaces

- Can improve GI economy
- Can be executed in terms of business processes
- Can be implemented by existing technologies
- Can be financed by public funding and public-private partnership.

Although the realization of the vertical GI marketplace includes a medium – high risk, taking the risk can be justified by its potential of a significant impact on the GI market development and exploitation.

12.2. IMPLICATIONS FOR BRIDGE-IT

The OpenGIS Consortium promotes the combination of technical GI services versus the ancient model of monolithic GIS. Within the BRIDGE-IT project, innovative and interoperable components are developed. One of the key issues of BRIDGE-IT is the proof interoperability in practice. BRIDGE-IT integrates a great variety of components in four different pilot applications all over Europe.

However, technological evolution forces economical evolution as well; interoperability has to be transferred from technology to business. The shift goes from single, monolithic companies to business networks. A business network of several companies finds together on users' demand; each company with its respective core competence provides one component of the desired end-product.

The BRIDGE-IT exploitation plan validates the new business approach. The strategies of the industrial partners for the commercialization of their components mostly focus on groups of two or three partners, each targeting a set of components to a special branch. Furthermore, the technical interoperability allows marketing strategies apart from the BRIDGE-IT consortium.

For example, AED-SICAD's mobile device component can be marketed on two levels:

- With the reputation of a successful real estate pilot application, the real estate branch can be addressed and convinced by branch-specific know-how. A similar application of the component can be realized with BRIDGE-IT partners.
- With the background of a technical proof of the component and its technical interoperability, different branches and application can be addressed, e.g., local authorities planning road constructions or optimizing biotopes. A re-use of the component can be realized with external partners.

The components developed by the BRIDGE-IT project proofed their interoperability in different pilot applications. However, they are potentially useful for many more application fields. Therefore, we recommend the BRIDGE-IT partners to leave the "normal" ways of marketing and distribution of the new products. In contrary, we recommend to exploit the chance of interoperability by addressing new application fields and new customers.

To see it the other way around: An exploitation plan of the whole consortium for a common "BRIDGE-IT product" would have proofed the development of a monolithic, non-interoperable product, and thus the failure of the project.

We see the GI market borderline, meaning that a young market is on the border to become a real business. Still GI technology and GI business models are not sufficient, but they have an enormous potential, an they are advanced sufficiently to start a real business.

We think that the BRIDGE-IT project with its comprehensive approach of complementing technological developments with research in upcoming technological approaches (Janowicz and Riedemann 2004), business models and GI marketplace, and legal issues and contractual models (Janssen 2003) provide a significant impact on the further exploitation of the GI market potential in entire Europe.

13. OUTLOOK

The technical innovation is interoperability. Our approach is to transfer this approach to innovative, process-oriented, and interoperable business models. We suggest internet-based GI marketplaces. They connect GI value chains and enable providers to generate information services on users' demand.

As a follow-up of the BRIDGE-IT task, we suggest to initiate a project for the realization of a specific, vertical GI marketplace.

Our ongoing research addresses improvements of the current concepts of GI marketplaces, primarily:

- Automated semantic matching of human and technical GI services
- Automated processing of user requests, e.g., by an OGC conformant notification service
- Additional scenarios for customers requiring GI products.

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