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Marketplaces for Geographic Information

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Abstract. E-commerce and e-business require new business models and services for the geographic information market. This paper identifies electronic marketplaces for geographic information (GI) as main components of new business models for an expanding GI market. It evaluates existing spatial and non-spatial marketplaces in order to develop key issues and guidelines for the (re)design of marketplaces adapted to the special requirements of the GI market. It describes services GI marketplaces need to provide. The consideration of technical aspects as well as business, organizational and institutional aspects leads to six categories of services: 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. The paper provides the basis for the ongoing research in developing a "cookbook" for the (re)design of marketplaces for geographic information.

1. Introduction

Geographic information (GI) lags behind the expected market growth. The vast majority of potential users of geographic information are not asking for the data sets they are mostly offered, but for information products and services that are tailored to their needs and ready-to-use. This requires a networked co-operation of the entire geospatial value chains of producers, service providers, integrators, service enablers, and end-users *(Niedzwiadek 1999)*. The challenge is to develop new models and successful mechanisms for the communication and co-operation of buyers and sellers of geographic information.

The following section describes new business models for the market for geographic information and suggests electronic marketplaces as organizational, institutional, and technical frameworks for co-operation. Our methodological approach for the development of key issues and services of electronic marketplaces for geographic information is to evaluate existing national and international marketplaces, of the GI market as well as of other economic sectors (section 3). As a result (section 4) we address the following key questions:

- What is a marketplace for geographic information?
- What are the services provided by a marketplace for geographic information?

Finally, we summarize our results and give an outlook on further research (section 5).

2. Why does the market for GI need marketplaces?

The future market for geographic information is not a market of data but a market of geographically referenced information products generated by technical and organizational services applied to data. The provision of services and particularly the organizational and technical integration of various services are not yet solved. There is a lack of co-ordination on a business level (e.g., process-oriented business models) as well as on a technical level (e.g., architecture for a service-oriented distributed computing environment).

The market for geographic information needs marketplaces for three reasons:

- The general trend of all economic sectors towards e-commerce and e-business applies to the GI market as well, because of the requirements of customers and providers.
- The future production of goods will be organized in process-oriented, internet-based business networks.
- The special requirements of the GI market for an extended co-operation of providers and an extended possibility of exchanging and integrating services produces a particular need for marketplaces and specific adaptations for the GI market.

The GI market wants and needs e-commerce und e-business. This requires new forms of business models that we call *business networks.* Business networks need an organizational, institutional, and technical framework for co-operation. In addition, the specific requirements of the GI market have to be supported by service-based *marketplaces for geographic information.*

2.1. E-commerce and e-business

In all economic sectors e-commerce and e-business is *the* success factor. Underestimating the internet causes hardships for companies. For example, SAP stocks declined from more than 600 Euros in 1998 to 265 Euros in 1999 because of the company's internet strategy. After investing some hundred of millions German Marks into new concepts, e.g., the new software platform mySAP, SAP recovered

with a stock exchange of 740 Euros in March 2000 *(Kerbusk 2000)*. 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. For example, ordering geographic data at the surveying authorities of North-Rhine-Westphalia, Germany, the far biggest data producer in North-Rhine-Westphalia, is not yet realized *(Fornefeld 2000)*.

B2B marketplaces are successful and promising in businesses world-wide. A ten-fold increase until 2002 leading to 600-800 electronic marketplaces in Germany, with an expected volume of up to US$ 15 billion is estimated *(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 *(Abel 1997)*. Consequently, GI marketplaces spring up, e.g., InGeoForum *(InGeoForum 2000)*, Geodata Infrastructure North-Rhine-Westphalia *(Brox, Kuhn et al. 2000a)*, geocommunity *(geocommunity 2001)*, OGETA *(OGETA 1999)*, and www.GeoMarktplatz.de *(www.GeoMarktplatz.de 2001)*. Yet, there are few, some of them are in a rather conceptual stadium, and a break-through toward usable and accepted geographically referenced products is still far away. The following two sub-sections point out the specific needs of the GI market for marketplaces and the specific requirements of GI marketplaces.

2.2. Business networks

Today the value chains of geographic information often consist, at best, of the data producer and the user alone. This constitutes a monolithic economic system with low efficiency *(Brox, Kuhn et al. 2000a)*. The turnout of this business model very often consists of geographic data sets that are not accepted as valuable products by most users. Neither are the expectations of data producers presently fulfilled nor is the economic potential of the GI market exploited.

The combination of data and *services* ("interoperation") is a key concern to develop a GI business network. There is a need for an interoperable production infrastructure for spatial applications. Production steps are data selection, integration, domain-specific data processing and information extraction, data analyses, and data representation *(Landgraf 1999)*. We have proposed *business networks* as a flexible response to the urgent need of generating information products that are tailored to the users' needs: Traditional and new providers of the GI market with complementary core competences find together on users' demand and generate the desired information products *(Brox and Kuhn 1999)*. Only the co-operation of the entire geospatial value chains of producers, service providers, integrators, service enablers, and end-users *(Niedzwiadek 1999)* can add the necessary services to the raw-material geographic data set. And only this effects the turnout of usable information products which will be successful in the market. A goal of marketplaces for geographic information is to support forming business networks organizationally and technically, e.g., by transferring existing solutions for the co-operation within virtual organizations to the GI market *(Rittenbruch, Kahler et al. 1999)*.

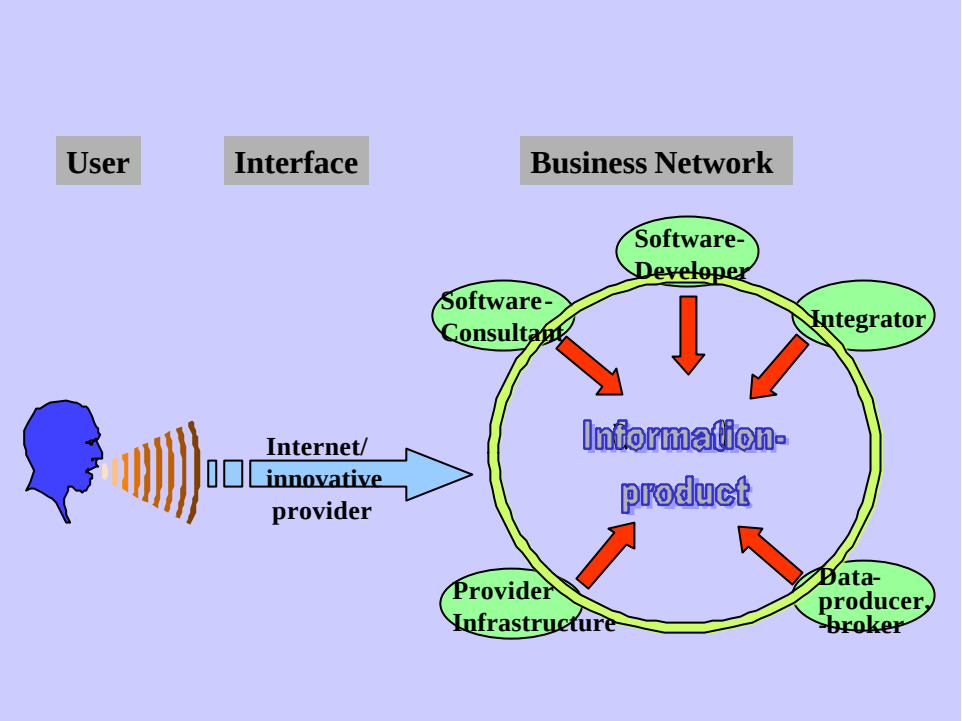

Figure 1: Business Networks

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 with 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 products.

Both, the interface between buyers and sellers, and the process-oriented production of information products within business networks, requires organizational, institutional and technical frameworks. We call the needed frameworks electronic *marketplaces for geographic information*.

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)*.

Geographic information and its market is complex. 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 from intermediate products, data and services.

To generate an information product, technical and organizational 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. The more complex case of generating an information product is the integration of non-automatic procedures into the workflow, e.g., consulting by an information broker.

This evokes two specific requirements of the GI market:

- an extended co-operation of providers with providers
- an extended possibility of exchanging and integrating services.

Therefore, it is particularly important for the GI market to establish horizontal and vertical marketplaces as main components of a business infrastructure and to support the specific requirements of the GI market.

3. Approach

In the 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 paper evaluates in the context of this GI marketing philosophy

- Non-spatial marketplaces, e.g., mySAP.com *(SAP 2000)*
- New marketplaces of the GI market, e.g., InGeoForum *(InGeoForum 2000)*
- The conception of a geospatial infrastructure in North-Rhine-Westphalia, Germany *(Brox, Kuhn et al. 2000a)*.

Marketplace	**Link**
Non-spatial	
Altra Energy, US	http://www.altranet.com
Amazon, UK, Germany	http://www.amazon.com

BizBuyer, US	http://www.bizbuyer.com
BizWiz, US	http://clickit.com
Chemplorer, Germany	http://www.chemplorer.de/
mySAP.com, Germany/US	http://www.sap-ag.de/germany/products/mySAP/index.htm
Ricardo, Germany	http://www.ricardobiz.com
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
Geocommunity, UK	http://spatialnews.geocomm.com/dailynews/2000/jun/08/crworld.html
Geospatial Data Infrastructure North-Rhine-Westphalia, Germany	http://gdi-nrw.uni-muenster.de, *(Brox, Kuhn et al. 2000a)*
InGeoForum, Germany	http://www.ingeoforum.de/
InGeoIC, Germany	http://www.ingeoic.de/
OGETA, US	http://www.ogeta.com/objective.html
SICAD Internet Suite, Germany	http://www.sicad.de/produkte/is/is_roadmap.htm
www.GeoMarktplatz.de, Germany	http://geomarktplatz.de/informationen/konzept.htm

Table 1: Evaluated marketplaces

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 Muenster "Scientific Consulting of Geospatial Data Infrastructure North-Rhine-Westphalia (GDI)" *(Brox 2000b)*, *(Kuhn, Basedow et al. 2000)*.

We studied the international and national success factors concerning the following key questions of GI marketplaces:

- What is a marketplace for geographic information?
- What are the services provided by a marketplace for geographic information?

4. Key issues and services of marketplaces for GI

The future market for geographic information is service based, yet the market lacks mechanisms for the provision and integration of services on an institutional, organizational, and technical level. Business organizations are, in essence, mechanisms for co-ordination *(Malone and Laubacher 1999)*. We suggest marketplaces for geographic information as business organizations that provide the required co-ordination that is crucial for the GI market. Marketplaces can be considered as middleware, particularly in an organizational sense but in the technical

meaning as well.

As a result of this paper we describe what marketplaces for geographic information are and the services they offer.

4.1. What are marketplaces for geographic information?

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)*.

4.1.1. 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 geographically referenced products, business and government
- Buyers of geographically referenced 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 4.2.2).

4.1.2. 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. 2000a)*. 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 an insight knowledge and sector-specific solutions will be provided.

4.1.3. Products

The GI market is a highly fragmented market with a great variety of buyers, sellers, systems, formats, users, and user requirements. Consequently, the products to be offered within a GI marketplace cover a broad spectrum:

- Information products consisting of data and added services for users (business), e.g., a map with statistical demographic data of X-town for an insurance company
- Information products consisting of data and added services as intermediate products for providers of the geospatial value chain, e.g., an integrated data set with environmental and traffic data for an information broker to be processed and sold to landscape planners as a basis for freshwater reconstructions
- Technical services, e.g., selection within a data set
- Organizational service, e.g., consulting about usability of data sets or software products
- Software tools
- Information, e.g., about existing environmental data sets in X-town
- Education and training.

4.1.4. 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 product consisting of data and services (see 2.3). Mostly such an information product is not on stock and not ready-to-use but has to be generated by technical and organizational services of various players in the GI market.

This extends the focus of GI marketplaces by two key issues:

- The co-operation of providers with providers has to be supported.
- The exchange and combination of services has to be guaranteed by an institutional, organizational, and technical framework, i.e., standards, access rights, usage.

4.1.5. 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 products 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)*.

4.2. What are the services of a marketplace for geographic information?

The definition of a marketplace is given by the services it offers. We describe categories of services and services themselves to be offered by horizontal or vertical marketplaces for geographic information. We intend to 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.

4.2.1. 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 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 4.1.1).
- *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 of standards and tools for co-operation. 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)*.

4.2.2. Services

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).

Services	Relevance
Matching buyers and sellers	
1. create and maintain catalogue of offered products (services and information products)	m
2. provide query mechanism for products (search and discovery) 2.1. (meta-)metadata of data, services, and information products 2.2. facilitate price determination 2.3. information about reference projects	m
3. publication of requests for information products on a Bulletin Board	o
4. visualization 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 products 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 products	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 products, 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. supervising and controlling 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	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 services and information products 26.1. metadata 26.2. offered products (data sets, technical services, organizational services, information products) 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. multilingual services	m
28. initiate and maintain international co-operation	m
29. education and training	o

Table 2: Services of marketplaces for geographic information

Table 2 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.

5. Conclusions and outlook

This paper has suggested marketplaces as core components of the expanding, internet-based GI market and its infrastructures. It described the service categories and services we consider necessary for a successful GI market.

Marketplaces are particularly essential for the GI market because of its structure and its products. The GI market is fragmented; it addresses a great variety of communities with specific requirements, semantics, and systems. Successful products of this market are not data sets, as has long been believed, but services and information products tailored and configurable to the users' needs.

For the GI market it is particularly important that providers of entire geospatial value chains can co-operate in process-oriented business networks to generate the required geographic information products. Marketplaces can support and co-ordinate this evolution by providing an organizational, institutional and technical framework.

We see GI marketplaces as a platform for business-to-business relations. Marketplaces are tools to connect the value chains of the GI market. There is a need for horizontal marketplaces as well as for vertical marketplaces for various sectors that fulfill the specific requirements of buyers of geographically referenced products, e.g., insurance companies, telecommunication, or logistics.

In general, all geographically referenced products can be marketed within the GI marketplace. The most successful and urgently needed products will be information products and services for their generation. Mostly, an information product is not on stock and not ready-to-use but has to be generated by technical and organizational services of various players of the GI market. This causes the extended need of the GI market for the co-operation of providers with providers and for a framework, i.e., standards and specifications that support the exchange and combination of technical and organizational services.

In order to reach the critical mass of business partners and products, marketplaces for geographic information have to be open technically to ensure interoperability as well as organizationally towards new users, providers, and market requirements.

The business of a GI marketplace is defined by the services it offers. We have described the technical services and put an emphasis on business aspects as well as the special needs of the GI market. This led to six categories of services:

- matching buyers and sellers
- support co-operation within the geospatial value chain
- facilitation of transactions
- marketing
- provision of an institutional, organizational, and technical infrastructure
- provision of additional services.

Further research will detail and test the proposed services by a (re)design of specific marketplaces for geographic information. We intend to develop a process for defining the required services on a strategic level, based on the services and categories described, and to detail the services on a business process level. A generalization of such case studies is expected to lead to a cookbook, similar to that of (GSDI 2000), to be applied by companies, organizations, and institutions for the (re)design of GI marketplaces.

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