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Elements of a Reference Model for Electronic Markets

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Abstract

A marketplace as a historically-evolved institution allows customers and suppliers to meet at a certain place and a certain time in order to announce buying or selling intentions which eventually match and may be settled. Due to the evolution of communication technologies time and space restrictions have been weakened.

Electronic markets (EM) representing the next step in the evolution of the former marketplace. They are emerging in different fields, supporting the exchange of goods and services of different types, with different types of actors and are following different architectural principles.

Some of the existing new systems are solutions for just parts of the transaction process which do not inter-operate with other systems. Further, the Internet with its tremendous evolution fosters the development of EM in retail business. A lot of different EM will arise which have to co-operate and network with each other. This rather hinders a structured development of EM and demands for common architectural principles. The necessity for a reference model towards real EM is given.

1. Coordination mechanisms

The business world is to a large extent determined by the activities of interacting organizations. A task within the domain of these processes lies in the *coordination of activities* as well as output of the participants. Fundamental forms of business coordination are: hierarchies, networks and markets [23], [24], [30]. If information and communication technology for coordination is applied within the framework of these basic models, then reference to an electronic hierarchy, electronic business network and electronic market can be made [21], [36], [13].

The market is the location where the supplier and customer meet [9] whose activities are governed by price and competition [22]. Significant problem in this respect is the information deficiency or asymmetry between the market participants [8]. The concept "electronic markets" [21], [26] is subject to wider consideration of this paper and will be analyzed in detail in the following chapters. EM result

if the information phase is realized or supported with means of a new information carrier. This is among other things due to the large transparency and low search costs resulting in more competition and globalization. The secondary effect of automatic price fixing is indeed still a seldom occurrence, however the effects of price fixing are immediately felt (compare the global reservation systems in the airline market).

2. Theory of electronic markets

Since 1989 the research area "electronic markets" is a relevant topic for the CCEM Competence Centre Electronic Markets at the Institute for Information Management, University of St. Gallen. An overview of the previous work and a detailed analysis of the theoretical framework can be found in [26], [10], [15], [16].

Although a number of EM were constructed in the past, suitable reference models in contrast to data modeling or business process re-engineering are missing to answer the question: "How can an EM be built and operate?". In the following section a reference model for electronic markets will be discussed, which attempts as a meta-model to present relevant elements. This meta-model is necessary for the development of application-relevant models of specific EM. Important for the understanding of the proposed reference model are the phases of a market transaction which form the basis upon which the concept "electronic markets" is developed. It has to be stated out, that the following proposal is from the viewpoint of an information manager, and not of an economist.

2.1. Phase model of market transactions

A market transaction corresponds to a finite number of interaction processes between market participants in various roles. The goal is to initiate, arrange and complete a contractual agreement for exchange of goods and services in the most efficient manner. The involved interaction processes are grouped into classes and form the *phases of a market transaction* [16, pp.18-22].

1. In the *information phase* suppliers and customers acquire a market overview by gathering information, regarding the general business environment and technology on one hand and information concerning the potential market partners (e.g. liquidity, ability to meet delivery date) as well as goods and services (e.g. specifications or conditions) on the other hand. The information phase ends for a market participant with the submission of an offer. With the receipt of an offer, the start of the agreement phase takes place.
2. In the *agreement phase*, conditions of the transaction are negotiated which will allow for an agreement to be made. The result is a legal-binding contract representing the agreement between the market partners. This can simply take place when an order is made involving fixed prices (e.g. product catalogs in which the price is pre-set). In other cases the agreement can be reached e.g. through an auction.
3. In the *settlement phase*, the agreed-upon terms of the contract are fulfilled. Depending on the type of the exchanged good or service as well as the participating partners, the settlement phase can have varying sub-functions. The terms for e.g. physical goods may include packaging, transport, storage and insurance. In this respect, this phase is an initiator of secondary market transactions (e.g. logistic and financial services [2]). Result of the settlement phase is the fulfillment of contract.

Figure 1 summarizes the explanation above and shows the result of each phase.

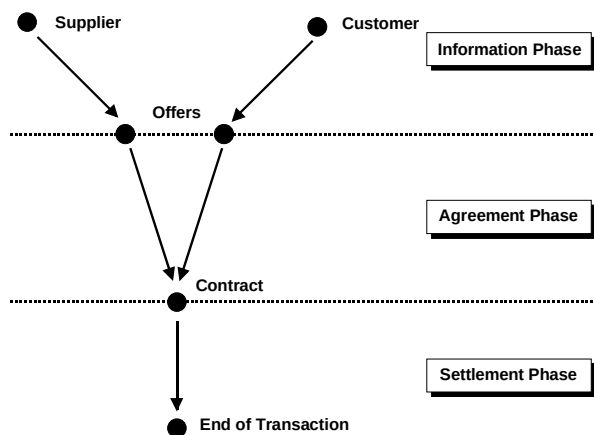


Figure 1. Phase model of market transactions

For the assessment of efficiency of a market transaction, the theory of *transaction costs* [5] can be applied which can assist in describing a portion of costs accruing in the individual phases. An overview of the individual components of transaction costs can be found in [5], [15, pp.179-184]. Transaction costs constitute a major share of the total price of a product today and are significantly in-

fluenced by information and communication problems. [Krähenmann 15, p.175] discuss in this respect "friction" and "coordination" costs. In addition, inadequate information transparency [6, p.148] with regard to the current market situation, as well as various uncertainty factors in view of unpredictable future events in the business environment and insufficient communication canals between the interactive partners influence transaction costs.

The merging of telecommunication and informatics to form *telematics* reduces the coordination of services between organizations over long distances and allows for the implementation of world-spanning decentralized coordination systems which the activities of decentralized systems are harmonized with. For this reason, telematics provides a large potential to reduce transaction costs [21], [26].

After laying down the fundamentals of phases of a market transaction, transaction costs and telematics systems, the concept of "electronic markets" will be discussed.

2.2. The concept of an electronic market

The evolution of *electronic markets (EM)* has just started. Significant characteristic of an EM is its independence from time and space. As long as a market participant has access to the underlying telematics system, no restrictions in respect to space and time (24h x 365d) are present. EM are ubiquitous and thereby available globally. They come close to the ideal point-market of neo-classical theory and offer the same chances for large as well as small and medium-sized enterprises. This characteristic differentiates EM significantly from real markets [28, p.20].

An EM, i.e. a market in the cyberspace, supported by telematics can be understood to be a market place which supports all phases or at least the information phase of a market transaction. An EM is accordingly a coordination mechanism for the market exchange of goods and services and represents the total - or a certain quantity - of the exchange relationships between potential market partners having equal rights. The interactive process between the market participants are thereby supported by electronic market services.

Requirements of an EM and their architectures derive from the needs of its participants, i.e. the customer's, the supplier's, the service provider's and the operator's requirements. Figure 2 depicts the concept of EM in a very simplified manner.

Sometimes the potential *customer* („Demand“) is looking for offers either in a specific field, or even in a complete unspecific way. At other times the customer has a specific demand for a certain good or service of a certain type. Electronic market services provide help for the selection and the evaluation of offers which are of high interest; these services are key services in EM. They reduce

the search expenses and therefore the transaction costs. An EM should also contain mechanisms allowing for negotiation (e.g. auctions) and automated set-up of electronic contracts which are binding for customers and suppliers, i.e. adding a certain level of trust and guarantees, even in case of failure of fulfillment. Further, the customer not only asks for end prices for products delivered, but also for the possibility to buy options on a contract (and thus the right on the agreed upon terms and conditions). Moreover, it should be possible to sell these contracts on the same EM, as it is possible today e.g. in stock markets.

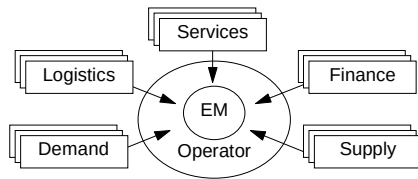


Figure 2. Simplified concept of EM

Complementary to the customer, the *supplier* („Supply“) wants to advertise and reach a high number of customers. Quantity is her success factor in the ever increasing competition, besides price and quality. So, the supplier demands to forge links between her selling bids and the customer's buying bids. While the customer might want to know the end price including shipment, insurance etc., the supplier usually prefers to indicate the actual price of the product at its current location. Thus, functions are required which help to calculate the total logistics costs, including e.g. taxes, fees, risk and credit costs. In the same way as the customer wants to have reliable information about the supplier, the vendor needs information about the customer. During the settlement phase the different expectations of customer and supplier have to be matched. Therefore, the fulfillment of (electronic) contracts in a generic way and in the most profitable way will be a key service in electronic markets, too.

Service providers („Services“, „Logistics“, „Finance“) supplement the offered goods and services of an EM or provide special services. Depending on the phase of a market transaction different service providers have to be integrated. Within the information phase secondary market information can influence the selection process (e.g. business news or test results). Trusted third parties and certification authorities are necessary within the agreement phase to negotiate contracts (e.g. time stamp and archive services). The settlement phase often initiates secondary market transactions to deliver and pay the ordered goods (e.g. tracking and tracing systems or customs clearing). In order to reduce transaction costs and to provide a permanent and constant support of the transaction execution [20], organizational arrangements and technical issues such as common standards and interfaces are necessary.

The *Operator* runs the EM and can be, depending on the business model, an autonomous operator, a group of market participants, a single supplier or a service provider. Operator's requirements can be derived from the sketched business models below.

With this short introduction into the theory of EM the basis is given for the proposed EM-RM.

3. Reference model for electronic markets

EM are emerging in different fields, supporting the exchange of a variety of goods and services with various participants and incorporate different architectural designs. Observable consequences of this heterogeneity is the diversity of the approaches for the creation of EM as well as the emergence of proprietary systems, i.e. manufacturer-dependent and closed systems. An example may be the cargo community systems for business-to-business relations. Some of these systems offer only solutions for partial areas of a market transaction and are in addition not networked with each other. From the viewpoint of the user, this limits the simple and comfortable execution of a market transaction and the inter-operability between the systems. Based on the enormous development of the Internet, an increasing number of EM for the retail sector, i.e. business-to-consumer relations, have been created, too (e.g. the auction system Onsale [34]). However, a structured development of EM is in this manner not possible.

In the future, all these EM platforms must be able to communicate with each other in order to be able to offer the requested services (e.g. integration of a customer-preferred banking institution and logistic service provider). This requires common architecture designs to build up an EM as well as procedure models to integrate market participants and to operate the EM which a reference model for electronic markets should take into account. Significant elements of this reference model are discussed below after explaining the scope of the proposed model.

3.1. Framework for specific models

A *reference model* should provide a framework for the creation of an application-related model, i.e. a reference model can be the basis for the design of specific models to depict reality or a part of it. The normative character of a reference model can be seen in its design for the depicted class of problems. The quality of an application-related model can be measured by validating the following requirements [25, pp.16-34]: syntactic and semantic completeness and correctness, adaptability and applicability. By now, the *reference model of electronic markets (EM-RM)* does not include any aspects of semiotics which are mainly relevant for formal modeling (e.g. data modeling),

therefore the focus lies on adaptability and applicability. These aspects are addressed by concepts and concrete elements which are elaborated in dedicated research projects with industrial partners, mainly in the sectors of media, finance, logistics and tourism (refer also to [31]).

The proposed EM-RM consists of two dimensions. The horizontal dimension contains the three phases of a market transaction whereas the vertical dimension is built of four views. The four views can be grouped into two main blocks of which the upper two views (Business and Transaction View) focus on *organizational aspects* with rather long-term impacts whilst the lower two views (Services and Infrastructure View) depict *technological aspects* with mainly short-term impacts.

The constraints of an EM are determined by *strategic* decisions, including decisions on which market service should be applied. The software and hardware system on the other hand are more *operational* by nature since they implement market services as well as the communications infrastructure for an EM. In the same way as a commander operates with his strategic line of approach and troops, an EM needs the flexibility to operate in an uncertain environment and must be able to handle unpredictable events. These *tactical* possibilities are determined by rough strategic decisions on the level of the Business View and are applied to alternative business scenarios within the Transaction View. The design of the market services determines the details of possible actions which in turn depend on the interconnection with the underlying infrastructure. Figure 3 visualizes the characteristics of the different views within the vertical dimension.

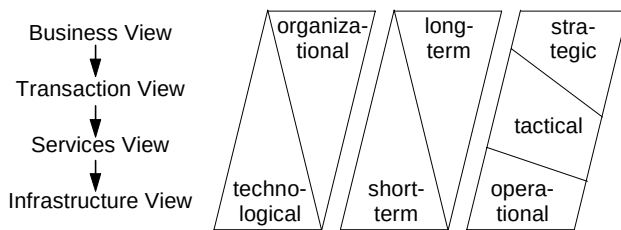


Figure 3. Characteristics of different views

The following chapter gives a detailed explanation of the dimensions of the EM-RM. Some of the outlined concepts of organizational aspects are based on the Open Distributed Processing (ODP) reference model [11], Open-edi approach [12] as well as [17].

3.2. Overview of the elements

Figure 4 shows the EM-RM in more detail. The concepts and individual elements are described in the following sub-sections.

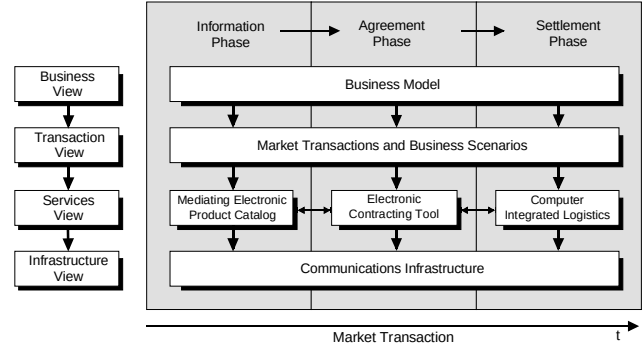


Figure 4. Proposed reference model (EM-RM)

Based on a business model which underlies the EM, the relevant market transactions and business scenarios between the market participants are to be identified, described and formalized. The design of the Business View but also the Transaction View is strongly dependent on the respective context of the to be described EM. Based on this reason, especially for the Transaction View, only a rough design proposal can be given. However, the necessary electronic market services of the Services View should be of generic nature: long-lasting, expandable, adaptable and reusable modules. After representation of the required market services, considerations of the Infrastructure View for the information and communication processes within the EM are to be undertaken.

3.2.1. Business model of an electronic market. A *business model* is the basis for an EM. An external orientation involves the general outlining of the purpose for the EM in a „mission statement“ in order to position the EM and to obtain potential participants for this EM. Internal orientation, i.e. for the market participants, the individual goals and strategies as well as business opportunities are to be described and harmonized with each other.

During the modeling of a specific application-orientated EM, e.g. the following focal issues are analyzed: Is market access open or does it apply only to certain groups? Wherein lies the value-added aside from the mere transaction service? What intentions, scope, business policies do the market participants have?

The one-time specified business model establishes thereby the framework for the creation and operation of an EM as well as determining the latitude for negotiations within which the electronic trade is carried out and derives the requirement for supporting services. On this level, the EM-RM attempts to provide methodology and modeling concepts which support the process of designing business models.

The following *fundamental business models* for the operator of an EM build a framework of reference not only for the operator, but also for the other participants of an

EM (Figure 2). Four fundamental business models can be distinguished which can occur in combination and impacts the specification of potential market participants:

- *Autonomous operator*: The operator is an independent organization or institution who charges the other participants for usage of the provided infrastructure and knowledge (e.g. flat-rates, monthly fees, transaction fees or advertisement). Customers can profit from professional services and independence and suppliers do not need technical knowledge to set-up an EM - this is especially relevant for small and medium-sized enterprises (e.g. PSN - Prodigy Shopping Network [35]). Sub-models can be specialized in regions, branches, specific customer problems or combinations (e.g. EMB - Electronic Mall Bodensee [32]).
- *Participants as operator*: Like in stock markets, participants know the rules, are well-known, act in different roles (customer and supplier) and trade standardized goods and services. The institution which runs the EM is often a new company founded by the participants. The main motivation for this business model is to reduce transaction costs for standardized and recurrent transactions and to keep control over the EM (e.g. SOFFEX - Swiss Options and Financial Futures Exchange [16, pp.63-69]).
- *Service provider as operator*: A service provider (e.g. a logistics company) is - like the autonomous operator - indifferent to the traded products. The motivation for a service provider is to sell her own products exclusively in combination to the offered goods and services. An example may be an integrated delivery service in an electronic mall which is operated by a carrier or the approach of the "VirtualOrder" concept from FedEx).
- *Supplier as operator*: This business model is best suited for big suppliers or warehouses to extend their core business. These operators supply individual customer solutions on an own EM supplemented by other suppliers and service providers. By means of interacting only with one market partner, the customer pursues her motivation to reduce transaction costs. The other suppliers and service providers are able to provide complementary customer solutions.

For the specification of potential market participants and possible actions, the business behavior of the market participant, their activities and procedures as well as the rules to be followed are described. Business rules involve for example facts of strategic planning (e.g. definition of business units in EM), possible decisions of tactical management (e.g. resources to be provided in the medium-term) or operational conditions (e.g. requirements relating to accounting procedures or the manner in which duties and rights are transferred).

A defined business model results in a requirement for directing the flow of operations in EM. Mechanisms are

necessary which provide the required services in the EM (e.g. guarantee of a security level or measures for trust). In addition, the affected market transactions must take place as requested. This need for a steering mechanism is satisfied within the next level Transaction View for the specification of market transaction and business scenarios.

3.2.2. Business scenarios and atomic transactions. The permanent and constant execution of a market transaction is achieved through an alignment of the business procedures of the market participants or the "way of doing business". This makes it easier to support trade relations electronically and offers potential for new forms of electronic business activities. Following the terms business processes, business scenarios and atomic transactions are explained in the context of the EM-RM.

Within each phase of a market transaction several inter-organizational *business processes* can occur (e.g. the process of guaranteeing non-repudiation services within the agreement phase or the control of the delivery status via a tracking and tracing system within the settlement phase). Business processes often imply a more internal view or the view of a closed user group. In such an EM open modeling techniques are inevitable. Identified business processes can be formalized and harmonized by standardized business scenarios. A *business scenario* according to the Open-edi approach [12] is a formal specification of a business process. The participants in the scenario as well as the information objects to be exchanged are to be specified. A "role" is a description of the behavior of an organization or institution within a scenario and corresponds to a business function. An "information object" is a formal description of the semantic content of the information to be exchanged. The following diagram (Figure 5) shows an exchange procedure between participants within the settlement phase [18]. In the illustrated scenario, three roles are involved: buyer (customer), seller (supplier) and shipper (service provider). The role of the seller can in some cases include the role of the shipper, if the buyer consents during the introductory automatic negotiation.

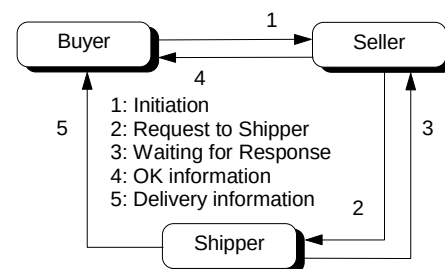


Figure 5. Exchange procedures in a scenario

Under consideration of the rules within the Business View, a time and situation-based assignment of informa-

tion objects to roles occurs in order to specify the process of interactions between the roles. The EM-RM provides necessary techniques for process modeling. From the viewpoint of the EM-RM there are no prescriptions for one special technique. Rather suggestions should be made when a technique is proven to be suitable, which can take place in the form of application-related case studies (e.g. within the LOGEC - "Logistics and Electronic Commerce" project [33]).

Documentary Petri Nets (DPN) can be applied since they fulfill most of the formal and notational requirements. DPN are a graphical formalism which is used for the representation of simultaneous or adjoining processes. With the use of DPN, condition diagrams in which the state of objects are graphically illustrated are combined with oriented diagrams with which the link between two objects is represented [4]. They are an extension of classical Petri Nets in order to be able to differentiate between the functionality of various document types as well as the integrated actions.

Within the framework of the Transaction View, the steering requirements derived from the respective business model is satisfied in the corresponding business scenarios. The modeling techniques to be applied make however no statements about the steering components to be used; they rather merely describe the manner of the steering. Below this more process-orientated sub-layer of business scenarios within the Transaction View, there need to be another sub-layer which serves *atomic transactions*. A business scenario consists of one or more of such sequential or parallel atomic transactions (e.g. information phase: query of an electronic product catalog or agreement phase: the filing of a business document serving as an evidence). These atomic transactions have to be identified and described according to the business scenarios.

The offered services of atomic transactions are realized by using the underlying market services of the Services View, e.g. the service of an electronic product catalog or a computer integrated logistics as it is described below.

3.2.3. Market services for the support of market transactions. Theoretically, each phase of a market transaction is supported by specialized electronic market services. It is apparent that within the framework of a market transaction, the services of the agreement and settlement phase respectively also must go back to information in the previous phase. Therefore, suitable interfaces between the electronic market services are necessary.

Key element of an EM are *electronic product catalogs (EPC)*. EPC support information exchange between the market participants. Instead of an electronic version of printed product catalogs, they function as an interface of the supplier to the market, allowing for ordering and using an unlimited number of value added services, as they are

known in the World Wide Web. With the use of well-designed EPC transaction costs can be significantly reduced. Therefore, the architecture of EPC is a central element of a competitive EM architecture.

The gap between the supplier's description of her offers and requirements on the one hand and the wishes and requirements of the customer on the other must be bridged. This is the field of intermediaries, so called *mediating electronic product catalogs (MEPC)*. They match the supplier's EPC with the customer's query EPC (Figure 6).

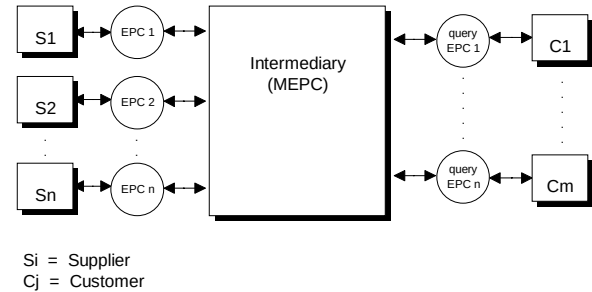


Figure 6. The field for intermediaries

A great number of organizational solutions for this problem are established in real markets or proposed for EM. Examples are EM for specific product types, institutions of dealer or trader, or the concept of automated agents. A symbiosis of several of them seems to be most efficient and probable. EPC concepts which strive for semantic representation have already been described in research literature [7], [27]. Via a recursive architecture and applying a uniform semantic, EPC of different suppliers can be customized. The supplier represents her products in an EPC allowing for a recursive architecture, i.e. the production of new EPC is based on already existing catalogs. A customized EPC stems for example out of all tourism catalogs offering services for golf vacations in South Africa in October.

Within the agreement phase, an *electronic contracting tool* including special tools for the negotiation of traditional trade via new electronic means can be applied. Some elements of the contract stem out of the EPC. This allows not only a cheap creation of contracts, but offers also the possibility of the establishment of a market for contracts itself. Electronic contracts imply a bundle of services like legal ones or insurance related ones, but should be abstract enough to leave open a variety of ways for fulfillment or settlement. On the other hand, the contract should specify all requirements of the transaction partners (e.g. when and where the merchandise has to be delivered), how and when the payment has to take place and what penalty will be applied if things go wrong. In other words, the contract should specify the "What" in-

cluding exceptions, and not the "How". This relative young research area is achieving increasing significance due to international and across-border business activity via Internet and requires interdisciplinary thinking to satisfy legal, economic and information technology demands. Relevant topics are e.g. establishing trusted third parties and certification authorities as well as security and trust-building services.

Goal and content of the settlement phase are mainly the booking, payment and delivery of ordered goods and services. The contracts negotiated in the agreement phase and concluded in the settlement phase provide the basis and specifications for this. A service of *computer integrated logistics* [3], [1] allows suppliers at their location to exchange merchandise for money and similarly purchasers can exchange money for merchandise. This model serves as an integration of EM for logistics of merchandise and finance and is a significant building block of EM in the settlement phase. The settlement of contracts can be offered and performed by specialized service providers, maybe offered in a separate EM for computer integrated logistic services, which integrates already existing transportation services and other services.

The transition from the Services View to the Infrastructure View represents the necessary information technological (IT) processes for market services. Herein the required concept of data and message exchange is applied (e.g. electronic data interchange, EDI).

3.2.4. Design of an open communications infrastructure. From the viewpoint of the *communications infrastructure*, a permanent and constant support of communication processes between all participants is to be ensured. In essence, all components necessary for the construction of distributed systems should be made available. If the components use offered services or provide them, the result is a client/server system [29].

An important issue within the Infrastructure View in connection with the development of the Internet is to connect the "classical" world of EDI with the Internet in general and the World Wide Web in specific [19], [14]. Today, both worlds exist in parallel. Most large firms use value-added network service providers (VANS). The Internet is being used increasingly by small and medium-sized enterprises. Tasks to establish a communications infrastructure for an EM apply to the requested IT aspects for the support of market transactions: organization of the inter-operability between IT systems, definition of the interfaces between applications, gateways for seamless integration of VANS-based and Internet-based EDI concepts, inclusion of trust-building services as well as identification and integration of further required services. These tasks will strongly be taken up by national and international telecommunication service providers and new competitors

in this market segment. It is expected that the still existing gap in the near future will be closed through currently available or new and innovative solutions.

3.3. Central ideas and outlook

EM are supported by telematics and provide a large potential to reduce transaction costs. As stated, that is especially true if an EM is developed in a structural manner, so that the resulting EM becomes non-proprietary, flexible and open. The proposed EM-RM aids to align architectural principles.

The elements of the EM-RM were grouped into the two main blocks: organizational issues and technological issues. For the organizational part four fundamental business models have been identified and the concepts of standardized business scenarios as well as atomic transactions have been introduced. These elements should be taken into account before starting to implement an EM.

The technological issues have been focused primarily on electronic market services which should be of generic nature. Key element of a competitive EM architecture are EPC, because they reduce the search expenses and providing a multitude of additional services. MEPC seem to be best suited to meet the requirements of the EM-RM. Trust-building services are a must for wider acceptance of EM. However, a lot of necessary services have not been defined yet and suitable institutions which can be integrated into the processes of market transactions are still missing. Currently most efforts on the World Wide Web address electronic market services for the settlement phase, i.e. payment services (e.g. the secure electronic transactions standard, SET) or services concerning the transport of ordered goods (e.g. electronic commerce solutions like "WebAPI" or "VirtualOrder" by FedEx). Nevertheless, an integration of the different services for the settlement of an electronic market transaction is still lacking. Among other things, a common EDI concept should be developed to integrate the different applications and systems.

It might seem appropriate to extend the EM-RM by a further function addressing communication or community issues. This helps to establish a relationship among customers and between customers and the company, creating a community of people sharing common interests. Customers interact among each other and exchange information e.g. about experiences with company goods or services. The information from customers to customers thus provides an additional level of trust (many-to-many). Additionally, the company gets the chance to directly respond to customer requests and needs, thereby strengthening the bond between the company and its clients (one-to-many). Being effectively implemented into an EM Platform it could be of high value for all parties.

4. Conclusions and hypothesis

This paper has attempted to provide a framework for the modeling of specific telematics-supported market platforms for the coordination of the exchange processes between the market participants. Thereby the vision of ubiquitous, location-independent and globally available EM should be given emphasis and the construction and operation of necessary platforms be made easier. The following two hypotheses summarize the most significant aspects of the necessity of a EM-RM.

1. *With a suitable reference model for electronic markets, the transaction costs can be significantly reduced.*

With increasing intra-firm networking on the one hand and the design of varying telematics systems spanning from bilateral inter-organizational systems to EM on the other, possibilities for the use of modern information and communication technology arise in a multitude of areas of business life in trade and industry. With the dissemination of these technologies through the application of integrated tools - especially within the Services View - the transaction costs can be significantly reduced. The largest potential within the framework of the outlined EM-RM lies in the described MEPC. Transaction costs can be reduced within contracting, if contracts are stem from an EPC. Also, the proposed EPC architecture allows one to design specific markets with powerful search mechanisms. Both are offered within the proposed architecture.

2. *A structured development of electronic markets requires a reference model for electronic markets and promotes the development of virtual enterprises.*

The present day observable heterogeneity and multifarious of EM platforms as well as the tendency for proprietary closed systems restricts the development of open systems for the coordination of the exchange processes between the market partners. With the increase in understanding of telematics systems with respect to requirements from the market participant, the operators of such platforms are compelled to communicate with each other, i.e. to exchange messages and data as well as adapt to processes. The EM-RM proposes common architecture designs, methods and procedure models in order to serve as a significant contribution to integration and cooperation of different systems. With suitable architectures such as the suggested architecture for product catalogs, specific EM can be built in a generic fashion. This can serve as a coordination platform between firms as well as within the firm. Thereby the EM-RM and its potential to reduce transaction costs supports the transition to the virtual enterprises.

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