B2B BEHAVIOUR EFFICIENCY

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Abstract. In most trade models all firms within an industry are characterized by applying common B2B technology. But still there are a lot of questions addressed to business behavior; when it comes to the choice of technology alternatives, which are selected based on both: costs and benefits. This paper considers theoretical models for analyzing the dynamics of firm behavior, its effects on efficiency and industry-wide efficiency growth. Costs-benefit analysis and theoretical models focuses on dyadic seller-buyer's situations, triadic firms' relationships and synergy effects, which are analyzed in context of EDI services, different nature of business use and performance. The study presented in the paper contains three different parts: first part of study is dedicated to B2B services, including electronic information exchange (EDI) services as well; second part – to organizational buying behavior; and third part – to information exchange efficiency. The article is based on comparative and financial analysis.

Keywords: B2B services, organizational behavior, trade, efficiency, IT services, EDI.

Jel classification: D03, F15, M29, O30.

1. Introduction

Buyers are looking for individual solutions that help to meet the challenge of their everyday life. They are torn between willingness to have the ownership of physical products in consumer economy and motivation for virtual economy stimulating new usage and development of functionality. Two business models can be addressed to firms' concerns (Tukker 2004): the first includes services connected with product movement. The second covers information services (data processing, telecommunications, on-line services, and other IT services).

Although the business models are different, one can conclude that from the buyer point there are the two aspects of the same selling process. Thinking economically there exist services attached to material movement (such services are named products) and services oriented to electronic data usage.

The analysis of economic scientific literature on B2B published by Oxford University Press, Cambridge University Press, Harvard University Press, Springer, M. E. Sharpe, Routledge, etc. shows that 0.4% of authors (from 0.65 mln. in total) are talking about B2B services. 462 of these authors mention the role of efficiency.

So, the analysis of literature shows importance of the research. The aim of research is to propose framework, which can be used to measure single-company and industry-wide efficiency. An economic model – Beckstrom's law (2009) is used for framework development. This core model has never included EDI specifics. In addition, costs-benefit and comparative analysis are used in the study.

2. B2B service definition

In general, B2B (business-to-business) service is an interaction between supplier, who is selling products, and buyer, who has a need: the potential supply of product by seller and the need to receive it by buyer. There are traditional B2B selling and collaborative, based on relationship establishment between sellers and buyers (Age 2011).

By studying the business behavioral aspects, it has to be taken into account that each company can be alternately or customer, or supplier. A potential difference between both also allows data exchange. Research results show that the supplier has a potential level higher than buyer to initiate EDI (Touzi *et al.* 2012).

Many definitions of this term exist having in common the three following elements: B2B service provider, B2B service customer and B2B service delivery (Spohrer 2007). The three main characteristics of service are provided in literature:
-   The co-creation of value: idea of B2B service customer as co-producer uploads data to service system and input it to service process;
-   Relationships: long-term relationships facilitate the ability to tailor the service offerings to B2B service customers' needs;
-   Service provisioning: there's capacity needed to meet fluctuations in service delivery demand and the same time keeping high level of quality for service with intangible nature. (Geigenmuller *et al.* 2011).

Nowadays firms step from the "classical" B2B service approach to the new multi-tier B2(B2B) service concept, which requires the development of platform that support all standards all messages centrally and therefore communications between various entities. Multiple buyers and suppliers to meet on an e-platform that rests on the Internet infrastructure in order to exchange data and conduct transactions online. Therefore, a technology is mandatory that offers multi-language development environment (Mertin *et al.* 2008; Saprikis *et al.* 2012).

2.1. Inputs from information and communication technologies (ICT) industry

The service industry considers service system under the following definition: a configuration of technology and organizational networks designed to deliver services that satisfy the service customers' needs, ideas or wishes. B2B service system includes: B2B service provider, B2B service customer, B2B service environment and technical support. In ICT industry, software is treated as a service. The computer science has proposed a service oriented architecture that

rests on the combination of service system with an effective-governance, technological strategy centered on the definition and on the re-use of services (Bohmann 2008). Here, functionality is decomposed in the set of functions or of services supplied by components. B2B service is an ICT company functionality that seems to be atomic from the service customer point of view.

To minimize production, costs the manufacturing industry has started using the one of B2B services - electronic data exchange (EDI) services, which are provided by ICT industry. EDI is defined as the transfer of structured data by agreed message standards between computer systems of companies without human intervention. EDI is carried out with the groups of companies trading within common industry area. Due to this EDI became an integral part of production industry. Key factors (relative advantage, compatibility, and external influences) which increase orientation to EDI (Saprikis *et al.* 2012):

- Competitive advantage achieved by industry leaders due to technical knowledge and their operational experience with EDI;
- Market pressure to follow industry leaders;
- Availability of EDI services in the market;
- Increased returns: automated data entry benefits comparing with EDI costs.

The primary interest comes when customers realize that suppliers create value. Thus, value creation by suppliers becomes the area of interests for firms. It can be translated into the access of technology, new markets, and information. Finally, buyers realize that this help them to achieve sustainable competitive advantage.

3. Behavior models

The first organization behavior models had their origins in consumer behavior theory and were copy of consumer behavior models. Later on organization buying process, organization environment were included into these models.

Organizational Buying Behavior has been dramatically changing since the 1970s for at least five reasons:

- first, global competitiveness, especially in auto production industry, have pointed out the competitive advantages of creating supply chain relationships;
- second, demand driven production and operations have to be instituted to serve the diversity of demand with respect to time and place;
- third, industry restructuring through acquisitions, mergers, and alliances brought the need to reorganize procurement function from decentralized to centralized strategic function;
- fourth, outsourcing of many support functions such as data processing and human resources;
- finally, the use of ICT including networked computing, EDI platforms, have restructured the buying processes, supplier and buyer ERP (enterprise resource planning: procurement and warehouse management) systems.

To understand aspects of organization behavior knowledge of organizational behavior, industrial organizations, and transaction cost theory is needed.

The source of next-generational competitive advantage is the type of relationships that firms have with their suppliers. In fact, researchers suggest that there should be multi-tiered firms' relationships for buyers with sellers, self-selecting the level of service based on their purchase needs. Wal-Mart is good example of strong buyer-supplier relationships, potentially buying from its estimated 61 thousand manufacturers/suppliers worldwide (Ailawadi 2001).

The situation, when consumer demand at retailer is linked with shipments from manufacturer to the retailer, is known as two-tiers model. In the cases of more complex distribution systems, the models of three tiers (or more) can be deployed; they incorporate the link with wholesaler (then there are links: retailer to wholesaler to production plant). Some retailers, carrying large varieties of product but small inventories, purchase products frequently by sending orders via EDI.

The model becomes more complex when companies are vertically integrated to outsourcing. Outsourcing has become the preferred way of doing business because it allows companies to focus on what they do best and allows them to trust companies which can provide services which are their core competencies and that are what they are concentrating on. So, in EDI case ICT outsourcing is used. EDI is a joint decision made by trading and outsourcing partners, which are taking into account risks and payoffs promised by the investment in their decision-making (Pereto et al. 2010). Four-step approach can be used for B2B services. It includes: (1) understanding the objectives EDI; (2) automated data delivery through technical environment; (3) integrating data within company and its supply chain partners; (4) establishing long-term B2B integration.

In sharp contrast to the older theories of economies the use of EDI and quick response for maximizing efficiency through economies of time (reduced cycle times) and mass customization is different in scale and scope. New ICTs allow firms to connect with each other faster and to establish better cooperation. Linkages such as EDI will reduce costs for both buyer and suppliers.

EDI between buyer and seller can occur in three ways (looking from buyer level): (1) data delivery about customers' needs (i.e., orders, forecasts, sales data), (2) data receipt about upcoming shipments (i.e., advanced shipment notification, shipment manifest), (3) data delivery about arrived shipment (i.e., delivery confirmation, discrepancy reports). Hansen (2009) mentions that buyer-supplier relationships evolve towards more cooperative relationships, which result in changing roles between each other. For example, the situation with co-managed inventory, where suppliers are authorized to write themselves orders (i.e. the buyer is sending sales data and the seller – data about order). Supplier and buyer behavior oriented to B2B integration reduces some of the costs associated with transactions. The transaction cost theory can be used to explain the increase in efficiency related to such behavior.

3.1. The roles of different parties

By outsourcing ICT companies the real benefits are now being appreciated. One main advantage of outsourcing is that supplier and buyer no longer have to make huge capital investments every time they choose to purse new business transactions. Instead of putting money into new solutions, these responsibilities can be outsourced to ICT organizations that already have the knowledge and capabilities to deliver B2B services. Because these capabilities already exist within outsourced organizations they are able to provide ICT service at a much cheaper price than what it would have cost the original companies to do such solutions themselves. Buyers and suppliers are now realizing the benefits that come with B2B integration.

Companies (buyer and seller) are ready to outsource as long as service providers are able to meet the following criteria: (1) quality; (2) technological capabilities; (3) ability to deliver the required amount of data on time; (4) costs.

When complete system integration exists between buyers and sellers, most routine communication will be conducted on-line. Relationship theory suggests that for relationships in which norms and expectations are well developed, provided interactions for purchasing orders, notification of order acceptance, delivery notes, notification of products acceptance, invoicing and payments (Perego *et al.* 2010) can help to improve the existing costs, performance, or both across time.

According transaction cost theory, transaction costs increase as transactors allocate resources for new solutions, and also service provider putting money into new capital investments. This as well shows that gains between transactors are possible when firms are willing to accept relation-specific technologies and investments. The findings suggest that the economic value created by service provider for transactors, in terms of lower transaction costs, may be substantial.

Relationship-specific adaptations are a common business practice. It requires investments and procedures specific to the needs or capabilities of an exchange partner. Whereas the other connectors focus on joint behaviors and shared expectations, adaptive behavior is defined so that it focuses on the individual behavior specific to the other party in the relationship.

The research will be based upon a behavior model of generic relationship types. According to this model, buyer-supplier-service provider relationships are characterized by these main elements: investments that might be necessary to conclude a particular transaction and gradual adaptations that might occur over time, switching costs, and the value delivered to one or both parties connected to these investments reduce costs, increase revenues, etc.

Most firms following a cost-focus strategy for ICT have weak synergy with customers. However, looking from synergy perspective, the expected synergy may be offset by the expectation that the other party may gain additional value. But under conditions of weak leverage and synergy, from buyer's and sender's perspective there is little to gain from data exchanging (Levy 2001).

Costs synergies are realized by eliminating paper documents that are viewed as duplicate with electronic documents. This is related to economies of scale.

4. Models used for efficiency analysis

The behavior theory of producers show that economic efficiency can be increased by selecting appropriate amount of transactions, at which benefits of repeat purchase are equal to minimum transaction costs. The full benefit of EDI can be obtained only when it is utilized for a large number of transactions. Authors Lee *et al.* (2005) used data envelopment analysis (DEA) model to benchmark the efficiency of EDI in the context of finance and trade transactions. Their model contained eight variables as input and four variables of EDI implementation and performance as output. Results showed that higher efficiency is utilized in financial than in trade applications (Lee *et al.* 2005).

Ever since investments in ICT moved from operational to decision support, academics and practitioners have been looking for ways to justify the costs (Peacock, Tanniru 2005). Traditional approaches, such as NPV, have been shown their ability to link investment justification with impact assessment.

According Beckstrom's Law the value to each user is determined by calculating the net benefit value the presence of the network adds to all transactions conducted by its users (buyers, sellers) over that network. The model can be used for any size of network, whether it has two users or billions. The model applies a user centric perspective. It can be used for EDI networks, there entities that uses network are companies. The network means services to participating parties, which are provided to entities, and those services can be valued by an accounting of the costs and benefits of all transactions that are enabled by those services. Since benefits and costs are calculated from the unique standpoint of each party, when there is no double counting (Beckstrom 2009) for two-tier and multi-tier analysis.

To specify the model, the future benefits of transactions must be discounted to net present value terms. It is also important to recognize that transactions are not always simple and paired as an online book purchase, where you deliver money and receive a book. Some transactions, such as licensing anti-virus software, occur annually, but most benefits are derived on a usage basis over that period of time. Put in economic terms, the net present value of any network to any entity is equal to the sum of the net present value of the benefit of all transactions less the net present value of the costs of all transactions on the network over any given period of time, as shown in the following equation (Beckstrom 2009):

$$V_{i,j} = \sum_{k=1}^{n} \frac{B_{i,k}}{(1+r)^{tk}} - \sum_{l=1}^{n} \frac{C_{i,l}}{(1+r_l)^{tl}} \tag{1}$$

Here $V_{i,j}$ is net present value of all transactions of k = 1 through n to individual i with respect to network j; i − one user of the network; j − identifies one network or

network system; $B_{i,k}$ – the benefit value of transaction k to individual i; $C_{i,l}$ – the cost of transaction l to individual i; rk and rl = the discount rate of interest to the time of transaction k or l; tk or tl – the elapsed time in years to transaction k or 1.

The simplest way to identify economic efficiency is to make the sum of net present value benefits and costs. The simplified equation is below:

$$V_{i,j} = \sum_{k=1}^{n} B_{i,k} - \sum_{l=1}^{n} C_{i,l} \qquad (1.1)$$

The net present value benefits (time saved through information access or productivity gains emanating from corporate information exchange) should be higher than the costs of that transaction, or the entities would presumably not execute that transaction. Also net present value benefits of transaction are equal to or less than the costs of conducting the same transaction through another service. In simple transaction like buying a book, where one entity delivers money and receives book, the benefits are assumed to be higher than costs (Beckstrom 2009).

The benefits of a transaction on a network are bounded with a lower and upper limit. Regarding the upper limit, the benefits should not be greater than the all-in costs of conducting the transaction through an alternative means.

Costs of networks include the costs of joining or maintaining access to EDI network, such as paying for Internet access, and all costs associated with conducting transactions over EDI network, including labor costs, electricity, the costs of service delivery, ERP integration costs, costs of time and any other.

The model can be explicitly extended to incorporate investments and security related losses. C' is equal to all costs, except costs of investments which are defined as IC and security related losses, which are defined as L. Then the equation becomes:

$$V_{i,j} = \sum B_{i,k} - \sum C_{i,l}^{'} - \sum IC_{i,o} - \sum L_{i,p} \qquad (1.2)$$

Here $C_{i,l}^{'}$ – the costs of all transactions except costs related to investments and security related losses; $IC_{i,o}$ – the costs of investments for transaction o to the entity I; $L_{i,p}$ – security related losses: the costs of security loss p to the entity i.

Security costs (investments plus losses) are optimal when they have been minimized. While calculating the expected losses is extremely difficult, the losses of service provider are the sum of all losses of network members, which appears due to EDI system breakdowns and data that is placed to system by one party and is not delivered to another party on-time due to technical EDI system issues.

$$SC_{i,j} = IC_{i,o} - \sum L_{i,p} \qquad (1.3)$$

Here SCi,j – security costs for the entity i in network j.

While in the short term for service provider investments would be greater, in the long term, the two should converge in that over time the lost value add would lead to an equal and offsetting investment in replacing network functions with new one.

5. The impact of EDI

Turner and Williams (2005) analyzed the impact EDI on automotive industry. Conclusions supported the hypothesis that benefits were being achieved depending on the degree of commitment of firms to have system integration.

Other authors indicated that organizations experience both operational and strategic benefits from EDI. Customer-initiated EDI users recognized slightly greater EDI strategic benefits than did other users. Also, long-time users recognized both strategic and operational benefits in greater proportions than did more recent users, and smaller firms more often cited better customer service and convenience (as strategic and operational benefits, respectively) from implementing EDI (Sriram *et al.* 2000).

Asare *et al.* (2011) mention that EDI provides benefits to the participating firms. These specific benefits are linked with both the extent to which EDI is diffused and applied and the level of subsequent benefits that are gained and accumulated by companies. The number of suppliers found that despite being forced into EDI adoption, they were obtaining some competitive advantage, and having received new business possibilities (e.g. international contracts) partly as the result of being EDI capable.

The research of Downing (2002) examines three categories of companies with regard EDI usage: (1) companies that not use EDI at all, (2) companies that use traditional (integration-based) EDI, and (3) companies that use Web-based EDI. Performance is examined for these three types of companies using following dimensions: process costs, operational efficiency, commitment between EDI partners, and overall performance. Results show that companies using Web-based EDI experience have superior performance in commitment between EDI partners, while companies using traditional EDI experience superior performance in internal operational efficiency as well as overall performance (Downing 2002).

Traditional EDI has been used for some years and brought its users significant advantages resulting in increased time-based delivery performance and operational efficiency (Iyer *et al.* 2004). Many small but operationally important suppliers lack enthusiasm for this EDI because it is expensive, complicated and they stand to gain little from it. This non-compliance prevents the large firms from realizing some of most significant tactical benefits of EDI such as advanced supply chain reforms. The problem of large retailers - the integration of both EDI systems using an intelligent gateway (Blanchard et al. 2008) now is moved to EDI service providers.

Using data from major U.S. office furniture manufacturers that adopted EDI primarily to improve the efficiency of accounting transactions, authors Anderson

and Lanen (2002) evaluate whether EDI reduces order-processing time (the time from sales order receipt to sales order scheduling) and whether this improvement is greater for more complex orders. Authors find that EDI is associated with faster order processing, independent of complexity, and more accurate data handling.

Past studies on EDI have focused mainly on large firms, but now also small businesses are able to enjoy the benefits of EDI. Kuan and Chau (2001) collected data from 575 small firms in Hong Kong and compared adopter firms with non-adopter firms. For small businesses, benefits are perceived to be higher by adopter firms than by non-adopter firms.

The impact of EDI is limited to geographic territory where EDI provider is presented. If seller seeks to sell goods abroad the connection between two EDI providers is needed. The parties of single EDI network are provided in Fig.1.
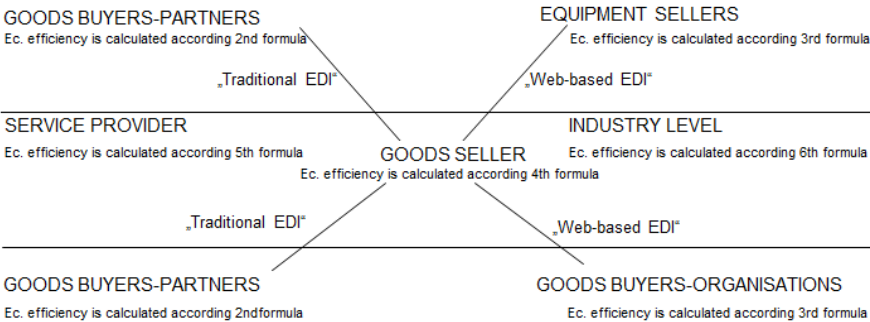
GOODS BUYERS-PARTNERS
Ec. efficiency is calculated according 2nd formula

EQUIPMENT SELLERS
Ec. efficiency is calculated according 3rd formula

„Traditional EDI"   „Web-based EDI"

SERVICE PROVIDER   INDUSTRY LEVEL
Ec. efficiency is calculated according 5th formula   Ec. efficiency is calculated according 6th formula

GOODS SELLER
Ec. efficiency is calculated according 4th formula

„Traditional EDI"   „Web-based EDI"

GOODS BUYERS-PARTNERS   GOODS BUYERS-ORGANISATIONS
Ec. efficiency is calculated according 2ndformula   Ec. efficiency is calculated according 3rd formula

Fig. 1. The schematic model, used to measure information exchange efficiency

The role of service provider is to redesign their software product and service offerings to align Web-based and traditional (integration-based) EDI possibilities (Rebecca 2002). Service providers are also responsible for technical controls, monitoring and ensuring data transfer. Thinking about costs and benefits, different specifics have to be analyzed. For example, costs for buyer and seller associated with service fee are benefits (service sales) for EDI service provider and so on.

The components of 1.2 formula: benefits, costs, investments and costs of security loss are detailed for each EDI network party in Table 1. This information was received from EDI providers EDImatrix and Elemica (which handle more than 50 million documents a year in different continents and have more than 1800 clients) and companies, experienced in EDI – Logica and Servinet.

Based on different nature of business use and performance several derivatives of core model (Beckstrom's law) are used for measuring single-companies and industry-wide efficiency (Table 2).

Table 1. Components of Beckstrom's law equation (Source: compiled by author)

	Benefits		Costs'	Investments		Costs of security loss
EDI	Web-based EDI	Traditional EDI	All types of EDI	Web-based EDI	Traditional EDI	All types of EDI
Seller	Lower	Higher	Service fee	0	One-time	Losses
Buyer	Higher		Service fee	One-time		Losses
Service provider	Service sales		Maintenance	One-time	Multiple	Sum of losses

Table 2. Formulas used for information exchange efficiency evaluation (Source: Table 1)

Formula nr	Formula
2nd formula	$$V_{i,j} = B_{i,k} - C'_{i,l} - IC_{i,o} - L_{i,p}, here\ i = w$$
3rd formula	$$V_{i,j} = B_{i,k} - C'_{i,l} - L_{i,p}, here\ i = f$$
4th formula	$$V_{i,j} = \sum_{k'=1}^{n} B_{i,k'} - C'_{i,l} - IC_{i,o} - L_{i,p}, here\ \ k' = number\ \ of\ \ in-transactions$$
5th formula	$$\begin{cases} V_{i,j} = B_{i,k} - C'_{i,l} - IC_{i,o} - L_{i,p}, \ \ here\ i = h\ (web-based\ EDI); \\ V_{i,j} = B_{i,k} - C'_{i,l} - \sum IC_{i,o} - L_{i,p}, \ \ here\ i = h\ (traditional\ or\ both\ EDI); \\ Minimize\ SC_{i,j} = \sum IC_{i,o} - \sum L_{i,p}, \ here\ \ i = h\ (both\ EDI\ systems). \end{cases}$$
6th formula	$$V_{i,j} = \sum B_{i,k} - \sum C'_{i,l} - \sum IC_{i,o} - \sum L_{i,p}, \ here\ n = number\ \ of\ \ trade\ \ parties$$

Derivatives of core model are created considering various parties' incentives and business behavior analysis. Suggested derivatives apply the B2B centric perspective. According this logic benefits are accumulated by company being in centric position. The benefits of company placed in center grow the new member joins the same network j and increases the number of out-going transactions. As main costs are constant, synergy effect is reached as the number of incoming transactions increase the net present value of benefits for company having centric position.

As service provider stands for ICT industry, industry-wide efficiency is measured only between trade parties.

6. Conclusions

The "classical" two-tier B2B service approach is moving to new multi-tier B2(B2B) service concept, which requires the development of platform that support communications not between two, but between various entities. This allows multiple buyers and suppliers to meet each other on e-platform seeking to exchange data about products and conduct transactions online. If in past mainly large firms were interested, now also small businesses are able to conduct transactions online.

The study results show that new source of competitive advantage is EDI adoption: companies received new business possibilities (e.g. international contracts) partly as the result of being EDI capable.

The impact of EDI is limited to geographic territory where EDI provider is presented. If seller seeks to sell goods abroad the connection between two or more EDI providers is needed. Due to limitation of study the cross-border EDI is not deeply examined and has to be investigated in further papers.

The research is based on behavior model with generic relationship types and not taking into account adaptive behavior (individual behavior specifics).

The framework, which can be used to measure single-company and industry-wide efficiency, is suggested in the paper. Derivatives of core model (Beckstrom's law) are created considering various parties' incentives and business behavior analysis. benefits and costs are calculated from the unique standpoint of each party, when there is no double counting for two-tier and multi-tier analysis. Suggested derivatives apply the B2B centric perspective. This means that synergy effect is reached for firm having centric position when new members join EDI network.

The study results can be useful for public policy formulation.

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