

Success Factors of Electronic Markets: Impact of Context and Process on Outcomes

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Abstract : In the past few years, many electronic markets have opened up but adoption of electronic marketplaces worldwide has been lower than expected. A considerable number of electronic markets already have ceased to exist and several collapsed during the recent dot-com meltdown. Perhaps a better understanding of risk factors, complexity and market requirements of these electronic markets, prior to implementation, may have allowed developers to create more effective information system solutions. Several consultancy firms, such as Forrester, Merrill Lynch, and Morgan Stanley, have made statement on several *success factors* of electronic markets, such as acquiring domain expertise, and a critical mass of users. However, none of those has been scientifically argued (Bartels, 2000). Because of this high failure rate of electronic markets, this research tries to more scientifically identify, from a thorough literature review of previous research, specific success factors that might be crucial for electronic market success. These success factors are then applied to several case studies, as to assess possible risk of success or failure.

Key words : Electronic markets, success factors, supply chain

1. INTRODUCTION AND RESEARCH OBJECTIVE

1.1 Introduction

Electronic markets, as defined by Bakos (1997), allow the participating buyers and sellers to exchange information about prices and product offerings via an interorganizational information system. Because of the fact that electronic markets might be able to reduce cost and other inefficiencies, these markets can appear between several stages of the supply chain.

Supply chain optimization has typically been an introspective endeavor, with companies attacking inefficiencies within corporate boundaries. With the development of the Internet and the more tightly controlled extranets that have been built between business partners, we have seen the emergence of integrated supply chains.

Creation of electronic markets have a number of different driving factors – from stakeholder motives, to market forces and regulatory pressures, to building a market of critical mass for transaction cost reduction. The success or failure of an electronic market can depend on several of these factors, although which factors has been based on more supposition than fact to-date.

1.2 Research Objective and Methodology

The research question posed is: *What factors could contribute to the success of electronic markets ?*

To address this, we first focus in this paper on what electronic markets are and how these electronic markets emerge, with hypotheses from literature.

1.2.1 Research Methodology

The research that formed the theory base for this paper was conducted in two phases. We first reviewed relevant literature and interviewed experts. The outcome of this phase was a framework for explaining success of electronic markets, and a questionnaire to investigate the

success factors. For the second phase of the research, we interviewed and studied cases to find support for the proposed framework.

The extensive literature review of approximately 110 papers initially focused extensively on economic analyses of effects of electronic markets; we then studied reports published by commercial research organizations like Forrester and Gartner. The starting point was formed by Malone's (1987) electronic market hypothesis and Clemons et al's (1993) move to the middle hypothesis. The literature review and expert interviews resulted in a conceptual research model, which identifies success factors that are proposed to have an impact on electronic market success. Case studies were used to evaluate these factors.

The case study approach was chosen to support analytical rather than statistical generalization (Yin, 1994), and because cases enable "the capturing of reality in considerable greater detail and the analysis of considerable greater number of variables" (Galliers, 1990). The empirical material gathered has to be seen in the light of offering support for the proposed success factors.

For this paper, four different electronic markets were analyzed on the context in which they operate, *what* (success) factors are present and *what* (economic) effects buyers, sellers and the electronic market itself are experiencing. An attempt is made to explain *how* and *why* each of these (success) factors acts upon each of the aforementioned (economic) effects.

Case studies in electronic markets are sampled from three different industries in order to discover similarities and differences in the type of stakeholders, economic effects and success factors. The electronic markets were selected on a requirement of having a significant transaction-volume, to be able measure some of the economic effects as experienced by the stakeholders.

The structure of this paper is as follows. The literature base for the research is discussed in the second section covering theoretical contribution. We address the findings of this literature review in the third section of the paper in a research model developed to categorize possible success factors. These success factors are tested with case examples from case study research in the fourth section of the paper. Conclusions and lessons learned are summarized in the final section.

2. THEORETICAL CONTRIBUTION

We start with a discussion of the emergence of electronic markets and hierarchies, followed by a consideration of several economic effects that electronic markets could cause for its stakeholders. In order to understand which factors are causing the aforementioned economic effects, we then focus on a number of success factors that have been found in the literature.

2.1 Emergence of Electronic Markets and Hierarchies

According to Malone, Yates and Benjamin, economies have two basic mechanisms for coordinating the flow of materials and services through adjacent steps in the value-added chain, *markets and hierarchies* (Malone *et al.*, 1987). Markets coordinate the flow of materials or services through supply and demand forces and internal transactions between different individuals and firms, presumably *minimizing production costs* for the desired product. The *coordination costs associated are however relatively high*, because the buyer must gather information and risk on a variety of possible suppliers. (Malone *et al.*, 1987).

Hierarchies coordinate the flow of materials or services through adjacent steps by controlling and directing it at a higher level in the managerial hierarchy, restricting the choice of suppliers for buyers to one predetermined supplier. *The coordination costs can however be reduced* over those incurred in a market by eliminating the buyer's need to gather and analyze different information about several potential suppliers (Malone *et al.*, 1987).

Drawing on the theories of Malone (Malone *et al.*, 1987) and Clemons (Clemons *et al.*, 1993), a distinction can be made between markets and hierarchies to coordinate the flow of products and services. According to Malone, the choice of a company for either a market or a hierarchy is based on the attributes of the product or service being traded, namely *asset specificity* and *complexity of product description*.

There are varying hypotheses on why companies make the choice between hierarchies and markets, specifically looking at the use of technology in the supply chain. The Electronic Market Hypothesis (EMH) looks at why companies are using *markets* to coordinate the

flow of product or services. Malone, Yates and Benjamin state “that the overall effect of information technology will be to increase the proportion of economic activity coordinated by markets” (Malone et al., 1987). In other words, lower transaction costs make markets more interesting.

There is also the argument given as to why companies are likely to utilize *hierarchical structures* to coordinate the flow of products or services, also known as ‘The Move To The Middle’ hypothesis (Clemons et al, 1993). Clemons, Reddi and Row state “*that industrial restructuring will increasingly be characterized by a ‘move to the middle’*”. This specifically refers to firms moving away from the market to intermediate governance structures when outsourcing, as IT will lead to a greater degree of outsourcing (a move to the market) (Clemons *et al.*, 1993).

There is a combining theory on the aforementioned hypotheses, which has further been investigated by Kaplan and Sawhney (2000), who differentiate electronic markets on *how* businesses buy and *what* they buy. Businesses develop a long-term, close relationship with qualified suppliers, which is called *systematic sourcing*, or acquire goods when they have to fulfill an immediate need at the lowest cost, which is called *spot sourcing* (Kaplan and Sawhney, 2000).

Several dimensions of electronic markets, such as the type of product and contract the market facilitates, the type of market making mechanism that is used, and the level of bias on an electronic market as investigated by Kaplan and Sawhney, can be seen in Figure 1. Level of bias can be defined as a range from markets favoring certain buyers or suppliers to unbiased markets open to all buyers and suppliers and favoring none (Malone et al, 1987).

Type of Product	Manufacturing inputs	Operating inputs	
Type of Contract	Systematic sourcing	Spot sourcing	
Market Making Mechanism	Matching	Aggregation	
Bias Level	Buyer centric	Seller centric	Neutral

Figure 1 : Dimensions of electronic markets

2.2 Electronic Market Effects

2.2.1 Stakeholders: Buyers, Suppliers, Market Makers

In electronic markets, stakeholders can be defined as participants who can affect or are affected by the market development and implementation, including market makers, buyers, sellers, investors, and service providers.

Stakeholders can be defined as participants in both the *task environment* and the *general environment* (Douma, 1996). The task environment encompasses all organizations or persons with whom the company interacts on a regular basis. These are buyers, suppliers of primary goods, components, machinery and know-how, capital providers, and unions. The general environment participants are those required for functional operation, but are not active participants.

3. RESEARCH MODEL OF SUCCESS FACTORS OF ELECTRONIC MARKETS

Based on an extensive literature search, 17 success factors for electronic markets were identified and developed into a research model, as shown in Figure 2. We distinguish between success factors related to the context of an electronic market, and success factors related to the processes of the electronic market.

Success factors related to the context refer to those conditions under which the electronic market operates, basically beyond the control of the market maker, which have an effect on the possible success of that market.

Success factors related to the processes are factors which characterize the trading processes on the market, and which are basically under the control of the market maker.

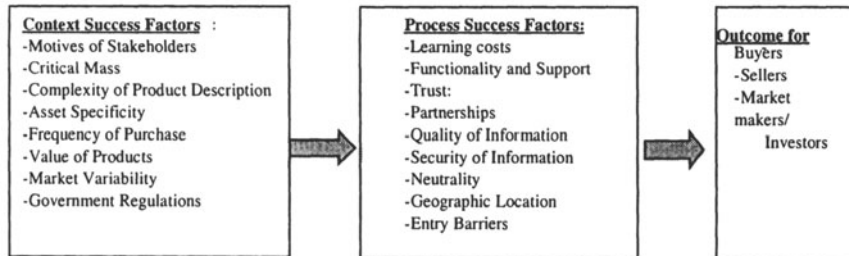


Figure 2 : Research Model of Success Factors of Electronic Markets, segmented into Context, Process and Outcome

3.1 Context related Success Factors

3.1.1 Motives of Stakeholders

Stakeholders will often pursue different, and sometimes conflicting goals. In his research on an electronic market in Hong Kong's air cargo industry (Traxon), Damsgaard found that it was essential that all parties would see the benefits from the arrangement and decide to participate (Damsgaard, 1998).

3.1.2 Critical Mass

Critical Mass can be defined as "the minimal number of users of an interactive innovation for the further rate of adoption to be self-sustaining" (Schoder, 2000). The importance of the establishment of a critical mass for electronic markets has also been illustrated by Lee and Clark (1996), in that the benefits realized by individual participants in an electronic market system increase as more organizations join the system.

3.1.3 Complexity of Product Description

As Malone proposes highly complex product descriptions require more information exchange and thus increase the coordination cost advantage of hierarchies over markets. Consequently items with

simple product descriptions are expected to be more suitable for (electronic) markets (Malone *et al.*, 1987).

3.1.4 Asset Specificity

Transactions involving asset-specific products often involve a long process of development and adjustments for the supplier to meet the needs of the (individual) buyer, a process that favors the continuity of relationships found in a hierarchy. Therefore (electronic) markets are proposed to be more suitable to source goods with a low asset-specificity (Malone *et al.*, 1987).

3.1.5 Frequency of Purchase

Frequency of purchase affects the benefits to be obtained through routinization. The lower the frequency the greater the incentive to try to get the best price each time through a (spot) market transaction (Choudhury, et al., 1998)

3.1.6 Value of Products

In case of high value products even small savings in prices for each purchase, due to comparison among suppliers, can offset the opportunity costs of long term relationship. Choudhury et al (1998) propose electronic markets will likely be chosen by buyers in case of high value products.

3.1.7 Market Variability

Electronic markets have the potential to significantly reduce search costs. This is especially true in those markets where buyers and sellers have to conduct an extensive search to find a trading partner an electronic market might be able to reduce these costs (Choudhury, et al., 1998).

3.1.8 Regulations

Fong et al (1998) found that statutory government support is important for the success of an electronic market, because of the high initial

costs and the problem of free-riders, where outsiders can use the system without making any contribution.

3.2 Process Related Success Factors

3.2.1 Learning Costs

As Lee and Clark (1996) argue, the reluctance of traders to adopt new technologies and embark on a new round of organizational learning may serve as a barrier to successful implementation of electronic markets.

3.2.2 Functionality and Support

Malone proposed that a final stage in the evolution of electronic markets would be the development of electronic markets that provide personalized decision aids to help individual buyers to make a selection from various alternatives (Malone *et al.*, 1987).

3.2.3 Trust

Trust especially applies to electronic markets where the only contact between buyers and sellers may be the contact through databases and the telecommunication network. As Fung and Lee (1999) propose, the development of trust in e-commerce is a continuous process involving initial trust formation and continuous trust development based on repeated trials, until a firm loyalty is formed or participants drop out due to distrust.

3.2.4 Partnerships

According to Damsgaard, partnerships with industry leaders and domain experts can contribute to the success of the electronic market. In his study on Traxon, an electronic market for the air cargo industry created by Cathay Pacific, Air France, Lufthansa and Japan Airlines Damsgaard found that *“each local Traxon system had the other shareholder airlines as initial customers, which constituted a significant share of the air cargo market”* (Damsgaard, 1998).

3.2.5 Quality of Information

Information about products, trading partners and contacts is considered a condition for success of an electronic market. Authenticity (identity of buyers and sellers), integrity (verifiability and completeness of product and price information) and non-repudiation (the ability to hold a buyer or seller to the terms of the transaction they are committed to) are three key features that will fuel or impede the growth of e-commerce (Alba *et al.*, 1997).

3.2.6 Security of Information

Integrity and confidentiality of especially personal and financial information must be assured. This requires not only instituting robust and secure encryption algorithms, but also ensuring that the service providers observe the highest level of internal control and ethical standards in the handling and storage of such information (Asuncion, 1997).

3.2.7 Neutrality

Beach *et al.* suggest in their study on electronic markets in logistics: "Electronic market will only succeed as a high value system for the entire industry provided it is run by an IS firm, fully independent from logistics, sellers and buyers." (Beach *et al.*, 1999). Similarly Fong *et al.* conclude "If ownership and control of the computerized market is not shared among market participants from various sectors within the industry, buyers and sellers are likely to ignore the system" (Fong *et al.*, 1998).

3.2.8 Geographic Location

Several studies suggest that the physical geographic location of the marketplace, headquarters and offices of the market maker contribute to the confidence of (potential) participants. Daniel and Klimis investigated an electronic market in the financial industry and found that "*due to the need for any financial service to be based on confidence between the buyer and the supplier, more localized personalized markets will evolve.*" (Daniel and Klimis, 1999).

3.2.9 Entry Barriers

Special procedures and regulations, serving as entry barriers for potential participants provide safeguards against entrants who are not trustworthy and are expected to contribute to the overall confidence in the electronic markets” (Ribbers and Van Heck 1998).

4. DISCUSSION OF CASE EXAMPLES

4.1 MetalSite

Context: MetalSite has been created for companies that produce, sell and use metal, in order to reduce supply chain inefficiencies associated with the metal industry. Stakeholders of MetalSite are suppliers, service-centers, and buyers of metal products.

Process: MetalSite had focused on the provision of extra functionality to a relatively under-serviced market, namely the *manufacturers and producers* of metal. It was expected that the increased use of sellers would pull buyers into the system. This research showed that sellers are only willing to pay for a system that provides functionality for them. It turns out that they do not adopt, and are not willing to pay for a system that only provides value for the buyer. Neither the buyers paid for this technology because it did not provide sufficient additional value to them.

Outcome: There are several discrepancies in the motives of buyers and sellers, which led to the initial failure of MetalSite. First, Ryerson Coil only used MetalSite to sell their short term, excess inventories. This company probably did not want to jeopardize their existing long-term relationships with their buyers. Since buyers did not receive enough additional value and functionality from trading on MetalSite, they used MetalSite for the purchase of short-term spot materials, impacting the critical mass of MetalSite.

MetalSite temporarily suspended operations in June 2001 and its assets were purchased in August 2001 by Management Science Associates, Inc. (MSA). MSA has used its initial interim period to thoroughly review more than 300 suggestions for improvements made by customers and to make numerous operating changes designed to

speed service and simplify operations for buyers and sellers alike. For the re-launching, MSA MetalSite has attempted to both improve functionality and increase user-friendliness.

4.2 ChemConnect and CheMatch

Context: ChemConnect hosts an electronic market for worldwide buyers and sellers of chemicals, plastics and industrial gas. Since the chemical industry consists of a very fragmented buyer and seller side, ChemConnect was created in 1995 for companies that want to buy or sell chemicals in a more efficient manner. The stakeholders of ChemConnect consist of buyers, sellers and charter members, including a total of 33 companies from the chemical industry that invested in ChemConnect as a means to obtain industry credibility and to attract more buyers and sellers.

CheMatch was an electronic market for the buying and selling of bulk commodity chemicals, polymers, feedstocks and fuel products. CheMatch has attracted a total of 750 companies from the US, Europe and Asia to do business on their electronic market.

Process: CheMatch focused on the global market for trade of spot commodity chemicals, whereas ChemConnect focuses more on facilitating auctions for specialty type chemicals.

Specialty chemicals, borderline specialty commodities and commodity products are general chemical products, with a low *physical asset specificity* and are movable at low cost, therefore having a low *site specificity*.

For CheMatch, a crucial remark was made by DuPont: "*Critical mass is not important, because we only use the RFQ for the procurement of raw materials and because of the fact that this reversed auction is pre-arranged in the sense that DuPont brings in its own suppliers, critical mass is not an important issue.*" This view on critical mass shows that DuPont considers CheMatch as a provider of a technology tools, which they could have purchased themselves.

Outcome: The reason for discussing both markets in the same section is that ChemConnect acquired CheMatch in January 2002. ChemConnect also purchased the Envera Network, one of the industry's two transaction hubs, in a similar deal in June 2001. By combining, the goal is to create increased liquidity that is going to be of tremendous benefit to the industry in the current economy.

4.3 Eumedix

Context: Eumedix focused on the international sector for the procurement of medical products, and had been created in a very inefficient market, with a low frequency of switching occurring from hospitals to other suppliers. Given hospitals often maintained their relationships with existing suppliers, it was also very hard for other, new suppliers to enter the stage. The reason for hospitals to use a limited number of suppliers, with whom they keep long-term relationships, was a result of the high complexity of medical products.

Process: Eumedix attracted the Amsterdam Medical Center, Leyenburg Hospital, and Gelre Hospital as buyers. The total number of transactions facilitated on Eumedix was less than twenty. Eumedix reports Procter & Gamble was one of the few suppliers who were moderately enthusiastic in offering on Eumedix.

Eumedix did not develop any strategies to attract suppliers to their electronic market, because of the fact that these suppliers were only approached if a hospital had selected a particular supplier with whom they wanted to trade.

Outcome: Procter & Gamble did not trust the way in which their product information was presented in the reversed auction and this clearly had a negative impact on the success of the electronic market. In this respect, reference is made to the theory of Lee and Clark on the resistance of buyers if an electronic market does not reflect product information properly (Lee and Clark, 1996).

5. OVERALL DISCUSSION ON RESEARCH FINDINGS

	MetalSite	ChemConnect	CheMatch	Eumedix
Convergent Motives	-	-	-	-
Critical Mass	-	-	-	-
Low Learning Costs	-	-	-	-
Value Added Functionality	-	-	-	-
Partnerships with Domain Experts	+/-	+	+	-
Trust	n.m.	n.m.	n.m.	n.m.
High Quality of Information	+/-	+/-	+/-	+/-
High Security of Information	+	-	-	-
Neutrality	+	-	-	-
Localization	+	+	+	+
High Entry Barriers	+/-	+/-	+/-	+/-
Low Complexity of Product Description	+	+	+	-
Low Asset Specificity	+	+	+	+

+ present

- not present

+/- more or less present

n.m. not measured

Fig. 3. Summary of Case Research Findings

Based on the theory and research on the success factors of electronic markets, several comments can be made:

- With respect to the *convergence in the motives of stakeholders*, it turned out that in cases where the motives of all stakeholders were not met, this electronic market was likely to fail.
- With respect to the *establishment of a critical mass* on an electronic market, it became clear that not the number of participants, but its usage and therefore the number and volume of

transactions compared to (non-) electronic markets is important for its success.

- As to *learning costs*, the necessary learning in order to be able to use electronic markets, clearly influences the adoption of electronic markets, and therefore its success.
- As to the provision of *value added functionality*, electronic markets offer multiple transaction mechanisms as well as credit and logistic services. Apparently, none of these were sufficient to contribute significantly to the establishment of a critical mass.
- As to the formation of *partnerships with domain experts*, it turned out that these have a positive effect on the achievement of a critical mass and therefore the success of an electronic market.
- As to a *high quality of product- and trading partner information* it became apparent that these contribute to the level of trust among traders and therefore to the success of an electronic market.
- As to *the security of information*, all of the investigated electronic markets developed privacy statements as a means to guarantee the security of the information provided by traders, such as company specific information and trading histories, which might have contributed to the level of trust among traders and thus to the success of an electronic market.
- As to *neutrality*, the absence of shared ownership clearly contributed to the failure of two investigated electronic markets.
- As to *localization*, the local focus of an electronic market might contribute to the trust among traders. As to global electronic markets, a globalized character of the industry combined with local support might have a positive impact on the level of trust among traders and thus on the success of an electronic market.
- As to *entry barriers*, the absence of these probably did not yield in distrust on the electronic market and thus had no impact on its success. This was a result of the fact that traders were mostly familiar with one another.
- As to *product complexity*, it became clear that highly complex products are not suitable to be traded on an electronic market, and therefore have a significant impact on its success.
- With respect to *asset specificity*, products that are designed for one single purpose only are not traded very often, which has an impact on the success of an electronic market.

6. ROLE OF INFORMATION TECHNOLOGY AND CONCLUSIONS

The reason for the emergence of electronic markets can be explained as result of the increased use of information technology (IT). From theory, it is clear that IT has the ability to reduce the complexity in the description of products, as well as the specificity of certain products. This allows for more types of products to be traded on markets and thus for the emergence of more markets to facilitate this. Furthermore, due to the use of IT, transaction costs can be reduced. Combined with the product cost advantage of markets, this makes markets becoming more desirable as opposed to the sourcing of goods through a predefined number of suppliers. It is clear that successful implementation of IT in electronic markets is a component of success factors such as creating critical mass, providing trust, and learning costs, among others. The relationship between these success factors and IT implementation is an area for future research.

Our findings suggest a few new contributions to the area of electronic markets. With respect to the attributes on which Kaplan and Sawhney (Kaplan and Sawhney, 2000) distinguish electronic markets, such as type of product, type of contract, market making mechanism, and bias level, two additional dimensions might be distinguishable. First, electronic markets can offer *public*- and *private* market making mechanisms. An example of this was found with ChemConnect, which offers the Exchange Floor, open to all traders, as well as the Corporate Trading Rooms, where traders have to approve one another. Second, electronic markets can offer a certain degree as to *the integration* of the trading process with the business process of a company. Examples of electronic markets that do provide integration are Elemica and Transora, which allow for ERP-to-ERP connectivity and *integrated* supply chain services.

With respect to the divergent motives of buyers, these were most of the time not willing to invite suppliers to the electronic market with whom they already had developed long term relationships. To be more specific, this damage could entail the disappearance of the incentive for suppliers to commit to non-contractible investments, and to charge a fair price (Clemons *et al.*, 1993; Treleven and Schweikhart, 1988). And with respect to the establishment of a *critical mass* on an electronic market, it became clear that not the number of participants,

but its *usage* and therefore the *number and volume of transactions compared to (non) electronic markets* is important for its success.

As to the provision of *value added functionality*, electronic markets offer multiple transaction mechanisms as well as credit and logistic services. Apparently, none of these were sufficient to contribute significantly to the establishment of a critical mass. It would therefore be better to provide 'real value' to traders.

It also was clear during the analysis of MetalSite, ChemConnect, and CheMatch, that buyers mostly used these electronic markets to fulfil small, temporal demands whereas sellers used these as an outlet for their excess inventories. This was caused by the fact that these traders did not want to jeopardize their long-term, already existing relationships with each other. Differently formulated, it is highly questionable whether electronic markets change long-term existing close relationships between buyers and suppliers.

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