INTER-ORGANIZATIONAL INFORMATION SYSTEMS AS A TOOL FOR COMPUTER-SUPPORTED CO-OPERATIVE WORK

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ABSTRACT

Business enterprises and other organizations use more and more outside services to support the conducting of their business activities. Increased efficiency and a more professional way of working can many times be achieved by using these services than by doing everything in-house. Examples of this "externalization" of business can be seen in all kind of services, from cleaning services to core functions of companies such as advertising, marketing in general, warehouse functions, etc.

This means that working is no more conducted as a group work inside companies. Most activities needing group work actually occur **between** organizations. Techniques for supporting co-operation between people in different organizations must clearly be developed.

The concept of inter-organizational information systems offers an excellent basis for this kind of analysis. Inter-organizational information systems can be seen as tools for enterprises and their employees to conduct co-operative work.

This study reports results of an empirical study conducted in a large insurance company. To evaluate the information systems of the company a framework based on the transaction cost theory is developed. In this framework, computer-based systems are supposed to lower the transaction costs involved in the work.

1. Introduction

With the current rate of information technology in use in organizations and the fast developments in the fields of office automation, telecommunications and traditional information technology it is clear that people in a workplace communicate all the time more through computer systems.

Actually more and more communication and group work is taking place between organizations nowadays. Business is living a period of increasing interdependence. Commercial enterprises are no more only rivals to each other, but also many different kinds of alliances exist nowadays. This means that information systems must also be thought as vehicles assisting inter-organizational relationships. This fact was seen for example by Felix Kaufman as early as 1966: *Company boundaries are not the only, or even the most meaningful, system boundaries. Therefore, even though internal systems may still be far from totally integrated, perceptive management needs to begin to consider the new possibilities for coordinating data processing outside its own organizational limits* [9].

The orientation of organizations towards external relations is strengthening itself all the time. In a current study it was found out that MIS organizations find communication related questions to be the most important group of all questions facing them [7].

At the same time it is clear that building information systems that cover several organizations is a demanding and resource-consuming task. Not everything can be completed overnight. That's why instruments assisting in finding the best investment alternatives are desperately needed. In this article it is suggested that business relationships and co-operative work is hampered by transaction costs, and that these costs should be eliminated.

In order to achieve this goal, the concepts of inter-organizational information systems and transaction costs are explored. As an early sketch of how the transaction cost could be used as an guideline for selecting between different inter-organizational information system possibilities, some inter-organizational relationships of a large insurance firm are analysed in order to find out whether transaction costs can be lowered and co-operative work so made more fluent by using inter-organizational information systems.

2. Inter-organizational information systems

Inter-organizational information systems (IOS's) have become one of the most discussed themes in the field of MIS as various examples from the academic world [2,3,4,5,6,8,10,11,12,13,14] as well as from the world of practitioners (for example the famous networks of SWIFT, IVANS, American Hospital Supply and airline reservation system in Europe and in the United States) show.

In spite of all this attention towards IOS's, many still feel inconvenient when IOS's are talked about. What are they actually and to which purposes can they be used? This kind of confusion is of no wonder in the current days of several hardware and communication architectures and booming distributed computing and network usage. All attempts trying to give light to the situation should be welcomed. We can attempt to understand IOS's from three viewpoints:

1 Why the boom with inter-organizational information systems? (pragmatic viewpoint)
2 What constitutes an inter-organizational information system? (component viewpoint)
3 To which purposes can inter-organizational information systems be used? (functional viewpoint)

The key notions from each of these viewpoint are summarized here:

Pragmatic point of view

Many economic, technical, organizational and competitive changes encountered in most industries have made IOS's feasible. Among the most visible reasons are

-deregulation in the field of telecommunications
-dropping prices
-emerging standards
-changing competitive environment
-traditional communication methods become more and more expensive

Functional point of view

IOS's are built in order to gain operative and strategic advantages. Yet building of company image, learning of technology or simply a "must" situation many times are sufficient reasons to build IOS's.

The three application areas of IOS's are
electronic data interchange
electronic mail
usage of external data-banks

Component point of view

The following are the key components of IOS's:
1 two organizations that communicate use the systems
2 the communication takes part through a computerized system

3. Transaction costs as an object of analysis

Much of the work around the transaction cost theory should be credited to Oliver E. Williamson[1], who has worked on this discipline for a long time.

The main idea of the transaction cost approach is that *institutions have the main purpose and effect of economizing on transaction costs* [17, p.1].

Current research in decision support systems, management information systems, artificial intelligence and many other fields has focused mainly on individual level decision -making. Real understanding of how groups and organizations make decisions has been missing. TCA offers as rich framework on which to build understanding of co-operative decision-making and behaviour on different situations.

Information systems are used to make information flow fluent and cheap. Since most transaction costs are caused by insufficient or missing information or the costly processing of it, information systems are devices to reduce transaction costs. *Information technology belongs to those technologies, like the telephone and money itself, which reduce the cost of organizing by making exchanges more efficient: it is thus a mediating technology, i.e. a technology that links several individuals through standardization and extension of the linkages.* [15]

The concept of transaction cost is very central to the transaction cost theory. Transaction costs are costs caused by conducting business transactions. They are *the costs of running the economic system*[1]. As

1 Williamson has written over 30 articles or books on the theme, including [16] and [17].

all kinds of costs, they inhibit economic activities.

Transaction costs can be compared with friction, a term used in engineering sciences:

> *A transaction occurs when a good or service is transferred across a technologically separable interface. With a well working interface, as with a well-working machine, these transfers occur smoothly. In mechanical systems we look for frictions: do the gears mesh, are the parts lubricated, is there needless slippage or loss of energy? The economic counterpart of friction is transaction cost* [17,p.1].

Transaction costs are costs that occur because there are several actors in the transaction. All the other costs are production costs.

Transaction costs are caused by **asset specificity** and **complexity of product specification.**

Asset specificity refers to the situation where an input used by a firm (or individual consumer) cannot readily be used by other firms because of site specificity, physical asset specificity or human asset specificity. In addition to these types of specificity, Malone, Yates and Benjamin introduce the concept of *time specificity*[10].

Site specificity occurs for example when a natural resource is available only locally, and its transportation is impossible or expensive. For example turf as an energy source is a site specific asset.

Physical asset specificity occurs when the design and/or construction of a resource is so individual that it can only be used for one purpose. A complex company-wide information system as a whole is typically asset specific.

Human asset specificity comes along with specialization. The skills of a lion-tamer are of no use for most companies.

Time specificity comes in when we speak of resources that can get old. Most of information or tomatoes are typically time specific resources.

Complexity of product description *refers to the amount of information needed to specify the attributes of a product in enough detail to allow potential buyers (whether producers acquiring production inputs or*

customers acquiring goods) to make a selection [10].

The existence of these forms of human behaviour further adds transaction costs.

Bounded rationality refers to the state where an actor taking part in an transaction tries to be rational, but because of missing information or other factors, his behaviour does not seem fully rational to outside observers. Limits on rationality must not be interpreted as nonrationality or irrationality.

Opportunism means *self-interest seeking with guile* [17, p.47]. Actors conducting a transaction even exert themselves to mislead, distort, disguise, obfuscate or otherwise confuse the other part or the transaction. It leads to **information asymmetry**, a state in which the other actor knows more than the other.

4. CSCW in the light of transaction costs in an insurance company

In this chapter the IOS's of an insurance company are analysed. The logic is to find out whether

a) the current tasks shared between two companies should be conducted in-house
b) whether the shared tasks are optimally automated or not.

By analyzing the transaction costs and the current systems three kinds of conclusions can be arrived at:

Conclusion A:
Both transaction cost and automation high => even heavy automation hasn't eliminated the transaction costs involved, the function should maybe be conducted in-house (if possible)

Conclusion B:
Transaction costs high and automation low => the situation could be improved with better information systems

Conclusion C:
Transaction costs low => no need for further automation

The study method was based on some 30 intensive interviews with

the employees and managers of the insurance company. During the interviews, the functions of the company needing co-operative computer-supported work between organizations were identified, and characteristics of these functions and the systems supporting these functions were discussed. The author has in addition had access to some of the systems himself and has been able to familiarize himself with plentiful literal material on the systems.

Sampo Insurance Company Limited, with its cooperating companies, is Finland's second largest insurance company group providing a full spectrum of insurances. When referring to the whole group of legally separate companies, we should speak of the Sampo Group. For shortness, we will from now on speak of "Sampo", implicitly referring to the whole group. Sampo has some 2000 employees distributed all over Finland in about 80 offices with headquarters in Turku. Sampo has about 5000 million FIM at its balance sheet and enjoys an total premium income over 2000 million FIM yearly. The information technology of Sampo is based on a IBM mainframe solution, with a big amount of microcomputers supporting the organization too. Sampo's position is especially strong in the private household sector: home, car, and travel insurance.

The units of Sampo are:

PRIVATE MARKET UNIT	(PMU)
BUSINESS MARKET UNIT	(BMU)
INVESTMENT UNIT	(INV)
FINANCIAL MANAGEMENT UNIT	(FMU)
SAMPO PENSION	(SP)

The information systems of Sampo are all under the control of one of the units. In addition to unit specific information systems there are some information systems common to all.

The three forms of inter-organizational systems taken under inspection are:

a) electronic data interchange (EDI)
b) electronic mail (EM)
c) accessing data banks (DB)

In a big insurance company there are of course several inter-organizational links. Only the following six IOS's are taken into closer examination:

	Type	Users
Statistics for authorities	**EDI**	**ALL**
Motor insurance application	**EDI**	**PMU**
ALIBA	**EDI**	**PMU**
Customer contact system	**EDI**	**BMU, (PMU)**
Bank contact system	**EDI**	**FMU**
Reuter Information Service	**DB**	**INV**
Other databases	**DB**	**ALL**

Table 1 The IOS's of Sampo to be explored

Of each system a short introduction to its nature is provided. Then the transaction costs involved are assessed and assigned a number from 0 to 3 (0 = no transaction costs). Finally the technology at hand is discussed, there are three possibilities:

(1) transfer of physical media (least automated),
(2) batch transfer or
(3) on-line transfer (most automated).

Statistics to authorities

The purpose of the system
Statistical information is sent to various authoritative statistical organizations, who use it in several ways. There is a possibility to get data back on all the companies, but currently there are no resources at Sampo to utilize this possibility.

Assessment of transaction costs
The data to be sent to the authorities is well defined and no difficulties caused by complexity of product description should be encountered. On the other hand the data to be sent is very customer (asset)specific, it can't be used in other external connections. Since the data to be sent is of very refined character, the bounded rationality of the insurance company is high. Because it is not question of a basic business relation, no opportunistic behavior should be found. On the average the transaction costs involved are quite low (=1).

Technology used to establish the link
Transfer of physical media (tapes).

Motor insurance application

The purpose of the system
To carry motor vehicle insurance applications to Sampo from car dealers, who do the applications on behalf of their customers.

Assessment of transaction costs
The whole system is based on the idea that the insurance applications the customers make are similar to every insurance company. With one electronic link the customer (actually the dealer doing the application for the customer) can contact all finnish insurance companies. So there is no asset specifity.

Complexity of the product description is different in the case of A) motor third party liability insurance and in the case of B) comprehensive motor vehicle insurance. A) is obligatory and similar to everyone, B) is voluntary and suits for tailoring to the customers needs. With a there is no complexity of product description, with B it is a severe problem.

Customers (dealers) suffer from both opportunism and bounded rationality. They try to find out the best offering, but have difficulties in finding out the right offer from the insurance company. On the whole it can be said that the transaction costs involved are quite high (=2).

Technology used to establish the link
Batch-connection from Sampo to Suomen Palveluverkko Oy, to the network of which the car dealers can connect themselves.

ALIBA

The purpose of the system
To carry information on the bonuses of customers who change their motor insurance from one insurance company to other.

Assessment of transaction costs
The information to be sent through this system is very simple (a digit telling the percentage of the bonuses a customer is entitled to) and by no means insurance company specific (the same information is needed by all the insurance companies. So there exists no asset specifity or complexity of product description.

Because we talk of a simple administrative function, opportunism or

bounded rationality are also absent. On the whole, transaction costs are about zero.

Technology used to establish the link
Batch-connection from Sampo to Suomen Palveluverkko Oy, to the network of which all major finnish insurance companies have connected themselves.

Customer contact system

The purpose of the system
Primarily a technical solution for sending and receiving messages between Sampo and other companies. Offers many possible applications; different kinds of messages can be sent with the system. Current applications include among other messages of changes in fleet insurances from truck companies and statistical information about losses and premises to the truck companies.

Assessment of transaction costs
The data to be sent through the system can take various forms. It is always tailored to the specific needs of the customer (asset specifity) and can take various forms (data to be sent is complex)

Customers are using the system for opportunistic purposes. By reading the statistics and changing the terms of their insurance policies they can save money. At the same time they anyway still suffer from bounded rationality.

On the whole, transaction costs are very high (=3).

Technology used to establish the link
Asynchronous communication on batch-mode, which uses normal dial-up telephone lines.

Bank contact system

The purpose of the system
Primarily a technical solution for sending and receiving messages between Sampo and banks. Can be used for various financial transactions.

Assessment of transaction costs
The messages to be sent through this IOS's are well defined (no complexity of product description) and at the same time addressable to any banks in Finland (no asset specifity).

No opportunism or bounded rationality exists. Total transaction costs are near zero.

Technology used to establish the link
A micro-computer based packet. Uses dial-up telephone lines on an asynchronous mode.

Reuter Information Service

The purpose of the system
Displays information on changes and trends in financial markets: stock market, raw-material market, currency markets, general news etc. This data is to support investment decisions by the investment unit.

Assessment of transaction costs
The information to be derived from the data-bases is very ill-defined. Many kind of data can be of use depending on the situation. So the data to be derived is to be called complex. On the other hand also other's can use the same data: it is no customer specific.

The service is used to lessen bonded rationality and used for opportunistic purposes: how should the money of the insurance company be invested for the best gain.

On the whole the transaction costs involved are very high.

Technology used to establish the link
Uses technology and equipment entirely provided by Reuter: on-line connection to Reuter's data bases.

Other data-banks

The purpose of the system
Connections to several data-banks can be taken in order to get different kinds of information needed in the running of the business.

Assessment of transaction costs
The situation is similar to the usage of Reuter's financial data service, the problems to be solved are maybe even more complicated.

On the whole the transaction costs involved are very high.

Technology used to establish the link
Connections to data bases through dial-up lines, the questions are made on-line but information is returned on a batch-mode.

The results of the empirical inquiry are summarized in table 2. One of the main results of the study seems to be that inter-organizational business relations in this organization are served through IOS's operating in a batch mode. While this mode of operation is suitable for many traditional operative back-office functions, it is not suitable to take care of the needs of today's many hasty business relations. A more interactive mode of operation is many times needed, which requires the use of on-line systems.

Only one function, decision-making on investments was still found out to have high transaction costs in spite of heavy automation. Unfortunately this function of an insurance company rests on data in various forms from outside word, and no possibilities to do these decisions without external contacts exist.

Half of the rest six systems fall to the category where transaction costs could be lowered with better information systems. On the other hand, there are also three applications which already have low transaction costs and where more automation won't bring any extra value.

	Transaction costs	Level of Automation	Conclusion
Statistics for authorities	**1**	**trans. of media**	**C**
Motor insurance application	**2**	**batch**	**B**
ALIBA	**0**	**batch**	**C**
Customer contact system	**3**	**batch**	**B**
Bank contact system	**0**	**batch**	**C**
Reuter Information Service	**3**	**on-line**	**A**
Other databases	**3**	**batch**	**B**

Table 2 Results concerning the seven IOS's of the case company

5. Conclusions

The fact that most business relations and work situations do not limit themselves to a single organizations should be clear to everyone. That's why means that support co-operation between organizations in addition to the more traditional intra-organizational view should be developed. The concept of inter-organizational information systems is among other things based on this idea.

Even the small empirical test conducted should assure the reader that by analyzing the balance between the transaction costs involved in a business relation and the sophistication of the system supporting that relation valuable information can be gained on how to develop information systems.

From the viewpoint of an organization, the elimination of transaction costs is a major challenge. The need of elimination of transaction costs is usually not studied from the viewpoint of an individual or worker, but it should be clear that by making business and working relationships more fluent lower transaction costs should also contribute to the job satisfaction of workers.

The most difficult thing with transaction costs seems to be the measurement of them. No general measurement method of transaction costs can't be constructed because the transaction costs involved in a relation are highly context sensitive. One possibility to measure transaction costs is to base the analysis on subjective opinions, as is done here, when the context sensitivity can be grasped but when no mathematical calculations are available. Another means is of course to construct a quantitative measurement instrument, when possibilities to handle the results are increased, but when at the same time a risk on not taking into attention the right and most important variables is added.

REFERENCES

[1] Arrow, Kenneth J., *The Organization of Economic Activity; Issues Pertinent to the Choice of Market Versus Nonmarket Allocation*, on the Analysis and Evaluation of Public Expenditure: the PPB System. U.S Joint Economic Committee, 91st Congress, Ist session, Washington D.C.,1969, 59-73.

[2] Barrett, Stephanie, *An IS* Case: the Closed Loop Scenario*, Information and Management 5/1985, 263-269.

[3] Barrett, S - Konsynski, B, *Inter-organization information sharing systems*, MIS Quarterly, special issue December/1982, 93-104.

[4] Cash, James I, Jr, *Interorganizational Systems: An Information Society Opportunity of Threat*, The Information Society 3/1985, 199-228.

[5] Cash, James I, Jr - Konsynski, Benn R., *IS redraws competitive boundaries*, Harvard Business Review March-April/1985, 134-142.

[6] Clemons, E.K. - McFarlan, F.W., *Telecom: Hook Up or Lose Out*, Harvard Business Review July-August/1986, 91-97.

[7] Feeny, David F. - Edwards, Brian R. - Earl, Michael J., *Complex organizations and the information systems function - a research study*, Oxford Institute of Information Management, Research and Discussion Paper 1987/7.

[8] Johnston, Russell H. - Vitale, Michael R., *Creating Competitive Advantage With Inter-Organizational Systems*, MIS Quarterly June/1988, 153-165.

[9] Kaufman, Felix, *Data Systems That Cross Company Boundaries*, Harvard Business Review January-February/1966, 141-155.

[10] Malone, Thomas W. - Yates, Joanne - Benjamin, Robert I., *Electronic markets and electronic hierarchies*, Communications of the ACM June/1987, 484-

497.

[11] Runge, David A. - Earl, Michael J., *Gaining Competitive Advantage from Telecommunications*, On *Information Management - The Strategic Dimension*. Editor Earl, Michael. Oxford University Press, 1988.

[12] Runge, David A., *Using telecommunications for competitive advantage*, Doctoral thesis Oxford Institute of Information Management and Magdalen College, 1985.

[13] Stern, Louis W. - Craig, C.S., *Interorganizational data systems: the computer and distribution*, Journal of Retailing Summer/1971, 73-91.

[14] Stern, Louis W. - Sturdivant, Frederick D., *Customer-driven distribution systems*, Harvard Business Review July-August/1987, 34-41.

[15] Thomson, J.D.,*Organizations in Action*, Russell Sage, New York, 1967.

[16] Williamson, O.E.,*Markets and Hierarchies: Some elementary Considerations*, The Free Press, 1975,

[17] Williamson, O.E., *The Economic Institutions of Capitalism. Firms, Markets, Relational Constructing*, The Free Press, 1985.