Twenty Years of Electronic Markets Research – Looking Backwards Towards the Future

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Abstract

Over the past 20 years the field of electronic markets has seen a considerable proliferation and differentiation. This position paper takes the opportunity of the 21st volume of "Electronic Markets" to look back at important developments and insights, suggesting a framework that captures the multiple facets and indeed empirical breadth and depths of this concept. It comprises three perspectives which include the market environment, governance choices by economic actors as well as the entrepreneurial dynamics of firms who initiate and operate market platforms as their business. In addition, we propose to study the interplay of technological, market, and institutional drivers in order to understand the phenomenon of electronic markets, which is also a precondition for designing electronic markets. Both activities involve more than an economically motivated choice between the discrete alternatives of markets and hierarchies. Rather, electronic markets are configurations across multiple, interdependent dimensions: Technology is an important force in shaping the field, but needs to be complemented by considerations of the competitive environment and the setting of rules in order to ensure efficient and effective plays of the game. Based on this framework, this position paper develops six propositions for the future of electronic markets. Overall, the advantages of intermediated structures, an ongoing technological sophistication, as well as further innovation in market mechanisms and services make electronic markets an enabler for many inter-organizational value chains. While we are confident that the ingenuity of inventors will yield a flow of innovations, recent economic crises have shed a dark shadow over the sustainability of electronic markets. They call for suitable rules and regulation amenable to economic prosperity and stability to be agreed upon on a broad level.

1. A Brief Retrospective

It is 20 years that electronic markets emerged as a field of research. While inter-organizational systems, such as Electronic Data Interchange (EDI) in the transportation sector, computer reservation systems (CRS) in tourism and electronic exchanges in banking date back even longer, the well-known "Electronic Markets and Hierarchies" article (Malone et al. 1987) and research projects, such as the Center for Coordination Science (CCS) and the Competence Center Electronic Markets (CCEM) with the journal "Electronic Markets" have marked important milestones for a more generalized research on electronic markets. As mentioned in the editorial and the interview in this jubilee issue of Electronic Markets, the paper on electronic markets spawned a broad academic debate, which is still ongoing. It has – directly or indirectly – inspired numerous entrepreneurs to develop electronic markets. The claim that the development and diffusion of information and communication technology will lead to a shift from hierarchical structures to market structures has become known as the "Move to the Market" or electronic markets hypothesis (EMH). Although, the number of electronic markets has significantly decreased after the e-business hype, there are still 645 electronic markets listed in the directory of electronic marketplaces today (E-Market Services 2011). "What we were trying to do […], was to predict broad, historical trends" Malone says in the interview covered in this issue. In fact they did, so this position paper takes stock and makes sense of the developments over the past two decades and reflects directions for the future.

In retrospective, electronic markets have two origins. From the *technological side*, electronic markets comprise the application of information technology (IT) to support communication and allocation purposes among multiple actors in one or multiple value chain(s). Well-known examples are Electronic Data Interchange (EDI), electronic catalogs as well as matching and auction mechanisms. Together with growing standardization these technologies had important impact on the *economic side*, in particular the costs of organizing economic activity among organizations. These transaction costs are prominent explanations for the feasibility of markets or hierarchies and for deriving expectations on future developments, such as the EMH. However, despite the ongoing technological innovation in areas such as Internet protocols, electronic trading agents, standards, semantics and ontologies, technology does not determine the choice of governance structure. Understanding the organizational, strategic and social implications of the IT-based transformation is required to understand the successful adoption and operation of electronic markets. While it is not feasible for a position paper to summarize 20 years of electronic markets' research, five key insights shall be mentioned.

First, Malone et al. (1987) applied the nature of hierarchical relationships also to the inter-organizational setting. In particular, transactions between small and large businesses feature asymmetric power constellations which in consequence are similar to intra-organizational coordination. This view had important practical implications since companies in many industries strived to externalize activities and the electronic integration effect inherent in electronic hierarchies has become an important element especially in the business-to-business (B2B) segment. Well-known application areas are the outsourcing of IT operation (ITO), application service provisioning (ASP) or business processes (BPO).

Second, it has become clear that electronic markets are far from representing a homogeneous class of systems. For example, research on electronic markets in the B2B-area has shown that these hubs may either support systematic or spot sourcing (Kaplan and Sawhney 2000, 98f). Whereas systematic sourcing is based on long-term contracts with a carefully selected number of suppliers, spot sourcing pursues the goal of meeting an immediate (or single) demand from a number of competing suppliers. In the former sense, electronic markets would support network or even hierarchical relationships and in the latter classical market relationships. However, in both cases the respective IT systems would classify as electronic markets.

Third, the suitability of a specific form of governance cannot be judged based on transaction cost considerations only. Production and coordination costs as well as asset specificity and opportunism are not explicitly including factors, such as flexibility, adaptability, quality, trust and innovation, which are critical when companies make (out-)sourcing decisions. As soon as such non-contractible issues are present, the number of suppliers will be limited as the respective business partners are required to make relationship specific investments (Bakos and Brynjolfsson 1993, 51). Furthermore, the frequency of exchange, access to knowledge and industry structure, also influence the suitable form of governance (Glassberg and Merhout 2007, 54f). Obviously, rather than facing just a choice of governance modes, companies use the opportunity to configure complex coordination mechanisms.

Fourth, the EMH is closely related to contingencies of economic activities. Although IT may have reduced transaction and coordination costs as well as extended the scope of products that can be coordinated via market principles, the “Move to the Middle Hypothesis (MMH)” highlighted factors, such as market structures and transaction risks, which influence the success of market mechanisms (Clemons et al. 1993). These contingencies reach from the external environment (e.g. regulation for property rights), market structure (e.g. fragmentation, concentration, information asymmetry) to product characteristics (e.g. information intensity, modularized offerings) and business practices (e.g. shared standards, settlement schemes) (Giaglis et al. 2002).

Fifth, the financial crisis in 2008 is a reminder of the vulnerability of electronic markets and indeed of the entire economic system. The crisis has discredited the effectiveness of market mechanisms as highly complex financial products were electronically traded in global markets, which lead to unforeseen and apparently irrational situations, must recently the Flash Crash on May 6, 2010 (Frydman and Goldberg 2011). Traditional values and principles, such as linking economic risk taking and accountability, responsibility and economic prudence, were questioned and financial institutions had accumulated debt and risks way beyond their financial means. As the financial defaults of these institutions were feared to cause a vicious cycle of financial collapse and ultimately a threat to the entire economy, understanding as well as regulating them has become a key concern.

2. Electronic Markets and IT-based Transformation: Three Perspectives on Electronic Markets

In response to these insights of extant research in the electronic markets field and the growing proliferation and diversity of electronic markets, three distinct perspectives shall contribute to structuring the electronic markets' phenomenon (see Table 1): The broadest view is the market or industry environment which describes the IT-driven transformation of national and international markets (see e.g. Castells 1998; Benkler 2006). The second view captures the choices of economic actors regarding the governance mode for their business transactions (market, hierarchy or network, Williamson 1975, 1991) and related issues of the design and combination of coordination mechanisms. The third view highlights the initiation, development and operation of electronic market platforms or market intermediaries as business models and entrepreneurial activity (see e.g. Kambil and van Heck 2002; Kaplan and Sawhney 2000). In addition to the technological enablers, this framework also emphasizes the role of market forces (market dynamics) and rule setting (institutional design) in order to explain the development of electronic markets.

Perspectives / Drivers	Electronic market as **economic environment**	Electronic market as **governance mode**	Electronic market as **business model**
Technology push	IT has become a key social and business infrastructure.	IT makes more products and services amenable to market coordination.	IT enabled transaction infrastructures and innovative value propositions.
Market dynamics	New rules and levels of competition drive innovation and market development.	Competition between governance models and between electronic markets drives innovation of coordination mechanisms.	Competition among electronic marketplaces drives service innovation and yields complex configurations of governance models.
Institutional design	Institutional settings shape technology development and its deployment. Political support and regulation facilitate further development.	Electronic markets are social institutions. Effective regulation reduces transaction costs, which implies regulatory competition.	Marketplaces are institutionalized transaction environments. Governance and ownership structures are success factors of electronic marketplaces.

Table 1: Perspectives on electronic markets and drivers

Electronic Markets as Economic Environment

The past twenty years have seen a dramatic rise of the electronic marketspace (e.g. Eskelsen et al. 2009). IT and electronic markets have shaped new industries and transformed entire sectors. This applies to e-business companies (e.g. eBay, Amazon) as well as to software companies (e.g. Microsoft, SAP) and IT service providers (e.g. Google, telecom companies). As explained by Kevin Kelly (1998) many of these information-based businesses are subject to the "New rules of the network economy". For example, the rule "more gives more" or "volume drives volume" is not only apparent in electronic markets and telecommunication networks, but also in the recent rise of social media platforms, such as Facebook and Twitter. Another contribution for the transformation of the entire economic environment is Thomas Friedman's popular treatise "The world is flat" (2005). In fact, most of the ten "flatteners" are results of the digital revolution (e.g. Netscape, workflow software, uploading or "The steroids"). In addition, sociologists (e.g. Castells 1998; Benkler 2006) have argued that this emerging electronic marketspace leads to profound social, economic and political transformations. Following these insights, this position paper argues that technological, competitive and regulatory changes need to be considered together in order to understand the impact and the transformation of electronic markets.

First, electronic markets have become the commercial face of *global communication infrastructures* yielding a tightly networked world that has emerged over the past 20 years. The commercialization of global computer-mediated communication environments has permeated almost any facet of economic activity. Currently, social media - a "social" adoption of global computer-mediated communication environments – provide an impulse for a new wave of commercial appropriation of a socio-technical innovation.

Second, *new competition* in the networked economy has transformed the competitive landscape across almost any industry. Information transparency has significantly increased, driven by entrepreneurs and innovators who created platforms for comparison shopping, product ratings and user generated content. Yet, companies have found new ways of avoiding all-out price wars and created new forms of information asymmetries (Glassberg and Merhout 2007). The airline industry is a prime example for a technologically driven transformation: low-cost airlines have changed the product offering to make them more amenable to the Internet (point-to-point connections of unbundled, low-frills flights) as a first step, which was followed by a push towards self-service (booking and checking-in online) and an increasing portfolio of service components (e.g. checked luggage) or up-selling (more legroom) and cross-selling (rental car or hotel) options offered online. These strategic moves may also be seen as an attempt to increase direct sales and bypass online and offline travel intermediaries. Other examples are the financial markets, which are often conceived as prototypes of electronic markets, or telecommunication markets. The latter feature an intense competition between network access providers within and across different technological approaches and architectures: power line, Cable TV, telecom networks/ phone cable, WIFI etc. Leading to the next point, governments promoted this development as broadband access is regarded as an important factor in the competitiveness of nations and regions.

Third, *governments* have been key enablers and facilitators of the electronic marketspace in many areas (Fligstein 2001). For example, the industrial policy in the US (National Information Infrastructure), the EU (eEurope), and numerous Asian governments (e.g. Informatization of Nation and Society, Republic of Korea) aimed at developing the communication infrastructure for the economy and society at large. Research policy in most regions has also led to significant governmental investment into research programmes, which de facto supported the private sector. At least in some countries (e.g. the US) taxation policy has been facilitating e-business (the sales tax advantage, Stibel 2010). Legal frameworks were crafted in order to balance the risks between service providers and consumers, specifically consumer protection and privacy laws e.g. in the EU. Finally, social policy addresses issues, such as education, cultural heritage and social inclusion (e-Inclusion) aiming at a broad based societal diffusion and support. In sum, technology expertise and familiarity have spread across all segments, the business, public sector as well as citizens communities, and have provided an environment for further diffusion and growth.

Electronic Markets as Governance Mode

While the predictions of Malone et al. (1987) may also be applied to the broader economic development addressed in the previous section, they were specifically targeted at the EMH, i.e. the comparative advantage of (electronic) market coordination over (electronic) hierarchies. There is ample evidence of the ongoing extension of market coordination (in the narrow sense, i.e. auctions, dynamic pricing typically via centralized market platforms) into the electronic sphere. *Technological advancements* combined with *market entrepreneurship* have driven an extension of market coordination into a broad and diverse array of domains from marketing, to health care or forecasting (see Table 2). Price-based coordination mechanisms have benefitted from reduced information and brokerage costs and provided extended allocation efficiencies. Moreover, the research field of micro market design has contributed to understand issues, such as price building or auction rules (e.g. Bapna et al. 2004; Neumann 2007).

Trade objects	**Examples**
Commodities	• Financial markets (e.g. Eurex, CME CBOT) • Energy markets (e.g. European Energy Exchange EEX) • Agriculture markets (e.g. CME Globex, The Seam) • Computing markets (e.g. Grid computing)
Software	• Web service directories (e.g. StrikeIron, RemoteMethods) • App stores (e.g. Apple, Microsoft, Nokia)
Information	• Geographic information (Brox and Kuhn 2001) • Advertisement exchanges (e.g. Google Doubleclick)
Predictions	• General events (e.g. Intrade) • Political outcomes (e.g. Iowa Electronic Market) • Video game sales (e.g. Simexchange)
Rights	• Trading CO_2 emission rights (e.g. European Union Emissions Trading Scheme)
Services	• Personnel or freelancer services (crowdsourcing, human cloud, microwork) • Maternity care auction (Smits and Janssen 2008) • Logistics markets (e.g. inet-logistics, Axit, Gudmundsson and Walczuck 1999) • Procurement platforms (e.g. Elemica, Supply On, cc hubwoo) • Comparison sites (e.g. uswitch, comparethemarket, kelkoo, comparis) • Auction sites (e.g. Ebay, Webstore, eBid) • Retailing platforms (e.g. Amazon, Grainger, Zalando) • Pooling sites (e.g. Groupon, Google Offers)

Table 2: Examples of products and services traded in electronic markets

While coordination efficiency, asset specificity and the complexity of product description were included in the early model of Malone et al. (1987), they have barely addressed the issue of *institutional design*, even though this is part of transaction cost theory. In fact, successful electronic markets, such as eBay or Amazon, invest substantial resources in the ongoing development of institutional rules to provide assurance, recommendations, user-

generated content or to reduce information asymmetries. Moreover, the market players (suppliers) are continually extending the repertoire of mechanisms to limit transparency and all-out price competition. As suggested by Kambil and van Heck (2002) in their book on market design, the design of the transaction processes needs to be complemented with shaping of the trade context, i.e. the institutional design.

Electronic Markets as Business Model

The third perspective focuses on centralized market structures and takes the view of marketplace operators. They are intermediaries that address information imperfections (Spulber 1996, 136). Their success is ultimately determined by transaction volumes and the bid-ask spread.[1] Research on intermediation in financial markets has contributed various models for determining the bid-ask spread and confirmed welfare effects (e.g. Cosimano 1996). While it highlights the price discovery function, it also recognizes that technology has provided multiple other sources of value for intermediaries. This leads to the *first* driver, which captures the influence of IT enabled transaction infrastructures on innovative value propositions. Following the functionalities of electronic market platforms (Bakos 1998, 35f; Giaglis et al. 2002, 233ff), the business models for electronic markets are manifold (e.g. Dai and Kauffman 2002) and include various sources of value as listed below.

- *Message handling:* Following the idea of clearing centers known from the EDI field, the translation of message formats is still an important function when messages are to be exchanged automatically between applications. Compared to the early offerings today's standards are based on XML subsets and also include the mapping of activity chains. Using business process definitions from RosettaNet's public-private processes, providers, such as GXS and e2open offer message handling in the electronics industry.
- *Transaction execution, including trade context processes:* Due to their topological advantages, markets are valuable infrastructures for the facilitation of standardized transactions. As prominent examples, Amazon and eBay provide professional services from the shopping cart to logistics and payment, fraud detection and buyer protection. Amazon even offers their services to competing third party providers in the marketplace section and sells individual services as Amazon Web Services.

[1] The bid-ask spread reflects the value added by intermediaries and consists of the costs of processing orders, holding inventory and adverse selection (Huang and Stoll 1997, 995f).

- *Market overview:* The electronic market provides a structured view of the offerings in a market using a centralized directory, order book or product catalog. Prominent examples are product catalogs in retailing sites, comparison sites as well Web service directories (see Table 2).
- *Price discovery:* Markets and in particular auctions offer dynamic pricing employing a variety of mechanisms (e.g. Dutch or English auction, single or double auction) and are traditionally a powerful instrument when price determination is a problem. This is the case due to abundant competition or a lack of competition in many commodity markets, e.g. for unique collectors' items. Auction markets aim for an improved allocation of resources and are also used for demand pooling (see pooling sites in Table 2). Examples, such as the maternity care auctions in the Netherlands, illustrate that auctions may also lead to a restructuring of markets (Smits and Janssen 2008).
- *Customer decision support:* Given the breadth and complexity of products available online, intermediaries provide various forms of customer decision support from recommender systems based on individual customer profiles, the analysis of aggregate shopping patterns (collaborative filtering) or the inclusion of customer product reviews and ratings (user generated content). Reviews and ratings are also offered to assess the quality of vendors (and customers).
- *Information sharing:* Transactions between businesses typically require a broader set of information to coordinate activities. Platforms for supply chain collaboration, such as GXS, GS1 or e2open support the exchange of planning and status information between many participants. This comprises, for instance, the publication of demand forecasts of large manufacturers with their suppliers or the consolidation of status information to track physical goods.
- *Product innovation:* The concept of crowdsourcing has transformed research and development processes in several industries. Business partners and sometimes even end customers actively collaborated via one platform to develop a specific product or service. For instance, the Innocentive platform is used to develop, publish and evaluate ideas for new products or Redesignme.com consists of a community that helps in redesigning products so that they become marketable.

Second, from the perspective of an electronic market provider, there is competition between governance models, specifically markets and network arrangements. Moreover, marketplace intermediaries operate in an environment of competition among marketplaces (e.g. Weitzman 2010), other intermediaries and direct sellers (for bypassing, see e.g. Weber 1994). They face challenges, such as conflicting relationships, partner resistance, as well as balancing the interests of trading partners. Their success seems not only contingent on the breadth of the of-

fered services but also on governance and ownership structures. Depending on various contingencies (e.g. market transparency, market fragmentation) the electronic markets' history has shown various opportunities for dis- and re-intermediation strategies (e.g. Giaglis et al. 2002). When market power was combined with the development and the operation of a market platform, these platforms were often rejected. This is in line with Malone et al.'s prediction of a move from biased to unbiased markets.

Third, in the institutional design dimension, electronic markets offer an *institutionalized transaction environment*. This includes regulatory functions, such as market access (e.g. requirements, registrations) and the availability of monitoring and enforcement mechanisms (e.g. protection against insider trading) as well as legal functions that determine contract law, dispute resolution, and the transfer of property rights.

3. Propositions for the Future of Electronic Markets

Compared to a description of the value that has already become apparent in existing electronic markets, forecasting future sources of value for intermediaries is more difficult. In order to stimulate the discussion about future trends of electronic markets this position paper suggests six propositions.

Proposition 1: Intermediated topologies of electronic markets reduce dependencies in value chains

As mentioned above, electronic markets provide an infrastructure that aims at facilitating transactions between buyers and sellers. In most of today's value chains, this takes place between various tiers, e.g. between end customers and distributors, between manufacturers and their suppliers and so on. In such settings intermediated (or centralized) topologies reduce the interface complexity from n * (n-1) to n * 2 connections. This also reduces the dependencies in value chains and thus the coordination efforts.[2] All examples listed in Table 2 are centralized markets with a market provider acting as intermediary between buyers and sellers. In principle, markets can also exist in a decentralized form, i.e. all actors interacting directly using standards, rules and plans which were previously agreed upon (e.g. within an industry). Since these reciprocal interdependencies require considerable standardization efforts and are prone to conflicts, centralized topologies feature pooled interdependencies which add structure to the transactions between the participants and reduce the potential for conflict (Kumar and van Dissel 1996, 287). They are also advantageous compared to sequential interdependencies which are typically

[2] Coordination is the management of dependencies between activities (Malone and Crowston 1994, 90).

found in supply chains where each party forwards information to the adjacent partner, but where an overall perspective is missing. The advantage of centralized electronic markets is supported by empirical research which shows that the number of messages required and the information quality in a centralized market with a limited number of brokers is always superior to decentralized market designs and also hierarchies (Talalayevsky and Hershauer 1997). Thus, the first proposition argues that in view of vertical disintegration, flexible co-creation concepts and modularized service-oriented architectures, centralized platforms will receive a growing importance to coordinate economic activity.

Proposition 2: Increasingly complex value systems sustain the proliferation of electronic markets

If economic production relies increasingly on flexibly coordinating products and services, classical sequential value chains will also become more complex. Figure 1 depicts electronic markets as nodes between multiple actors, which transact within an institutional environment. While Figure 1 suggests relatively simple transactions, the unbundling of products and services requires multiple transactions (and markets) to contract complex products or service bundles. This could open up the possibilities for intermediaries that configure, offer and monitor solutions, which comprise products from various providers as well as marketplaces. For example, some services in the area of financial advisory already pursue a life cycle view of business relationships and create individual solutions from a broad range of services including checking accounts, financing and insurances. We envisage similar bundled services for mobility, computing services, independent living in the third age and the like. This will also involve the extension of electronic markets in new domains, such as maternity care, emission rights, and software apps (cf. Table 2). The transformative power was illustrated by successful markets, such as eBay or the Apple App Store (MacMillan 2009), which created new markets by crafting and enhancing the rules and functionalities of their service. Like the first proposition, the second expects that the role of electronic markets in the economic environment will increase. In addition, in the future we will see a more interwoven landscape of distributed and cascading electronic marketplaces with some markets acting as meta- or sub-markets.

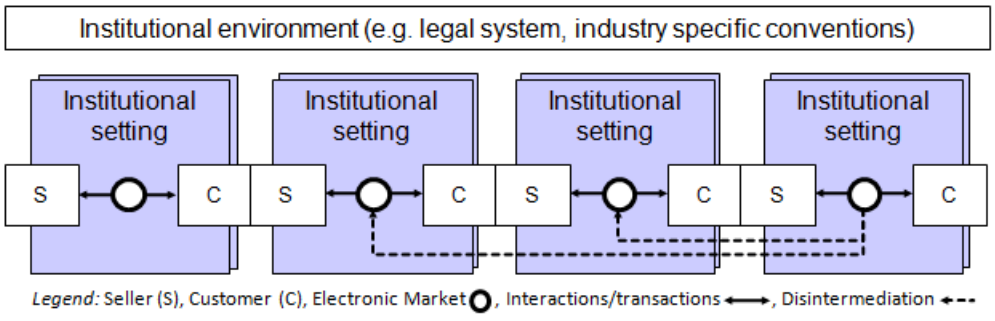

Figure 1: Electronic markets as intermediaries in a supply chain

Proposition 3: All-in-one marketplaces increasingly combine various modes of governance

Early electronic markets, such as the auctions in financial exchanges and the flight schedules as well as capacity management in the computerized reservation systems, provided a limited set of coordination mechanisms. While these systems are still operating successfully, electronic markets in other industries have combined several coordination mechanisms as part of their business model. Examples, such as Elemica or e2open, illustrate extended transaction and life-cycle support beyond electronic auctions. In fact, the three generic market functionalities yield a variety of opportunities for market operators to add value within value chains. So-called "all-in-one-markets" (Kambil et al. 1999) feature a variety of coordination mechanisms, which link the possibility of competitive bidding to determine a price and to keep the pressure of competition on the one hand with the advantages of a predictable relationship to encourage relationship specific investments (non-contractible issues) and functionalities for closer collaboration (e.g. Markus and Christiaanse 2003) on the other. A combination of market and hierarchical components (Holland and Lockett 1997, 485) could either occur sequentially with the bilateral execution of a number of transactions following after an auction was conducted or in a concurrent fashion where trading mechanisms are available on one platform. Examples for the latter are Click2Procure which is the buy-side marketplace of Siemens AG in the B2B-domain and the well-known options from eBay in the B2C area (Hasker and Sickles 2010, 10). Thus, the third proposition argues that the nodes shown in Figure 1 will become more complex in themselves by combining various modes of governance.

Proposition 4: Lower signalling cost shape new and improved market mechanisms

Electronic markets are at the heart of flexible pricing in many industries. Sophisticated solutions for flexible pricing and price signalling have emerged, e.g. in the airline industry. As airlines' capacity is fixed in the short term, they have been using yield management techniques (price differentiation) for years (e.g. Klein and Loebbecke 2003). In a period of intense competition from low cost carriers, airlines use their Web sites to signal price variations for different flights and also show the number of available seats in a particular price category. While this does not offer direct price negotiations, it allows passengers to pick flights based on their price-time preferences and thereby contributes to a levelling of demand. A similar approach is pursued by utility companies. Based on demand predictions and smart metering[3], they are offering lower prices at times of low demand. Even in an industry limited by legal constraints (e.g. Reimers 1995), market mechanisms prevail and secondary

[3] Supported by smart metering technology utility companies might even control some equipment of companies or even households in order to generate demand for electricity in times of spare capacity (e.g. to run the compressor of a refrigerator) or lower demand by taking certain pieces of equipment off line.

markets were created by intermediaries (e.g. Priceline, Qfly). The future will also see a stronger diffusion of flexible pricing in B2B electronic commerce with innovations in differential pricing (in revenue management, procurement, and supply chain coordination), and mechanisms for the evaluation of complex and multi-dimensional bids (Bichler et al. 2010). These features are not "one time" innovations, but will require constant reassessment and improvement. For example, market operators, such as eBay, are in a unique position to monitor auctioning behaviour and develop or adjust auction rules and parameters. Over the years, eBay has become an innovator, introducing auction bots for automatic bidding, refined review mechanisms for buyers and sellers in order to ensure the fulfilment of the respective obligations (delivery of promised goods and payment) or seminars to teaching bidding behaviour. Phenomena like "sniping", bidding in the last seconds of an auction, show the ingenuity and energy of bidders (Bapna 2003). eBay is probably also one of the largest market research sites as they document all auctions and make anonymous auction data available for academic research. Amazon has already made information from their platform part of their web services offering (Alexa Web Information Service).

Proposition 5: Technological innovation in standards and services will add value

In addition to the industry- and business-oriented aspects of the electronic markets' evolution, IT-based innovations will continue as important enabler for electronic markets. On the one hand, service-oriented concepts require centralized platforms that support the publication, configuration, and management of services across multiple actors and systems. Among the solutions emerging in this domain are the Universal Service Description Language (USDL), Universal Description and Discovery (UDDI) and the Business Process Modeling Notation (BPMN). Ultimately, they will enable electronic marketplaces to become part of more complex value systems by facilitating a larger variety of service configuration. On the other hand, cloud computing has shown that most local applications may also be hosted on external platforms. Combining the software-as-a-service (SaaS) idea with the functionalities of application stores (from Apple, Nokia or others), electronic markets might become the operating system of many value chains. While the business partners prefer standardized transactions and will advocate shared conventions for processes, services and data, the market place providers – in particular first movers – may prefer proprietary (back-end) solutions in order to achieve a competitive advantage over other providers. Thus, likely outcomes are technical configurations that combine standardized and proprietary elements. Second movers might emphasize standardization as a differentiating value proposition.

Proposition 6: Social networking will transform electronic markets

Finally, electronic markets will experience a revival of the social. One of the major trends in recent years has been the rise of social networking. In contrast to the commercialization of the Web and the anonymous logic of collaborative filtering, individuals as citizens, consumers or other members of the society are trying to regain control. They use the Web – and more generally social media – for their private enterprises of socializing, sharing, voicing their opinions etc. Recommendation sites (e.g. Rotten Tomatoes, iLike, Musicovery, Goodreads) and reputation management strategies will increasingly become integrated in the market overview function and influence buying decisions. As mentioned, the strengths of markets lie in efficient resource allocation based on price signals. While the diffusion of IT has undoubtedly lead to more market and price transparency globally, competitors drive each other to provide price information or intermediaries have created a business based on product and price comparisons. Yet, markets generally and auctions specifically are social mechanisms to establish a price (Smith 1990). The rise of social media and networking (based on electronic communication) is a reminder that individuals tend to make decisions based on opinions, recommendations and feedback by their friends and peer group.

4. Risks and Sustainability of Electronic Markets

Given the continued success and transformative power of electronic markets, a key question remains: is this development sustainable? First of all, the adoption of an electronic market in its target community and the active participation of its members are inherently linked to the market's liquidity. Many market initiatives were not successful in attracting a critical mass of transaction volume and thus were discontinued. Research has shown that explanations are often not technological, but organizational and cultural in nature (e.g. Reimers 1995). As mentioned earlier, intermediaries face challenges, such as bypassing, conflicting relationships, partner resistance, balancing the interests of trading partners. Success often seems not only contingent on the breadth of services that they are offering but also influenced by governance and ownership structures. When market power was combined with the development and operation of a platform, these initiatives were regularly rejected (e.g. Alt and Klein 1999). However, deliberations about social, technical, economic, political and environmental issues are bound to fail if they neglect the phenomenon of risk. As mentioned in the introductory section, the financial crisis has highlighted the increasing exposure to risk that can easily and swiftly spread around the globe. In view of the pervasiveness of electronic trading, it is difficult to clearly separate traditional and ICT related risks. Beck (1992) has coined the notion of risk society to describe a situation in which technical progress yields new risks,

which absorb a growing amount of societies' attention and problem solving capabilities. It seems that well known risks have become exacerbated and more contagious since they spread around the globe as easily as news or ideas.

First, the notion of *infrastructure risks* or cyber risks (Bremmer and Gordon 2011) highlights that communication networks have become vital infrastructures for the economy and indeed the entire society. As communication infrastructures are available on an ubiquitous scale and mission critical for a fast growing number of domains, including energy provision, healthcare, traffic control and commerce, societies' dependence and vulnerabilities have dramatically increased. The temporary suspension of the EU Emissions Trading System on January 19, 2011 in response to recurrent security breaches (European Commission 2011) is just one example of the vulnerability of trading infrastructures. Technical flaws have thus undermined what has been carefully designed from a competitive and regulatory point of view (European Commission 2010). Other examples are the cascading network risks in the globally distributed production and supply chains: severe weather conditions, industrial action, disruptions caused by contagious diseases in one part of the world can (and do) affect operations in other parts – often within days.

Second, *transaction and price risks* emerge with the dissemination of electronic markets (Clemons and Reddi 1994). The transformation from floor trading to electronic trading has illustrated how trading was embedded in a broad range of social practices of monitoring and signalling (Clemons and Weber 1997). Purely electronic modes of trading might yield new forms of risk and require new mechanisms of dealing with risk. To contain transaction and price risk as well as uncertainty on the effects of ICT on industrial organization, Clemons (2007, 2) suggests to develop "enough pattern recognition skill to convert an unknown and uncertain situation to a known and risky one". One facet of opportunism related risk has become more prevalent in the electronic marketspace: leakage of sensitive information. As information can be copied and communicated at virtually no cost, the risk of massive and systematic leakages of trade information has increased by an order of magnitude.

Third, *systemic risks* are prevalent when electronic systems interact almost autonomously among each other. An early contribution in Electronic Markets has described the effects of communication speed and the stability of trading systems (Addor 1992). While Addor was expecting that the instantaneous communication of fluctuations in electronic markets would yield more stable markets, the opposite outcome is also possible. There have been instances where automated trading lead to a downward spiral in financial markets. The intransparencies involved in program or algorithmic trading "have overtaken the industry [... and] for better or worse, the computers are now in control" (Salmon and Stokes 2010). More recently, the problem of system critical companies received

considerable attention. While innovation in the electronic marketspace often sparks a virtuous cycle of competitive countermoves, further innovation and productivity growth (Farrell 2003), a few companies achieve a speed of growth and quasi-monopolistic market positions, which make them – at least temporarily – system critical *(too big to fail)* within a relative short period of time (Johnson and Kwak 2010). Such companies require specific regulatory responses, geared at the relative position of these companies in their respective market environments. Technology and market forces alone do not seem to prevent the rise of biased markets.

Overall, the discussion of technology-induced risks on electronic markets has been quite limited. The analysis of the root causes of the financial crisis has yielded controversial results: some argue that the markets in principle are working, while others call for much stricter regulation. Whatever the final verdict may be, the crisis has highlighted the role of regulation for markets to function but also that electronic trading is happening at a level which is difficult to control: The financial services industry has become a truly global industry with mind boggling volumes of transactions if compared to the size of national budgets or even gross national products. As a result many financial services institutions have become system critical to an extent that countries are risking bankruptcy in order to keep individual banks alive. The regulatory side of providing incentives and safeguards for a sustainable and accountable development has not kept pace and in numerous instances has failed dramatically. The balancing of risks and accountability did not work. A comparative study (Bertelsmann Stiftung 2010) highlights the salience of institutional reforms and social governance, which have helped in particular emerging economies to respond to the crisis effectively. Flyvberg et al. (2003) in their study of risks related to infrastructure (mega) projects claim that more accountability is needed to mitigate risks and participatory and deliberative approaches in order to achieve better informed and more democratic decisions.

If electronic markets incur new and extended risks, these risks need to be considered when discussing benefits and gains of electronic markets and should be internalized, i.e. carried by those who participate and benefit from the markets. However, regulators are facing a dilemma between unnecessary administrative burdens caused by regulation and the risk incurred as a result of insufficient regulation and control. While “smarter” regulation may be called for, the inherent limitations of setting productive rules in a global environment with regulatory competition and highly mobile and resourceful actors need also to be acknowledged. The EU Emissions Trading System mentioned above is an example for coordinated efforts to develop, amend and develop regulation for a young and dynamic market in light of ongoing economic and climate crisis as well as fraudulent actions.

5. Conclusions

Although the research field “electronic markets” has been a topic of research in academia and practice for over two decades, the concept of electronic markets appears more relevant for today’s distributed and networked economic systems than ever. Starting from the available research in the electronic markets field, this position paper suggests an extension of the existing knowledge by proposing a multi-dimensional framework. Starting from the empirical diversity of electronic markets, it argues that the design of electronic markets is not driven by cost-evaluations only. In fact, it requires understanding the intricate relationships of technological potentials, market dynamics and the rules defined within the institutional environment. For that purpose, it links micro layer phenomena, such as business model innovation with macro layer phenomena (transformation of market environments) and shows how technological innovations, competitive dynamics and rule setting (from standardization to regulation) are linked and require realignment between individual incentives and the interests of the community. This also calls for distinct educational and research efforts at a time, when most educational institutions seem to be geared towards increasingly specific micro analyses rather than taking a broader, systemic and interdisciplinary perspective.

Extension of electronic markets across all levels

While pure play electronic market mechanisms seemed limited to a small array of application areas, in particular the computerized reservation systems in tourism, the exchanges in the financial sector and some examples of electronic supermarkets in the retail sector, today’s picture of existing electronic markets features a much greater diversity of application areas for electronic markets. More products and services have become tradable on electronic markets and innovative trading mechanisms have emerged. At the same time, communication rich environments have developed which facilitate crowdsourcing for news, ratings, predictions, services or innovative ideas. Successful companies have learnt how to mobilize, facilitate and benefit from social production. Moreover, within the competitive ecosystem of market platforms (Clemons & Woodard, 2011), highly successful electronic market platforms have emerged, such as eBay or the Apple iTunes App Store, which have created new market segments and spurred systems of innovation.

Increasing complexity of market platforms

At the same time, the understanding of the phenomenon “electronic market” has progressed. Where some isolated technologies were used to link businesses in the beginning, today’s picture comprises a broad set of design

options to realize added value to market participants. Overall, the complexity of electronic market architectures and governance forms, such as all-in-one markets or mixed mode governance, is increasing. Although the App Store may be a market from the end customer perspective, it involves hierarchical relationships at least with some suppliers and a very strict institutional setting. From the business model perspective, the diffusion of an electronic market and the adoption by its potential users is highly contingent on numerous factors beyond the attributes of the transactions. Although some sources of value for an intermediary are known on the business model level, the configuration of these value drivers still requires more research. Centralized or intermediated electronic market architectures appear to be promising, supported by ubiquitous infrastructure of the mobile Internet, which makes information easily available to some two billion potential participants. Higher degrees of interactivity and multimedia interfaces, widespread computer literacy and the growing standardization of processes and services in many industries are other examples. As a few global mega-platforms are emerging, important questions about their governance and the competition between those platforms arise.

Sustainability as ongoing challenge

Finally, the success of electronic markets in the broad sense raises fundamental issues of sustainability, market governance and the protection of economic, political and social institutions. Technology is changing the way we are living and working as well as our social, economic and political systems. Electronic markets have become large scale and critical infrastructures, whose failure has massive economic and social effects. The financial crisis is only a reminder of the fact that we have joined a global risk society. This position paper has argued that institutional design orientated by principles of good, social governance and accountability not only reduces transaction costs, but is crucial for a sustainable development. However, it also recognizes the dynamic relationship between innovation and regulation. Regulation within the institutional environment and setting of electronic markets assumes certain patterns of behavior on behalf of the market participants. Examples, such as “sniping”, illustrate that rules will be challenged by human creativity and inevitably yield unforeseen effects. Electronic markets need to adjust and, thus, require continuous monitoring and improvement. Understanding these dynamics of electronic markets becomes even more important in view of more interconnections and the diffusion of electronic agents. Thus, like for every powerful (technological) concept, efforts are required to develop its potentials and to contain risks at the same time.

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