Common Gaps in Information Systems

Juha Kontio
Turku Polytechnic, Finland
juha.kontio@turkuamk.fi

Abstract: Information systems and databases in six Finnish organizations are evaluated in this multiple case study research. The main idea of the research was to describe the main gaps in information systems in the case organizations. In each case the gaps are presented with authentic descriptions. The research identified altogether seven different categories of gaps. These are first abstracted to four common categories of gaps: 1) data, 2) infrastructure, 3) turning data into information and 4) people working with the information systems. Finally, the four categories are further abstracted to two common categories of gaps: 1) information and 2) infrastructure.

Keywords: Information Systems, IS-Gaps, Databases, Case Study

1. Introduction

Information systems are natural parts of the business processes in all kind of organizations. Information systems are of vital importance to many organizations across a wide range of sectors of the economy (Waema et al. 1994). In many cases information systems are the core players in doing the business. Typically these information systems are taking care of some specific part of the business. These information systems must however be able to communicate with each other, because strategic decisions usually require information from several functional areas within an organization. This fluent alignment of information systems to serve business is also one of the biggest concerns among managers. For example, in a ranking of top IS management issues, optimizing enterprise-wide IS services and optimizing organizational effectiveness were the top two issues in 2001 (CSC 2002). Thus, any means that can help organizations to process and manage information presents an opportunity they cannot ignore (Walsham 1993).

The business data is managed through the information systems and stored in the databases. Organizations need to be able to process this data and use the information efficiently in order to succeed (Walsham 1993). However, according to a recent study more than 25 percent of critical data is incomplete and inaccurate (Gaudin 2004)! This kind of poorly managed data presents real problems for the management of large organizations. These information-related issues have been ranked very highly in several studies. For example, in a Norwegian study IS managers were asked to rank today's key IS management challenges in order of importance and *developing and implementing information architecture* came fourth (Christensen et al. 2000). The same paper studied other similar research results and concluded that *making effective use of the data resource* was in second place. Another study came up with similar results when ranking critical IS management issues: *developing and implementing an information architecture* was ranked fourth and *making effective use of the data resource* was in seventh place (Brancheau et al. 1996). Yet another study ranked *organizing and utilizing data* third out of top IS management issues (CSC 2002). The same survey also studied the important technology trends and in the Europe the top two issues were 1) Real-time information access through innovations in data storage and management and 2) Open data exchange extending the reach of information across the extended enterprise.

All the above motivated to a multiple case study. The aim is this research was to evaluate the information systems and the databases in a group of different organizations. In this article the focus is on presenting the gaps of their information systems. The article is organized following. In section 2 the research and the used methodology is presented. In section 3 some descriptive data of the studied information systems and databases is presented and the specific gaps in each case are described. Finally in section 4 and 5 discussion and conclusions are presented.

2. The research

2.1 Research methodology

Methodologically this is a multiple case study research. This research methodology was selected, because the goal of the research was not to achieve statistical generalization rather analytic generalization (Yin 1994). A case research aims for in-depth understanding of the context of a phenomenon (Cavaye 1996). A case study examines a phenomenon in its natural setting, employing multiple

The correct reference for this paper is:
Kontio J (2005) "Common Gaps in Information Systems" *The Electronic Journal of Information Systems Evaluation*, Vol. 8, Iss. 2, pp 123-132, available online at www.ejise.com

methods of data collection to gather information from one or a few entities (Benbasat et al. 1987). Furthermore, a case study is particularly appropriate for practise-based problems (Benbasat et al. 1987).

This research follows the interpretive tradition of the case research. Interpretivism means that there is no objective reality, which can be discovered by researchers and replicated by others (Walsham 1993; Broadbent et al. 1998). Interpretivism aims to understand phenomena from the point of view of participants directly involved with the phenomenon under study (Cavaye 1996). In this research it means that the information systems and databases are not directly examined rather through interviews.

2.2 Research design

The main idea of this research was to evaluate information systems and databases in a group of different organizations. The focus was especially on describing the gaps of their information systems and producing common categories of the identified gaps. The main research question was:

> *"What kinds of gaps organizations are dealing with in their information systems and databases?"*

Six Finnish organizations were selected to this research. In every organization multiple information systems and database were analysed. Thus this is a multiple case study with multiple units of analysis (see Table 1). Multiple cases are desirable when the intent of the research is description, theory building or theory testing (Benbasat et al. 1987). Multiple cases also enable analysis of data across cases (Cavaye 1996). The organizations were selected some general rules in mind (size, business, private/public, not competitors, not IS producers). Every organization also serves a specific purpose within the overall research (Yin 1994), since they all had some specific field to study within this research.

Table 1: The case organizations

Organisation/abbreviation used in this research	Line of business	Private/Public	Turnover2002 (million EUR)	Employees 2002	Specific research field
SOK corporation/SOK	Co-operative society (main businesses food & groceries and hardware)	Private	2998	4645	Data modeling for application integration
Salon Seudun Puhelin Oy/SSP	Telecommunication	Private	28	121	Management of information systems
State Provincial Office of Western Finland/WEST	Regional administrative authority	Public		350	Managing inquiries with databases
Statistics Finland/STAT	National statistics	Public	52	1 074	Storing spatial data in databases
TS-Group/TS	Printing services and Communications	Private	293	2 052	Managing customer information in databases
Optiroc OY/OPTI	Building materials	Private	149	388	Maintenance and customization of IS

2.3 Data collection

Multiple data collection methods are typically employed in case research studies (Benbasat et al. 1987) and this research do not make any exception. The main method used in data collection was semi-structured interviews. Interview was selected since with it very targeted and insightful observations can be perceived (Yin 1994). Data was also collected from existing documents, which provided stable, unobtrusive, exact and broad coverage of the cases. (Yin 1994) These additional documents (annual reports, memos, publications, presentations) were received during the interviews.

Altogether 54 interviews were arranged (see Table 2). The average length of interviews was approximately 100 minutes and the total time of interviews was over 91 hours. The interviewees were selected with the organizations' contact persons, typically the CIO of the organization. The interviewees represented various positions, but they were normally persons in administrative positions

toward the information systems like CEO, CIO, IT Manager, IS Manager, Project manager and Main user.

The themes of the interview were delivered beforehand to interviewees and all the interviews were recorded and notes were taken during the interviews. One of the themes concentrated directly on gaps within the information systems and databases. Gaps came up as well when other themes were discussed. All interviews were transcripted to a database application specially designed for this research. Working in this way the large amount of the collected data was more easily managed and later analysed. This solution also answered to Benbasat et al. (1987) definition that the researcher should be meticulous in record-keeping and to Yin's (1994) second principle of data collection: create a case study "database". The transcript of the interview was produced from the database and emailed to the interviewee for corrections and possible additions.

Table 2: The interviews.

	SOK	SSP	STAT	WEST	TS	OPTI	Sum
Interviews	12	10	7	10	8	7	54
Interviewees	14	10	6	10	8	7	55
Total length of interviews in hours	26	17	11	12	12	13	91

2.4 Data analysis

The interview materials were analysed inductively with methods of qualitative content analysis. This means that the content categories were formulated as a result of interpretation of the interview material instead of using deductive approach and theory based categories. The analysis identified seven different categories of gaps (see Table 3).

Table 3: The categories of gaps.

Category name	Description
Logical structure of database	The database design has not succeeded in capturing all the necessary elements or the logical structure should be designed or that the requirements have changed during the time, but changes has not been implemented to the database.
Data integrity	Refers to the validity and consistency of stored data (Begg et al. 2002). These problems were usually originated from the duplicated relevant data.
DBMS	All the problems relating to the DBMS in use. There were gaps like stability/reliability of the DBMS, lacking tools, limited capability to manage the data and other similar gaps.
Response times and hardware	Gaps relating to hardware performance and hardware age.
Integration	Gaps in transferring data from one information system to the other.
Reporting	Gaps like insufficient reporting tools and difficulties in producing reports.
Personnel	Lack of qualified persons or recent changes in the personnel.

These categories are used when presenting the gaps in information systems and databases in each case organization. When the case results are introduced real names of the information systems are not used. Information systems are only numbered and the nature of the information system is told.

3. Description of IS related gaps in the cases

3.1 Descriptive data of the information systems

The research analyzed altogether 44 different information systems that were classified in four categories (see Figure 1).

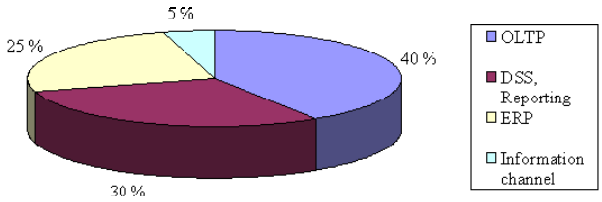

Figure 1: Distribution of types of the information systems

Over half (52 %) of the information systems and the databases studied during this research are critical to the business and they are used in business-critical processes. Figure 2 shows how business critical information systems are distributed in the different IS-categories. Most (65 %) of the business critical information systems are OLTP-systems.

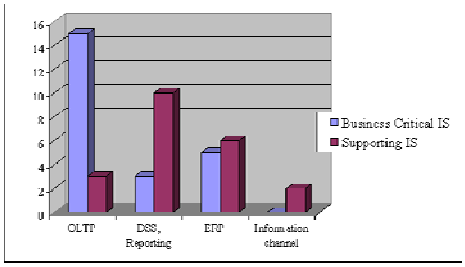

Figure 2: The distribution of business critical information systems

 ©Academic Conferences Limited

The average implementation year of the information systems is 1997 and the average age of the information systems is almost 7 years. Within different cases the average age of information systems range from 4,6 to 10,7 years (Kontio 2003). The average implementation years in different IS-type categories is presented in Table 4. The DBMS solution behind all studied information systems was relational database.

Table 4: Average implementation years in different IS-type categories

Category	Average implementation year
OLTP	1995
DSS, Reporting	1998
ERP	1998
Information channel	2001

Table 5 shows what type of gaps the interviewees identified in their information systems and databases. Keep in mind that these gaps do not exist in every information system and database of the organization, but these are the gap areas the organization has to deal with in some of the information systems and databases.

Table 5: Identified gap categories in cases

Case	Logical structure of database	Data integrity	DBMS	Response times and hardware	Integration	Reporting	Personel
SOK	X	X	X	X	X	X	X
SSP		X	X	X		X	X
STAT	X	X			X		
WEST	X				X	X	
TS	X	X	X	X	X	X	
OPTI				X		X	X

3.2 SOK Corporation (SOK)

The S Group has organized itself into a co-operation network comprising the regional cooperative societies and SOK Corporation. SOK Corporation's task within the S Group is to help the cooperative societies produce services and benefits competitively for their customer-owners by focusing on providing support and procurement services for all the S Group's companies. (SOK-Yhtymä 2003)

The interviewees identified a total of 22 essential information systems and databases. The average age of these systems is little over seven years. Within these 22 analyzed information systems of SOK Corporation all the categories of gaps exist. However the different information systems and databases suffered naturally from different gaps if none. Table 6 presents how interviewees described the gaps of the information systems and the databases. The interviewees mentioned no remarkable gaps in seven information systems and databases.

Table 6: Gaps in SOK Corporation's information systems and databases.

Information System	Described gaps
1 (Customer data)	The information system is developed in a "quick-and-dirty" way and now every little change is very expensive and you never know when everything collapses. The documentation of the IS is also not satisfied and interviewee's quess is that there is plenty of overlapping information. Also the logical structure of the database is suspected.
2 (Accounting)	The integration of this and other information systems is a very toilsome task and it requires lot's of manual work. Also reporting and analyzing possibilities are insufficient.
3 (Organization)	Gaps are mainly logical gaps i.e. how the data should be managed. The environment is unestablished and the concepts are still changing.
4 (Products)	Integration with cash systems is not satisfactory while the present integration solution poses unnecessary delays in data transfer. These batch transfers present additional middle phases and non-transparency in processes.
5 (Room reservation)	A gap is the integrity of customer data. Customer data is transferred from central reservation system to hotels and other way around. The IS in hotels does not check the existence of a customer automaticly from the central reservation systems and this leads easily to situations where customer is stored in the database multiple times. The supplier of the information system has been careless when implementing new version of the information system and this has resulted in considerable fall in performance and non-functionality of scandinavian alphabets. The database management systems is also quite unreliable. It corrupts

Information System	Described gaps
	easily and needs to be indexed time after time presenting unavailability of the information system.
6-8 (Premises)	A person has left the organization and this has caused some gaps. Reporting is also noticed to be erroneous. Reports contain false information. Clear software errors have also been detected. Gaps have also existed in transfering data files between information systems indicating integration gaps.
9 (Season products)	Current integration solution uses emails and sends Excel-files as attachments to business units. This causes additional manual work that could be avoided with a more sophisticated integration solution.
10 (ERP)	Data uploading from operational information systems requires very much preparation.
11 (Reporting)	Data uploading from operational information systems do not function properly all the time and sometimes the data does not come through.
12 (ERP 2)	Only gaps deal with data transfers, but typically the reason for these few gaps is in the surrounding information systems not in this.
13 (Car sales)	Sometimes the locking causes uncomfortable waits that are anyway only short-term.
14 (ERP 3)	The information system has been extended step by step and therefore the database has myriad of necessary and unnecessary tables. It is easier to create a new table than to change the existing ones and the programs using those tables. For example changing to Euro caused creation of numerous tables.

3.3 Salon Seudun Puhelin Ltd (SSP)

The vision of Salon Seudun Puhelin Ltd:n is to be the closest, most reliable, best quality and most useful partner in telecommunication for Salo region now and in the future. The role of the company is to build and develop networks for telecommunication and services for people, companies and communities of Salo region. The focus areas of the company are:

- Broadband telephone network and services
- Mobile network and services
- Regional network
- Cabel televion network and digital services
- Internet portal (Allu)
- Real estate security and control systems. (SSP 2001)

The interviewees identified a total of 4 essential information systems and databases. The average age of these systems is six years. Within the 4 analyzed information systems of SSP four categories of gaps exist. These categories are Data Integrity, DBMS, Response Times and Hardware and Reporting. Table 7 presents how interviewees described the gaps in these information systems and databases.

Table 7: Gaps in SSP's information systems and databases.

Information System	Described gaps
1 (Telephone Network)	Some of the features of the information system are not exploited and additional training is needed to fully exploit the information system. This system also stores customer data although the same information is available in information system two. Integration to that information system is missing. The server is very old and the performance of it is descending.
2 (Calls)	The main operative system is working very well. Some gaps deal with the skills of the users and the way user enter data in the system. Users are not given any training how to use the system. This has lead to a situation where insufficient and even false data is inserted in the database. Also the importance of this information is not clear to everyone. Second gap is the definition of data owners that is currently lacking. Third gap is that information systems offers only limited possibilities for marketing actions and analysis.
3 (Reporting)	The reporting system is suffering from limited capacity of the database management system. The performance of the system is also varies very much depending on the amount of data managed.
4 (Accounting)	The accounting system works very well and reliable, but it has suffered poor performance.

3.4 Statistics Finland (STAT)

The mission of Statistics Finland is to combine collected data with its own expertise to produce statistics and information services for the needs of society, promote the use of statistics and develop national official statistics. Statistics Finland operates administratively under the Ministry of Finance, but is fully and independently responsible for its activities,

services and statistics. Statistics Finland has personnel of around 1,100, of whom 200 are employed as statistical interviewers. (Tilastokeskus 2003)

Table 8: Gaps in Statistics Finland's information systems and databases.

Information System	Described gaps
1 (Locations)	The data is transferred and transformed from one format to another and this might lower the accuracy of the data. Same data is stored in different scale in different places. Many storage places lead to traditional update gaps. The naming of the data is also inconsistent and same data has different names in different places.
2 (Categories)	There are pressures to alter the logical structure of the database because present structure does not serve all use cases.
3 (Companies)	The data is transferred from different sources regulary, but at different points of time. This makes the management and the utilization of the data a bit uncomfortable when other data source is claiming something else than some other data source.

Within the specific field of study (geographical information systems) in Statistics Finland the interviewees identified a total of 3 essential information systems and databases. The average age of these systems is ten years. Within the 3 analyzed information systems of Statistics Finland three categories of gaps exist. These categories are Logical structure of the database, Data Integrity and Integration. Table 8 presents how interviewees described the gaps in these information systems and databases. In addition to gaps in these specific information systems and databases they also assessed the overall environment of their information systems and databases. One of the biggest gaps that the interviewees mentioned is the diffuculties in combining different data sources when statistics are produced. This combining requires additional work thus presenting unnecessary costs. Another major gap is that there is no central storage for spatial data and changes in spatial data are very difficult if not impossible to audit.

3.5 State Provincial Office of Western Finland (WEST)

The State Provincial Office of Western Finland is a joint regional administrative authority of seven ministries. The agency is divided into eight departments. It promotes governmental and regional goals by taking care of duties in

- judicial administration,
- rescue and fire administration,
- education and culture administration,
- physical education and juvenile administration,
- agriculture and forestry administration,
- traffic administration,
- consumer, competition and groceries administration,
- welfare and health administration and
- jurisdictional district and register administration.

Regionality of governmental administration means also that every State Provincial Office is responsible for evaluating the basic service regionally and locally. (Länsi-Suomen lääninhallituksen peruspalvelujen arviointiryhmä 2002) The State Provincial Office of Western Finland collects large amount of data to produce the evaluation report. The interviewees identified a total of 2 essential information systems and databases that provide information for the evaluation. The average age of these systems is eight years. Within the environment of State Provincial Office of Western Finland three categories of gaps existed. These categories are Logical structure of the database, Integration and Reporting. A major gap is the poor management of collected evaluation data. At present there is no adequate information system and database in use. The collected data is disorganized and therefore also awkward to use. Spatial data is also becoming more and more important, but at present the management of it is separated from other evaluation data. Thus extra work is needed also here. Another gap is that additional evaluation data is collected from other information systems in a way that need quite much manual work. The evaluation report is published as a book, but more and more people are asking parts of the evaluation results in electronic format. At the moment the production of this kinds of special reports is a very laborious task.

3.6 TS-Group Ltd (TS)

The TS Group is a communications group, which processes and provides information, as well as develops, produces and markets graphics products and related services. The group's parent company, TS-Group Ltd, is responsible for subsidiaries, real estates and

administration of the whole group. In addition it publish newspapers and the main newspaper is Turun Sanomat. (TS-Yhtymä Oy 2003)

The interviewees identified eight essential information systems and databases. The average age of these systems is almost seven years. Within the eight analyzed information systems of TS-Group Ltd five categories of gaps exist. These categories are Logical structure of the database, Data integrity, DBMS, Response Times and Hardware, Integration and Reporting. Table 11 presents how interviewees described the gaps in these information systems and databases.

Table 9: Gaps in TS-Groups Ltd's information systems and databases.

Information System	Described gaps
1 (Customers)	Centralized customer database functions well, but it does not give a full picture of a customer and this has initiated to the CRM-project. The server is also quite old and interviewees present ideas about upgrading it. There has been gaps with data integrity occasionally when a customer duplicate is accidentally created.
2 (Order entry)	The information system emphasized too much ordering process itself and do not offer enough support for marketing and selling. The database contains lot of data about customers, but any easy query-system does not exist. The information system has also certain limitations that hinder versatile use of the system. Addresses and coordinates have become increasingly important for example in following the delivery of newspapers, but the information system has limitations in managing spatial data.
3 (Advertisements)	The management of customer data in marketing is mentioned as a gap. It is difficult to segment customers and to become aware of the profile of the customer. Another gap that the interviewees mentioned is the lack of browser-based user interface. Version upgrades cause also gaps since computer-specific setups are needed. Finally integration with their partners' information systems has some faults that slow down the processes.
4 (Printing house)	A major gap in this information systems is the slow performance that cause frustrations among users. The interviewees mentioned that the server, the database and the information system are all partly reasons for the slow performance. The database management system is also critisized, since it does not offer any tools for ad hoc –queries, it trappes occasionally, it has insufficient indexing possibilities and the lock management is poor. The documentation of the information systems is also critisized: there are many documents but they are somehow ambigous. The information system has also internal incapabilities like moving from bid to order that is not supported at present.
5 (Accounting)	This information system has gaps in reporting. The viewer of reports is old and not compatible with newer operating systems. It is also very difficult to compare different years. Another gap deals with integration. The integration with data sources is risky and errors have been detected.

3.7 Optiroc (OPTI)

Optiroc Ltd manufactures mineral-based materials for both buildings and other civil engineering projects. Optiroc Ltd is part of HBE-group that is part of Heidelberg Cement group, but organizationally Optiroc Ltd is however a very independent unit.

The interviewees identified five essential information systems and databases. The average age of these systems is over four years. Within the five analyzed information systems of Optiroc Ltd three categories of gaps exist. These categories are Response times and hardware, Reporting and Personnel. The interviewees had conflicting ideas about the information systems in Optiroc Ltd. Some interviewees were very satisfied with the present state of art, but others were much more critical. The critisism concetrated on the Order Entry system and on the Reporting system. Other systems received no critisism. A fundamental gap in Optiroc Ltd is the lack of IT/IS-strategy that could define the guidelines for most of the issues that originated the critisism.

Table 10: Gaps in Optiroc Ltd's information systems and databases.

Information System	Described gaps
1 (Order entry)	The critical comments mentioned that the main operative system is a failure since it just replaced the old one, but did not developed the processes of the company at all. During the design of this system the requirements of marketing and sales were bypassed as well. The information system is a very customized solution and some interviewees identify risks because the maintenance of the information system is a responsibility of a few consultants. It is also mentioned that tiny changes to the information system are done too often. The user interface is also critisized although some interviewees are very satisfied with it.
2 (Reporting)	Optiroc has own reporting tool, but the gap is that the users lack the skills to use the tool.

4. Discussion

One of the major gaps that SOK Corporation must deal with is about integrating their numerous data sources. This research with the specific research field focusing in data modeling for application integration was already a step to this direction. The data modeling emphasized same entities that the interviewees recognized important and problematic in the present information systems. For example both customer and product entity types are big challenges for the modeller, because the corporation operates with such a high number of different entities of these types.

In Salon Seudun Puhelin Ltd the main challenge is the integrity and the quality of the data. The personnel should be trained for proper use of the information systems. It should also be emphasized the value of the data as an organization's valuable asset. Another issues that the research raised as challenges were integration and reporting. At least with reporting some plans already exists to overcome the capacity limits.

For Statistics Finland the major challenge is to rebuild the data storage solutions in the area of geographic data. In practise they have clear plans to exploit increasingly modern databases. The modernization relates also to the gaps that they have in integrating different sources of data for statistics production. They are for example studying and testing different spatial database management systems. Some emphasizes must be placed on data quality of geographic data as well to be able to provide accurate statistics also in the future.

The main challenge in State Provincial Office of Western Finland is to desing an information system for the management of the yearly collected evaluation data. This research played here an initiative role since the goal was to design a first version of the necessary data model. With a new information system most of the reporting related gaps could be also solved. In addition, a appropriate database solution will also enable the management of spatial data together with other evaluation data. These solutions would offer good tools for versatile and flexible analysis and reporting. However, the key issue in the whole organization is still the integration of the existing information systems and the propaple new one.

Customer relationship management was the focus area in the case of TS-Group Ltd. The interviews confirmed the need for this movement to customer oriented way of doing business. There are also additional developments besides the CRM system. For example the old information system of printing house will be soon replaced and this will propaply solve the performance gaps as well. For reporting a data warehouse project is going on. Also in this case one central point is the integration of the information systems. In this sense TS-Group Ltd has prepared themselves with XML.

In Optiroc Ltd most gaps originated from the lack of the IT/IS-strategy. Maybe this was already recognized in the organization beforehand since the focus for this research was defined on maintenance and customization of information systems. The strategy would define the expected lifetimes of the information systems and thus speak out the maintenance and customization politics in the organization. The solution to overcome the gaps in reporting is simple: organize trainings for the users.

5. Conclusions

This paper wanted to describe common gaps in information systems of the case organizations. Data analysis produced seven different categories of gaps in these cases: 1) Logical structure of database, 2) Data integrity,

3) DBMS, 4) Response times and hardware, 5) Integration, 6) Reporting, and 7) Personnel. These seven categories can be further abstracted in four categories of gaps: data, infrastructure, information and humans (see Figure 3).

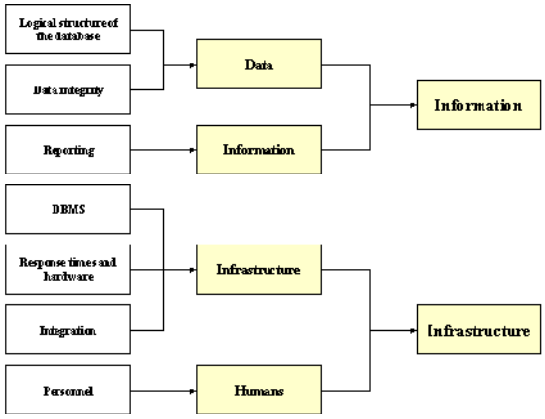

Figure 3: Final gap categories.

Logical structure of database and data integrity builds up the data gap category. This research confirms other researches (Brancheau et al. 1996; Christensen et al. 2000; CSC 2002) where data related issues have been ranked in top places when critical IS management issues have been listed.

Database management system, hardware and integration build up the infrastructure gap category. Infrastructure has been identified critical also in other studies like in CSC et al. (2003).

Information is a more descriptive name for the original name reporting. Basically, in this category the question is about turning data into information and presenting it. This result is not surprising since analysis and decision-making was identified as the most constraining issue because of lack of appropriate solutions in a study in 2003 (CSC et al. 2003). Thus the results confirm each other again.

Finally, humans refer to users and developers of the information systems.

The four abstracted categories of gaps can be abstracted even further to two categories of gaps in information systems: Information and Infrastructure. Information describes quite well the basic categories and actually they all lead finally to gaps information. Similarly Infrastructure describes broadly the basic categories except personnel. However, we could understand also personnel as basic part of the IS infrastructure.

The research identified many IS-gaps in the organizations, but fortunately the organizations were aware of most them and corrective operations have already been launched. Different cases are focusing in different categories of gaps. SOK and STAT are focusing in data. SSP, WEST, TS and OPTI are focusing in infrastructure.

References

Begg, C. and T. Connolly (2002). Database Systems: A Practical Guide to Design, Implementation, and Management, Addison-Wesley.

Benbasat, I., D. K. Goldstein and M. Mead (1987). "The Case Research Strategy in Studies of Information Systems." MIS Quarterly **11** (3): 369 - 386.

Brancheau, J. C., B. D. Janz and J. C. Wetherbe (1996). "Key Issues in information systems management: 1994-95 SIM Delphi results." MIS Quarterly **20** (2): 225 - 242.

Broadbent, M., P. Darke and G. Shanks (1998). "Successfully completing case study research: combining rigour, relevance and pragmatism." Information Systems Journal **8** (4): 273 - 289.

Cavaye, A. L. M. (1996). "Case Study Research: a multi-faceted research approach for IS." Information Systems Journal **6**: 227 - 242.

Christensen, B. H., P. Gottschalk and R. T. Watson (2000). Global comparisons of key issues in IS management: extending key issues selection procedure and survey approach. Proceedings of the System Sciences, Hawaii, IEEE.

CSC (2002), Critical Issues of Information Systems Management, Computer Science Corporation, http://www.csc.com/aboutus/uploads/CI_Report.pdf, 30.7.2004.

CSC and FEI (2003), Technology Issues for Financial Executives, Computer Science Corporation, http://www.csc.com/solutions/managementconsulting/knowledgelibrary/1328.shtml, 29.6.2004.

Gaudin, S. (2004). "Report: 25 % of Critical Data is Flawed." Datamation (May 19).

Kontio, J. (2003). "RETRO-hankkeen loppuraportti: Tietokantatrendit yrityksissä ja organisaatioissa." TUCS National Publication (No 2, December 2003).

Länsi-Suomen lääninhallituksen peruspalvelujen arviointiryhmä (2002).

Peruspalvelut Länsi-Suomen läänissä 2001. Länsi-Suomen lääninhallituksen julkaisusarja, Länsi-Suomen lääninhallitus**:** 155.

SOK-Yhtymä (2003). Vuosikertomus 2002. Helsinki, Suomen Osuuskauppojen Keskuskunta.

SSP (2001). Vuosikertomus 2001. Salo, Salon Seudun Puhelin Oy.

Tilastokeskus (2003), Statistics Finland in a Nutshell, http://www.tilastokeskus.fi/tk/tkpahkinankuoressa_en.html, 3.5.2003.

TS-Yhtymä Oy (2003). Toimintakertomus 2002. Turku.

Waema, T. and G. Walsham (1994). "Information Systems Strategy and Implementation: A Case Study of a Building Society." ACM Transactions on Information Systems (TOIS) **12** (2): 150 - 173.

Walsham, G. (1993). Interpreting Information Systems in Organizations. Chichester, Wiley.

Yin, R. K. (1994). Case Study Research - Design and Methods. Thousand Oaks, SAGE Publications, Inc.