A strategic information system in the public sector - A major opportunity with several small ordinary barriers

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Abstract

The discussion on strategic information systems (SIS) and the possibilities of achieving sustaining competitive advantage with SISs, was at is peak in late 1980's and early 1990's. Since then, many researchers have come to the conclusion that achievement of that kind of competitive advantage is a difficult task or almost impossible task. However, there are some very rare cases in which sustaining competitive advantage can really be reached. However, it seems to have been left unnoticed that the potential of such competitive advantages can often be found in the public sector. There are two objectives in this paper. First, through an example and theoretical background it is presented a way, how it could be possible to public organizations to achieve sustaining competitive advantage with strategic information systems. Second, the problems preventing the strategic benefits of SIS, are also discussed. The results of longitudinal research are based on two wide studies in a case organization. The issues of strategic information systems in public sector are highlighted especially from the European point of view.

Keywords: Strategic information systems, public sector, competitive advantage

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Strategic Information Systems Planning

1. Introduction

In the 1980's, there was a strong belief of achieving sustainable competitive advantage through strategic information systems. Attempts to this were developing totally new and different types of information systems (IS). In Europe, a belief in the possibilities brought by strategic information systems was created by American style success stories. Many of these examples concerned inter-organizational systems (e.g. McKesson Drug Company (Clemons & Row, 1988)). Objectives of the system were often to tie up the customer as a regular customer. In late 1980's the estimates of the gained competitive advantage changed to caution. Especially innovator's position was noticed to be difficult. Developing new information systems is expensive, and competitors can easily copy and even improve the systems. (especially inter-organizational system). It was regarded that the system brings only a temporary competitive advantage with respect to competitors. (cf. Leino, 1995 p. 34; Reponen, 1991 p.6; Reponen, 1994; Ciborra, 1990; Ciborra 1993)

For how long the competitive advantage, achieved by information systems, lasts depend on how long it takes the competitors to build a similar system. Issues as company structure, or management of institutional context can differentiate the company from its competitors (cf. Clemons & Row, 1991; Oliver, 1997). Those elements may enable sustainable competitive advantage for a firm, because it may be difficult or sometimes even impossible for the competitors to change their resources. If an information system connected to such elements, it can be hard for the competitors to build up a similar system (cf. Mata et al., 1996; Clemons & Row, 1991).

The public sector is in a tightened financial and competitive situation (cf. Salminen & Niskanen, 1996). One of the reasons for this is that the political climate in Europe is emphasising liberal market policy. As a consequence of this, the public sector is competing in service production with private firms. Some public organizations are even competing with each other (cf. Heinonen 1997, p. 57). In practice, the public sector is in a direct competition with the private sector, or in an indirect competition through the monitoring of their costs of producing same services.

However, public organizations often differ in structure (group organization and common integrated functions), and institutional context (tasks fixed by laws) from their private competitors. In some cases also risk financing (taxes) of development of strategic information systems make achieving a sustainable competitive advantage possible for the public sector. However, this possibility has not been recognised by the public administration. Instead of acting as an innovator, the public administration paradoxically tries to follow the trends of the private sector. In the private sector, achieving sustainable competitive advantage with information systems is difficult and rare. As a result it is no more discussed as much in public as in 1980's.

In this article two studies are presented. The first one is concerning strategic meaning of information system in the public sector and the second one is handling those problems that can prevent strategic benefits of information system. The contribution of this paper is illustrated through theoretical background, and these two studies concerning geographical information system (GIS) of the Vaasa City between years 1994-1998.

2. Recent research

According to Heinonen (1997), competitors of each other are both public and private organizations, which satisfy similar demands. Heinonen (1997) claims further, that the units of municipalities and units of private sector are competitors even if they are not using money for their transactions. The units of municipalities are competing with private firms, but they are also competing with units of other municipalities and civil service departments. The number of competitors is varying case by case (Heinonen 1997 p. 57).

In some public sector areas and countries, there is also an enhancing claim for the idea of provider-purchaser split made by the public sector today. This means that services are procured by the local municipality board and then sold by the units or boards under it (Salminen & Niskanen, 1996; see also Valtionvarainministeriö 1997; cf. Checkland & Holwell 1998). In this model the units of municipalities are clearly in a competitive situation with the private firms. The ideas of provider-purchaser split and the competitive market situation can be applied to other public organizations such as the civil service departments as well.

Even when the private purchasing service providers are considered as subcontractors, the public administration is in a so-called indirect competition with the companies through the follow-up of their own production costs business world subcontractors are not wanted reach competitive position. The companies want to keep their core competencies and know-how in their own hands. Although outsourcing would be seen as a positive trend in municipalities, loosing strategic competence is a serious threat (Salminen & Niskanen, 1996 p. 83) for the existence of municipality. However, it is not only the questions of whether companies are competitors to municipalities at the moment. It is also the question of the future position of public administration, because it can be believed that public sector is much more in a free market situation in the future than at the moment (cf. Salminen & Niskanen 1996; cf. Heinonen 1997; cf. Valtionvarainministeriö 1997, p. 50-51; see Moskowitz & Nassef 1997; cf. Kim & Micheclman 1990; cf. Checkland & Holwell 1998; cf. Friedman and Cornford 1989). Because development of large (strategic) information systems are long lasting projects, one should be prepared for the future.

Strategic information systems can be defined in many ways. According Wiseman (1988, p. 18) they can be defined to support or sharpen the competitive strategy of the enterprises. Strategic information systems can be connected to competitive advantage.

> "***Strategic information systems are information systems which are designed to bring competitive advantage or have resulted in a competitive edge*** (Reponen, 1993)."

Furthermore, competitive advantage may be achieved through lower costs or better services compared with competitors (Reponen, 1993). In this study it used Reponen's definitions about strategic information systems.

There are some studies on strategic information systems in the public sector. Mirani and Lederer (1994) have studied anticipated benefits of new information systems in the U.S. Their study of benefits of 178 projects revealed nine benefit factors, of which one was strategic advantage. The third most prominent employer in the survey was the government, but unfortunately the study did not discuss the attitudes of the employees towards strategic advantage, and their opinion on the attributes bringing strategic advantage to the public organizations.

Kim and Michelman (1990) have studied the possibilities of using information systems as strategic competitive weapons in the U.S. health care markets. In the 1980's there was a change in the American health care from cost-based reimbursement to fixed fee payment structures. As a result the competitive pressure was intensified. The competitive strategic solution was the integration of organizations and of several separate information systems as one huge hospital information system (HIS). Researchers have become aware of the fact that the system is based on structure of health care producers but it seems that they are not discussing sustainability of competitive advantage achieved through HIS. Unfortunately, the researchers do not generalise the ideas about structure based IS into other public organizations. It is possible that they do not conceive health care producers as part of public sector in the conceptual sense, although the situation in some public sectors in European is similar to the situation among the American healthcare producers. In general, the European public sector is today probably little less competed than the health care in the U.S. But the future situation can be more or less same here in Europe (cf. Checkland & Holwell 1998; cf. Friedman and Cornford 1989). It seems that the idea of an integrated information system and structure could also be generalised to other public organizations.

3. An example: the city of Vaasa

3.1 Background

Vaasa is a city in the west coast of Finland with some 56 000 inhabitants. About 73% of inhabitants are Finnish-speaking and about 27% Swedish-speaking. A university, as well as multinational enterprises like ABB and Wärtsilä NSD, are essential parts of the city of Vaasa. There are 3800 employees working for the city of Vaasa. The bilingual workers and the international connections of the city contribute to the characters of Vaasa. Although the financial situation of Vaasa has been good, compared with the other Finnish municipalities, the political atmosphere in Vaasa also has caused a pressure to produce more cost-effective and competitive services.

3.2 Strategic meaning of geographical information systems

In 1995 information system strategy study for city of Vaasa was created. This is the first study presented in this article. In this IS strategy study the question was: what were the possibilities to sharpen the strategy of Vaasa through information systems and potential to create new strategic possibilities by these systems. In the study, top-managers, unit-managers, users, IS-personnel and outside consultants were interviewed. Researchers did total 35 interviews. Some of those interviewed people were also participating in this IS strategy project. In addition of interviews the researchers participated in the project-meetings, used written material and had conversation with the personnel. The heuristic outcome was that planned geographic information system (GIS) could bring sustainable competitive advantage to the organization of the city (explained in later chapters why). This heuristic outcome was based on interviews but it was really crystallised in the project meetings. In the level of Vaasa City it was seen as follows:

> *"The GIS is in the 'conglomerate' level of Vaasa the most strategic thing and system* (Vaasa City, 1995)*."*

To the same extent technical office concluded as follows:

> *"The GIS is a very important strategic information system to its serve customers and its interconnections* (Turunen 1996 p. 90)*."*

The benefits and costs of huge information systems are difficult to measure reliable (Saarinen 1991). Thus, in the planning phase the benefits and costs of the GIS were not tried to measure and heuristic opinion of consultants and academic researchers were emphasised.

Competition strategy and service-idea of Vaasa are large, thus only the essential points to understand the importance of the GIS are shortly presented. One of most important thing and the core competence in the strategy of Vaasa is "*to produce best possible price-quality services for citizens"*. In the production of the services must be taken into account that the city has "*to produce services in a competitive price as well as keep the prices on the same level with private firms"*. (Vaasa City, 1995)

To reach the service goals, the city is "*developing co-operation networks covering the offices and also private organizations"*. The city is going "*to benefit from combining resources of different offices in production of services"*. The city is concentrating on "*offering high quality services to citizens and organizations, for example through investing in information technology"*. (Vaasa City, 1995)

The GIS could possibly give competitive advantage for Vaasa through facilitating better services and lower costs, and it would also sharpen strategy of Vaasa. This massive system would enable the offices to use information produced by another offices. The GIS might improve the quality of services and cost-effectiveness by for example, reducing redundant work, making the transfer of information faster, speeding up the overflow of jobs and services, improving correctness of information, improving co-operation possibilities, and reducing stock capital.

The competitive position in city organs varies by services and units. One is in a partial competitive position through monitoring of indirect cost. For example, in the housing unit one of the officials said:

"*If we are not credible and effective our unit is liquidated.*"

On the other hand, other units compete in free market. One public servant in technical service unit said:

"*We are continuously in an intensive competitive situation with private firms*".

With better services and lower costs the city might achieve sustainable competitive advantage in comparison to private firms. The companies or organizations that are competitors to the city units, in comparison to which city might achieve sustainable competitive advantage, can be for example technical service providers. Such include engineering and planning consultation firms (street, traffic and house planning), construction companies (house and road), maintenance and cleaning firms, government units (apartment-, measurement- and road construction units), and even small neighbouring municipalities. Possibly less significant sustainable competitive advantage might be achieved in public street network maintenance, repair workshops, transport units or the local telephone company. Competitive advantage would be created comparison to neighbouring cities, which compete for the same inhabitants (Heinonen 1997, p. 57). Compared to other neighbouring cities competitive advantage would not be sustainable because they have also a possibility to develop the similar systems.

The geographic information system uses an operational data collection, which has taken several years. The operational information systems is forming together one strategic information system (see Reponen, 1993). The GIS is a widespread system and will be based on the conglomerate structure of the city, different offices that have some common functions. The system would use existing structural resource difference but it also would create new structural resource difference. The structural resource difference would be formed of differences in vertical and horizontal integration and somehow of an institutional context (tasks fixed by laws). The organizational structure would differ to a great extent from private companies, and also from civil service departments. This type of system firms or other organization involved, most probably could also not be built because of the structural and institutional difference.

3.1 Function of GIS

The main part of the GIS is a recordsystem, which was built in late 1970's. It includes various subrecords. Subrecords were functioned as separate records in different parts of the city administration. During the past few years independent offices of the city have developed information systems to support their services. The main reasons for this were to disintegrate information systems in Vaasa City. There was no common database and the same information was saved independently to each record. It was realised that it would be sensible to integrate the separate information systems both vertically and horizontally.

During the year 1994 the Measurement unit started to use a ground information system which expanded, during the year 1996, into the Technical planning unit. At the moment it would be possible to use the GIS in the all units (in Figure 1) excluded Power plant and Local telephone company. Although there has been already a few successful experiments concerning a possible data transfer and implementation from the latter mentioned companies to the GIS of Vaasa. Thus in practise, it is only a matter of time when these companies start using the integrated GIS, and sharing their valuable information with all the units of the city of Vaasa.

The ground information system is the core of the whole geographic information system (Fig.1). After that, the system has expanded further, and today information from the mainregister can be connected to digital survey (ground information system). This has required the development of the registers; integration between the various units and offices, and delivering new information systems compatible with the ground information system. Furthermore, it is the attribute data register(s) that really makes the "raw" topographic data become a real geographic information. In principle, geographic information can be defined as follows (Vaasa City 1993):

Topographic and spatial data + Attribute data registers = Geographic information

The actual GIS is based on a graphic planning system called Xcity that uses relation database Ingres. Beside Xcity (Measuring unit, City planning bureau), the other graphic planning software in use is Xstreet (Municipal unit) and Xpipe (Waterworks). The most important attribute data register in the city of Vaasa is the KunTi-register (Kuntatietorekisteri) that contains for instance the most essential information about the real estates (ownership, building site information etc) in the Vaasa City area. A GIS-user can gather and/or edit geographic information through the illustrative digital map -user interface, and perform SQL-queries to the KunTi-register. Technically the information would be saved only once in the office where the information is generated and developed. The system could be benefiting the whole city and it can be called a geographic information system, GIS. Technically the system is doing fine, although some of the computers connected to the GIS of the city of Vaasa must be updated in near future, so that the GIS can be used more effectively. There are only minor problems with the system in the City planning bureau and Waterworks. Those units are benefiting the system partly manually, that is: manual maps and registers.

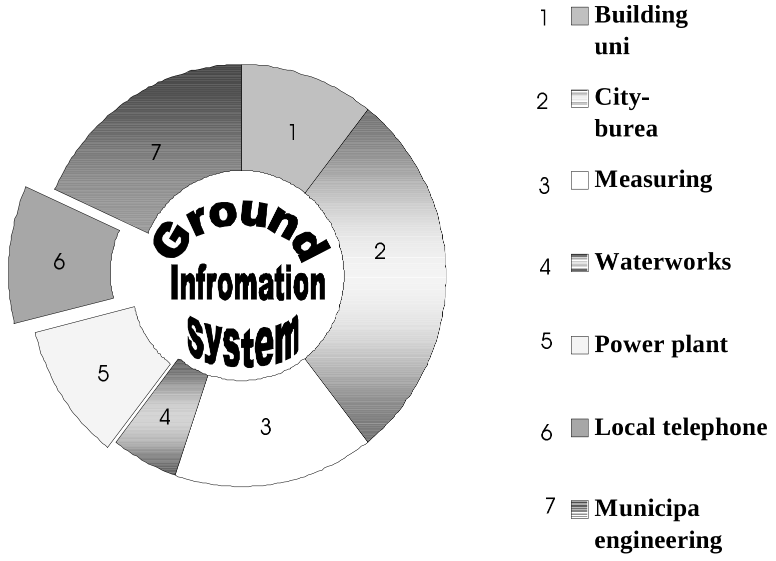

Figure 1: Information producers of GIS

The GIS consists of the information systems and the functions of following units (Figure 1): the Measurement unit, which produces grounds (basic data), and the Municipal engineering unit are both units of technical office of Vaasa. The City-planning bureau is big partner and it is not included in the technical office, thus in the city of Vaasa. The smaller partners are the Building inspection unit, and the public enterprise waterworks (Vaasan Vesilaitos). The power plant (Vaasan Sähkö), and local telephone company (Vaasan Läänin Puhelin) are public companies. All of these units take part in the provision and use of the GIS. There are also other units using the information produced in those units: the Building unit and the Technical services in the Technical office, fire station, city office, finance division and such. Most remaining units use the services of some of these units and, thus, use indirectly the information produced in GIS.

Examples of what kind of services the GIS can offer:

1. If a citizen wants to clarify current state of a real estate, following information is needed: city plan information, information about subdivision of real estimate, title information and entry into the land registers information. In addition the studied certifications of the building, inspection reports, the current dweller and owner information can be needed. In the manual context, in order to gather all this information, one would have needed to visit a group of civil servants in several bureaux. The GIS can do it by means of one screening.

2. In the manual environment the Waterworks, Power plant or Sewer system unit could open the streets many times during a short period. That is not very cost-effective, and it also disturbed the citizens. In the GIS the projects are updated

automatically. The location and the types of the cables and pipes of the unit in question, as well as similar information concerning other units can be seen in the system.

3.2 Main problems in the function

In 1998 the system was still not functioning as well it could. Although the technical capability is existing, the system is not yet benefited fully. There are still several problems that are not very rare in firms too (see Grover et al. 1995). A project concerning those functioning problems was launched. This is the second study presented in this article. In the main part of this study, 27 interviews were completed. Decision-makers and keyperssonel of computer users were interviewed. According those interviews three main groups of processes were identified that are as following (cf. also Korhonen 1998).

3.2.1 Bottlenecks in the main processes

Generally, organizations that use massive information storages in their processes, human actions and IT know-how are in an important role in a successful project. On this basis, human-related actions (or non-actions) and basic computer know-how can be in many cases a critical bottleneck in a process. These problems and bottlenecks in the main processes can be both technical and human-related. The general opinion was that the co-operation between different units is not as effective as it should be. For example, in the Municipal unit one of the officials said:

" Everybody's just doing his/her own job almost with blind eyes, without caring about the others " and

" No-one is in charge for the wholeness of what we're doing here "

The first bottleneck (although a minor one) is the topographic data production, that is: topographic measurements (tacymetres, air photographs etc.) and data transfers from older geographic data resources to the present geographic information system. Especially the latter mentioned process is very slow and it takes a lot of time and human resources if it is done correctly and carefully (for example, transferring up-to-date city planning data or Waterworks' sewer and pipe data from manual maps to the GIS that uses exact digital spatial data as its map data). Another matter regarding topographic measurements was that the division of measurements between different units was not evident.

There was also a general opinion that the resource-, financial- and schedule management of municipal building projects were sometimes ineffective, as well as information flow between different participants of a building project. Furthermore, the final municipal plans (drawings) are not made with Xstreet, but with AutoCad, by transferring a map picture in dxf-format from Xstreet to AutoCad, into raster format.

This causes often an information break: possible changes in final building data (streets, underground pipes etc) cannot be perfectly transferred back to Xcity, because of different kind of data format. Thus, one of the main goals of Municipal unit concerning the GIS is obviously implementing Xstreet more and more into the graphic planning process itself.

The Waterworks' sewer and pipe data is still largely in manual maps, but there has been a lot of improvement lately in that matter. That is, the data from manual maps are currently being transferred to the GIS by digitising and performing confirming measurements if needed. When digitising, the final quality of the data is strongly affected by the quality of the original map, attachment of the map, quality of the digitising table and digitizer's skills (Tokola et al. 1994: 8). The biggest problem in this process has been especially the scale differences in manual maps; there are old map data sources with 1:500-, 1:1000- and 1:2000 scale maps, and there are 1:500 maps even in two different grid coordinates (old and new grids), which makes data transferring even more difficult.

The City planning bureau (which isn't officially a part of the Technical office) hasn't been using Xcity as their designing and planning tool so far, but there has been a lot of improvement lately, too. Until these days the data needed for the actual city planning process has been partly delivered to the City planning bureau from other units on normal paper maps, but now the situation and the methods are changing.

3.2.2 Lack of appropriate education, inadequate software manuals

One basic problem in implementing the GIS has been the level of computer know-how of the personnel. And furthermore, the need for appropriate education concerning the GIS has been remarkable. This is actually the main reason why the GIS has not been benefited fully so far, and the strategic role of the GIS of the city has not yet been fully benefited. The Measuring unit has been using the GIS for many years, and its personnel have the longest experience of GIS and thus the highest know-how concerning the use of GIS. But, in all other units appropriate education and training is obviously needed.

Another issue in implementing the GIS has been the two little bit inadequate software manuals. These manuals have not helped the officials in their planning and designing work. However, there has been discussion between the city and the software company about improvement of the situation.

3.2.3 Uncommittment and attitudes of the personnel

Relatively low level of GIS-know-how isn't just a matter of lack of education. It is also a matter of attitudes towards the new and "strange" technology. In principle, importance and strategic role of the GIS has been understood in the top management of the city of Vaasa. This has not, however, reached all the levels of different organizations within the city. If the units of the city want to achieve possible strategic competitive advantages with the help of GIS, personnel must learn how to use the new information technology and its software effectively.

Apparently, it is basically a matter of learning new ways to do the job, by using the new and effective tools to plan and design and to find and edit information. When implementing new systems and thus new ways to do things, it is often obvious that there is a certain kind of resistance against the new technology among the personnel. Following kind of opinions were heard during the project:

" At this age, you don't learn any new tricks. I will retire soon, so… "

" We have always done these things this way "

" I don't trust computers "

However, it is interesting that things like usual process problems, lack of education and uncomitment, are ignoring even the benefits of even strategic information system. In this example top-managers had fully understood the strategic meaning of the system. In some units the attitudes of the personnel towards computer-orientated planning and designing have been rather a negative. By appropriate education and with active support from the manager level these, after all small problems, can be solved in a reasonable period of time. It is also a matter of respecting the planning and design work done by the officials and understanding the value of exact, up-to-date high quality geographic information. The less effort is put on gathering and checking the needed information, the more attention can be paid to planning process itself, in other words, the actual work of the officials. This is, of course, an important and effective way to motivate the personnel to change their methods.

4. Discussion

This kind of structural resource difference can also be found in public organizations, such as hospitals or civil service departments, that resembles conglomerate of city organizations. The situation is similar in various European countries as well. There are, of course, differences depended on countries, organizations and fields of activity.

Attention should be paid to whether it is acceptable for the public organizations to try to benefit indirectly from the tasks fixed by laws or special financial position. On the other hand should the tasks stated by laws be seen only as an encumbrance for public sector? From the public organizations point of view answer is "No". Public sector is normally taking care only those tasks fixed by law that firms are not willing to do. Naturally, also the firms also try to get advantage from the institutional context (cf. Oliver, 1997) including laws and taxes. If public enterprises cover their costs with the income from their services, the risk finance by the citizens is reduced considerably. Thus, the more competitive markets are, the less problematic are the ethical issues. In those cases private firms are real partners, they should be taken along into IS-developing projects at the very beginning by the public administration. So far this has been seldom. In those situations, the systems would greatly benefit all partners.

Loosing strategic competence is a serious threat for municipality (Salminen & Niskanen 1996). This danger exists when the production of services is outsourced. Strategic information systems, are ways to keep the strategic competence within the municipality, though information of the system would be used also when dealing with the subcontractors.

Similar strategic information systems, based on the structural difference resources, could be, for example, data warehouse solutions and management information systems. These systems are widespread and their operational data has been gathered from several resources.

5. Conclusion

Based on existing theories, this paper describes a situation, in which public sector organization could gain sustainable competitive advantage based on its structural resource difference. Ideas may also be generalised into other public organizations. In public administration there has been no serious need for developing strategic information systems to create sustainable competitive advantage. However, in the tightening market situation, there is a need for such systems, but unfortunately competition models consider directly the private sector, where sustainable competitive advantage can rarely be achieved by information systems. As a result of rarity, its the topic is not very common in the IS-debate (in spite of importance of the issue). Strategic information systems, mainly based on the structural resource difference, have still enormous potential in the public sector. This potential has not been realised and therefore not been used to its full potential in the public sector.

In the Vaasa City the top-managers had understood the importance of their commitment in the projects. They had also fully become aware of strategic meaning of the GIS. Technically almost everything was functioning well, even the interfaces between the organizations. In spite of those matters, quite normal problems with commitment of employees and problems in the processes are ignoring even the benefits of strategic (or planned as strategic) information system! It is evident that IS-developing projects in the public sector are now in a phase in which whole chains of different functions are automated without caring about any "official" organization borders. Integration of different information systems is actually necessary, because development of separate systems brings only marginal saves. On the other hand, gathering information and logistic chains of information services make organizations more dependent on each other. All this puts a lot of pressure on the officials in the public sector; they now have to, in a way, learn to live in a whole new management culture to achieve the possible strategic competitive advantages.

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Åbo Akademi University
• Department of Computer Science
• Institute for Advanced Management Systems Research

Turku School of Economics and Business Administration
• Institute of Information Systems Science