Introduction

People and organizations have been collecting and systematizing data for time without end. It has been clear that people, organizations and governments are increasingly acting like consumers of the data and information. This is, for example, due to the advancement in organizational computer technology and e-government, due to the applied information and communication technology, due to increasingly demanding work design, due to the organizational changes, and finally due to new applications and innovations in both public and private organizations (e.g. Tidd et al. 2005, Syväjärvi et al. 2005, Bauer et al. 2006, Burke 2008, Chowdhury 2009). All these studies let us to accept that both data and e-government based procedures have growing impact to organizations in public and private sectors.

Data, information and knowledge have become valuable resources for societies, organizations, actors and governments of all kind. Many organizations have recognized the importance of data that is has accumulated over time and seek ways to increase its value. Hence, the need for both organizations and government agencies to generate, to collect and to utilize data in public and private sector activities is increasing. For example, organizational and governmental complexities are growing and simultaneously the potential of data mining is becoming more evident. However, the implications of data mining in organizations and government agencies remain still somewhat blurred and unrevealed (e.g. Syväjärvi & Stenvall 2009). Further research is needed in the field of information management and e-government.

It is commonly recognized that information includes different elements (e.g. signals, data, information, knowledge) and various relations between each of these elements. In current context of information management, we have aimed to the direction of data mining and information and communication technology (ICT). The information management refers to the general management of information, information based process, information warehouse and information and communication technology (Beynon-Davies 2002, Choo 2006, Syväjärvi & Stenvall 2007). In government, the impact of information on has been under increasing scientific interest (Jones, Boushey & Workman 2006). Information can indeed generate fundamental changes both to the structure, processes and, for example, management of governmental collaborations. However, in the
field of public administration and e-government there has not been enough research neither about the role of data mining nor about its relation to information and communication technology.

As indicated, in current paper we approach data mining and ICT in public administration. Data mining is defined here as the principle of sorting through data and to picking out relevant or evident information for organizational and governmental purposes (e.g. Watson 2005, Hamlin 2007, Syväjärvi & Stenvall 2009). Both the evidence-based policy and performance management are close to present data mining approach as those aim to improve government effectiveness by developing and utilizing a more rigorous base of information and evidence to guide decisions about, for example, program design, funding, implementation, and management (e.g. Heinrich 2007).

Furthermore, the topics of information management and data mining have a clear connection to the e-Government as it is concerned with issues like efficiency, cost-effectiveness and seamless, transparent, integrated service delivery, and ICT in government (e.g. Brown 2007). Now and increasingly in the near future organizations in public sector confront many challenges with the information and communication technology. As ICT has become more available, the reformulation of information, its use, and service productivity processes have turn out to be reality, leading most public organizations to strive for greater efficiency, efficacy and accountability in their internal and external relationships. These particular situations consider especially information intensive public organizations and these can be seen as conventional perspectives of information technology in the field of e-Government. In research it is still somewhat open what kind of influence ICT or e-Government practices have in organizations. ICT is probably not just another tool for accomplishing the work rather it actually influences the ways we organize. Additional study is needed in order to understand the role of ICT both as a tool and a solution in information management.

In current paper we have studied information management in terms of data mining and ICT. The study is a part of our ongoing research called “Knowledge and information management in the City of Helsinki”. This qualitative research consists of both individual thematic interviews and focus group interviews. By interviewing various high-position managers in public administration, we concentrated to the following research questions:

*What is the role of data mining in relation to governmental information management?*

*What kind of importance ICT is given in governmental information management and as related to data mining?*
Data mining and ICT in information management

Mining of data, information, and knowledge from various databases has been recognized by many researchers from various academic fields (e.g. Watson 2005). Data mining is indeed a multidisciplinary field, drawing work from areas like database technology, statistics, pattern recognition, information retrieval, learning and networks, knowledge-based systems, knowledge organizations, management, high-performance computing, data visualization, etc. In current focus is of public administration and management, data mining means the use of sophisticated methods, analysis, procedures and applications to discover previously unknown, valid managerial information and finally, relationships in large data and information sets (Syväjärvi & Stenvall 2009). All these approaches are apparent in various fields of both public and private sectors.

Data mining seen as the extraction of hidden information from large databases can be a powerful approach with potential to help organizations focus on the most important information in their data warehouses. Data mining may ease to predict future trends and behaviors, allowing organizations to make information or evidence steered decisions (e.g. Stenvall, Syväjärvi & Harisalo 2007). The automated, prospective analyses offered by data mining move beyond the analyses of past events. These are typically provided by tools of decision support systems (e.g. McNurlin & Sprague 2006). However, it is important to know how data mining can answer organizational information needs that otherwise might be too time consuming to resolve. The information that is needed in management is usually more future-orientated and quite frequently somehow combined with the latest information and communication technology.

Data mining in the public sectors consists of collecting the data, analyzing and predicting on the basis of data, and understanding implications of the data and information. But probably one of the most important issues is to reveal how data is used in information or evidence-based management? It is obvious that organizations and their managers collect and process massive quantities of data. Data mining is thus deeply related to the evidence-based management and thus to better organizational performance and overall policy (Hamlin 2007, Heinrich 2007). For example, Hamlin (2007) concluded that in order to satisfy performance measurement requirements policy makers frequently have little choice but to consider and use a mix of different types of information. However, data mining produces also threats for information management. In public sector the information that guides service delivery typically originates from various sources. Although government guidelines vigorously call for more experimental evaluations and other rigorous methods, yet in the absence of high-quality, readily available information on outcomes and under
high-stakes pressures to demonstrate organizational improvements, data collected for these purposes are more likely to be misused or manipulated in performance analysis.

In relation to information management, the data mining is also connected to decision making. We can imagine how decision making situations are followed by both rational and tentative procedures. As data mining is typically associated with data warehouses (i.e. various volumes of data and various sources of data), we are able to clarify some key dimension of data mined decisions (e.g. Beynon-Davies 2002). These include information needs, seeking, and use in information management. As data mining is seen as the extraction of information from large databases, we still can notice the management linkage in terms of traditional decision making phases (i.e. intelligence, design, choice, and review) and managerial roles like informational roles (Minztberg 1973, Simon 1977). Data mining thus emphasizes that manager even in the era of digital government has needs to seek, to receive, to transmit and finally to learn with information in various ways. However, as related to ICT and e-Government development thus due to fast development, everyday changes and familiarity with technology it seems evident that situational factors are more stressed (Moon 2002, Syväjärvi et al. 2005, Bauer et al. 2006).

Finally, in government it is useful to notice that data mining is popularly referred to as knowledge discovery. Knowledge discovery is about combining information to find hidden knowledge (Papa et al. 2008, Kuusisto 2009). However, again it seems to be important to understand how “automated” or convenient is the extraction of information that represents stored knowledge or information to be discovered from large various clusters or data warehouses. In practice, data mining has been used in both human resource and customer relationship management which are both significant elements of public service delivery. For example, data mining can be helpful to human-resources departments in identifying the characteristics of their employees and thus on the basis of information obtained it can help HR focus recruiting efforts in respect to service delivery. Secondly, the customer relation management might use data mining, for example, to identify future service needs and thus to optimize needed resources so that one may predict which service channel and which service offer a customer is most likely to respond. Moon (2002) argued that information technology has given possibilities to handle information among governmental agencies, to enhance internal managerial efficiency and the quality of public service delivery, but simultaneously there are many barriers and legal issues that cause delays.

Information and communication technology is associated to information management of almost any organization. Information is data in context, which means the data has been given an explicit meaning in a specific context. In relation to the management viewpoint, it is obvious that organizations need tools, systems and procedures useful in making critical decisions. Managing
information resources means that data has meaning and it is such information demands of expanded information resources the job of managing has also expanded (e.g. McNurlin & Sprague 2006, Stenvall et al. 2007).

It is not surprising that in public administration quite many see a trend from government to governance in which public actors increasingly use more horizontal, instead of vertical, forms of steering and work together with other public actors and private actors to achieve policy outcomes. In many cases information processing is thus multileveled (Jones et al. 2006). The ICT and information management are needed because various difficulties to achieve positive gains among actors, an also the fact is that complex inter-organizational networks are quite ambiguous and unpredictable. Public administration concentrates on strategies and governance or institutional structures, but less to the function of both ICT in information management. Thus especially in the context of complex information management, the ICT have been largely ignored.

The development of both ICT-based information management and e-government takes place in a continuously changing organizational environment and set up a huge pressure at the same time as expectations are quite high (see Bannister 2005, Brown 2007). For example, e-Government promises to deliver a number of benefits to citizens, businesses and governments. The ICT has created, however, a new mandate for management of knowledge organizations. Organizations confront many changes due to the ICT. The change effort for any organization is unique to that organization. ICT and information management clarification may cause specific requests like manager self-examination, information gathering, communication about ICT needs, dealing with unanticipated consequences, and finally, the stronger capture of e-Government.

E-government is defined as government’s use of information and communication technologies for the production and delivery of information and services (Fountain, 2001, Brown 2007). Electronic government is over and over again employed as an innovation mechanism to obtain greater levels of efficiency and effectiveness. Apparently, because e-government may offer substantial performance gains, it has become one of the core elements of change or reform. In terms of change structures, processes and humans are challenged as information management is linked to all of them (rf. Burke 2008).

Papa & Daniels (2008) summarize that because of many functional reasons organizations invest in information technology for productivity, information management, and control. It has been shown for example that ICT may be controversial in nature when related to people’s work satisfaction, but it should be well taken care by management (Syväjärvi et al. 2005, Golden & Veiga 2006). For many management operations, the use of ICT has become a standard for achieving
positive gains. It is important to know the true nature and use of ICT in information management and also the future possibilities of it in government.

As stated earlier, the ICT in fact influences the ways we organize. E-Government is the use of ICT by public sector organizations. To understand e-Government we must understand ICT and vice versa. Heeks (2006) states that we need to see how e-government systems are management information systems. Furthermore, Barrett et al. (2006) studied ICT and organizational change and concluded what is needed is studies such draw on and combine both organizational studies and information system studies. This indicates that as ICT is related to information management systems and e-Government we need to analyze managers’ personal relation to ICT and their opinions and expectations for its future functions. But on the other hand, and additionally to former human inspired viewpoint, the question is mechanic or technical in its nature. Typically with e-Government and management information systems (e.g. Moon 2002) it is studied what kind of change, evolution and innovation oriented role ICT-based systems offer and how systems offer support for future government and information control.

The process of managing ICT in organizations is becoming increasingly complex as it becomes more important. The governmental environment is changing as we have core demands like customer-centricity, ubiquitous organizations, electronic work processes, and continuous and discontinuous change that all test the public service delivery. Thus information and communication technology advances in different types of networks, communications, computation, and storage result in collections of data, capturing information of value to organization, government, and society. Data volumes are indeed currently growing very fast and as looking forward the exponential growth is not likely to stop. The huge size of data is indeed imposing big challenges on infrastructure for information, storage, sharing and management. How ICT is used in information management depends heavily on both the environment surrounding and managers of organization that use information.

Methods and research target

The empirical data is collected during the continuing research project “Knowledge and information management in the City of Helsinki”. The project is going on under cooperation between the University of Lapland, the University of Tampere, and the University of Edinburgh. Both the methodological and data source triangulation were applied (see Patton 2002) in this
qualitative research. More precisely the research data was collected by thematic interviews and focus group interviews and thus, a qualitative approach is stressed.

Data gathering was completed in two separated phases. At the beginning individual thematic interviews were done with high-position managers of the Helsinki City who are responsible and attend to the management of public services. Totally 20 administrators were interviewed. These interviews were analyzed and thereafter two focus group interviews were implemented. People in the first focus group (n=7) represented information management and electronic government specialists. In the second focus group we had top managers (n=6) who were not that familiar with current thematic. The purpose of focus groups was to check the validity of earlier thematic interviews and to open up new perspectives of information management related to data mining and to ICT in government. In each interview major topics were information management, data mining, and ICT in government. All the interviews were digitally documented.

The City itself is very valuable research target with its e-Government defects and advances. Helsinki has received international interest because of various electronic service developments and citizen or user-friendly e-government solutions. For example, the UN reviewed online services and according to its results published in 2008. In the UN survey, Helsinki was ranked one of most advanced cities in the world as main review criteria were content, service, participation, usability and information security. However, it is important to see the current target as a fruitful research environment.

Findings about data mining and information management

At the moment research is in progress and we report only preliminary findings. According to the most critical views, the problem with the utilisation of information in management is that the information produced by systems cannot be used in its current form. Information is given in such fractional way that it is not suitable for the management use. The information system seems to be decisive factor. Priorities seem to lie in economics and even in the best of circumstances the data has no predictive or forecasting qualities that are seen very important – it merely presents the situation as it already is. This will lead huge data mining needs and to the “jungle” of many information sources.

“We use systematic approaches in order to gather information and storage it, but this is mainly all what our mining procedures or ICT systems allow to do… I mean
following steps like sharing, further refining data or information and the use of information are very difficult.” (Member in focus group 1)

”We talked about where the information rests and the basic problem with this coded information is that every time that information is coded, it creates inflexibility. It is also clear that the utilisation of information, customer centricity and strategic thinking should be more flexible. But how – that is a completely different thing… decisions are not clearly based on data, but the decision-making process requires a number of compromises in a complex political environment…” (Individual interview)

Almost all available databases were seen enough large and trustworthy and it was also quite commonly agreed that people in management position do indeed mine and seek for valid information. Information was seen, thanks to advances in technology, secured and protected in many ways. Best experiences and practices were recognized in the area of financial monitoring and budgeting. The role of information was seen as a key part of management (like in strategic planning and monitoring) even the overall political decision-making was considered both complex and giving limitation. But with the very best and probably most developed sectors again data mining and use of actual information in management was seen problematic.

One challenge seemed to be quite diverse and fragmented government. The City of Helsinki does not have strong central governance and the various departments operate with a relatively great degree of autonomy. Departments have been seen to represent the very best expert knowledge in their area of operation. Municipal councils approve four-year strategies for departments to concentrate on the goals that the council strives to achieve during its tenure. And strategy is – as previously described – the result of certain degree of compromise reached through the political decision-making process. The progress towards reaching the objectives is monitored annually as a part of the budget process. In this context, there were good comments about ICT-based systems how those will standardize management activities. But at the same time there were critical comments about unsystematic data mining procedure and moreover how to shift the data for management needs.

“There are meetings on either weekly or monthly bases between different city administrators, but still what is common is probably only related to systems… it is up to expert area how they develop data or information mining procedures, etc. So data mining and its use in information management is not systematic in government, it is more like
depending what kind of benefits it can bring to various expert sectors and how committed individual managers are with these data mining issues.” (Member in focus group 1)

One observation from the research material is that there are indeed methods and ways available for data mining. They are not, however, systematic and matching across the entire city. Experts reveal in the focus group interviews how upper management delegates the responsibility over development areas and matters they are unfamiliar with to their closest subordinates and experts. According to experts, the delegation of in-depth involvement in projects does not, however, provide an open opportunity to guide the department head towards something new. Expert interviewees say that there is a danger of leaving development work for a specific person or different sector department to deal with and the significance of that project is then determined by the valuation, role or status of that one person. Uncoordinated development work with complex environment is not a very good combination.

“In Europe we are one of the most developed city with this, what was it… yes data mining, and our departments know how to deal with information. They all are experts in their own area.” (Member in focus group 2)

As noticed before, other information acquisition areas as part of management were scarcely presented in the individual interview material. For example, dialog with experts, customer relationship management, networking and partnership management, risk analyses and forecasting or were like infrequent notion of data mining. In fact, the majority of discussion (and especially in case of focus group 2) was very much technology oriented and other possibilities were mentioned only about one-third of individual interviews. Also, and not surprisingly, other realistic data mining possibilities were under discussion in focus group 1.

Finally the city has involved different kinds of data mining development projects, where its expert departments of the current field have shown particular strengths. They work closely together with various operators, such as the government’s technical research centre as well as the polytechnics and universities. From a data mining perspective, these development projects are mentioned in the interviews in those operational areas where strong customer database management is particularly important, such as social and healthcare areas. In the combination of data mining and information management, it seems important that experts have their feet on the ground as others might concentrate to rhetorical aspects.
“Everyone knows that management and decision making should be based on data and valid information. We as responsible experts of information management and ICT work very hard in order to show and remind about the importance information, data mining techniques, etc. Sometimes it is sad to see that people will give credits to this work, but they do not follow or they do not act as they think… they have high expectations and promises, but everyday life may differ a lot from this information and IT management reality.” (Member in focus group 1).

“But it is also our experts’ task to look after and develop our services to such direction that we are understood and involved.” (Member in focus group 1)

"Experts will need to think about not only content, but also very much about how the information needs to be presented. We have seen some good ideas to put on hold, because the manager was unable to grasp what was going on.” (Individual interview)

The general problem in decision-making today or in the future is not the lack of information, but rather the separation of relevant information from the irrelevant and, according to expert views, the way in which the leaders can make use of the information. One key question, according to current findings, was how department and top management attitudes can be changed and moved towards the realistic rather than rhetoric development of information management and data mining. Overall as complexity and uncertainty increase, the importance of these issues increase simultaneously.

Findings about ICT and information management

According to interviews, there is a concern over the managers’ ability to explain what kind of information and in what format the information should be presented. Own information needs are not always well known. Also new, unfamiliar and continuously changing ICT puts people to situation that does not allow to doubt management and decisions. At the same time management employ most probable assumptions together with that information which is somehow in reach. Expectations about ICT are high and ICT is seen as positive performance injections for both individuals and departments. According to the findings, people and departments work at different phases and their readiness to meet concerns of certain expert areas varies a lot as well as does the viewpoints.
"Too many of us are afraid to challenge the manager and the fact remains that career possibilities are for those who agree and do not challenge the manager, they rather want a yes-man… people do what is asked. There is plenty of knowledge and innovation, but harnessing and managing it is rather outdated." (Individual interview)

“Information systems are very operative in sense that those systems guide our everyday work. Systems in management are all right, but in case of information and management we still more supportive systems for everyday management instead of technological tricks and elegance”. (Member in focus group 1)

“It is nice that we can use so much mobile and other high technology in management and that our information systems support management in so many ways. In the future electronic possibilities are huge and those will somehow give us even better performance in both management and service delivery… essential information is produced for all in our city and it can be found from one place”. (Member in focus group 2)

Even people are not always recognizing their own information needs or viewpoint differ, it seems somehow evident that ICT and electronic government approaches lack certain governmental uniformity. Only consistency is most likely related to standardized information systems and the rest is open. Furthermore, views in both expert and manager group stated the role of information technology and advancement of pilot projects. This in a way showed the trust in both information systems and technical know-how. We found that high promises and expectations are clearly technology-centric and especially this was manifested in focus group 2.

The city’s success has played a part in the dominance of such discourse, the prevailing self-interpretation. Instrumentally laced technology-centricity and its idealisation is, however, manifested in various degrees of concern amongst experts who feel that there is a risk of believing in the great success story of an information technology-centric city, but at the same time the human-factor begins to be forgotten. Individuals and HR are relatively often mentioned in management interviews and close personal connections are valued by the managers across the board, whether they were residents, customers or own staff. In this regard the views of managers and experts differ from one another. Experts believe that technology is often practically taken the number one spot, whereas managers’ view is that information technology is user friendly, IT marginalisation countering is a key strategic area and human-centric, innovation developed to work in a person’s everyday life have been created in various cooperative projects with IT companies. City department
heads’ individual and group interviews do share their unwavering trust in information technology. And the aforementioned interview settings refer to those many projects where cooperation is being done. Experts, however, felt that they are relatively alone and the challenge is to get the manager of a large department or unit to be genuinely excited about the development projects. The material does not, however, reveal how management skills are supported and guided towards interactivity and information-based management, how managers strengthen the organisational culture of sharing information and how they develop organisations to be more adaptive and prepared for continued change.

In other words, the city has a number of high quality high tech projects and information technology is used and the use of IT has its own strategy that is being monitored. The challenge is, however, the rhetoric and glory that is related to information technology and the prevailing organisation’s self-interpretation of such rhetoric of idealisation. At the same time there are genuine questions about how individuals and communities operate as the users of technology, how there is not enough information sharing within the organisation, information is being hogged and department heads are unapproachable about what they should know because it is almost impossible for the manager to admit that they do not know.

"Structures should be much more flexible and operational methods should be much more flexible. And skills should be much more based on interactivity than what they are today. Our challenge is not to control operational basic information; rather, the challenge is the kind of information that would help us see the direction in which we should proceed.” (Individual interview)

“New and changing situations are demanding and we should have such information systems that provide information very fast and precisely, because we do not have enough time go through all information loads with every partner.” (Member in focus group 2)

The interactivity between different departmental units, data moulding and information interpretation processes are, according to the research data, difficult challenges for the management from the information management perspective. Its implementation would require the re-thinking of control methods and control-related concepts because organisations and their operational methods are changing; according to the interview material, for example, professionals seek support and interactivity from their own peer-groups and networks. The various high skill-level networks and
city’s current activities have begun to question the traditional hierarchical challenges that might hinder electronic government and development.

ICT brings also dynamic turbulence to complex organizational settings. The need for change is not only set for information management or e-government, but also for people and processes that are in touch with change. The city’s operational environment is changing into an ever more connected and networked entity. The challenge is related to the development of information technology and information management that has not been able to provide an answer for the increased need for information processing. Current operation models were designed to transport raw data to the top of the organisation to support decision-making and processed information or data to the implementing level. Centralised decision-making, however, limits ability to adapt to the ICT-based changes in the operating environment and therefore also ability to adapt to complexities.

Conclusions

In this article we have studied and analysed data mining and applied information and communication technology in relation to governmental information management. The context of our study is Helsinki, a city that can be considered as an investor and developer of ICT and information management. The research material indicates especially how the e-governmental development practices based on data mining and applied ICT have started and what is considered to be those meaning from the point of administration and management in the city.

Interviews of specialists indicate that the potential of data mining is acknowledged. Data mining is a logical continuum for operations concerning data warehousing. The development of data mining is still, however, unorganized and incoherent. This is largely due to the fact that ICT based practices are advanced in several independent projects that are lacking sufficient coordination with each other. The nature of the development operations is mostly based on “technology first” thinking. The system or application driven approach seems to put people in organization and service users to follower role. This causes frustration and obvious problems to information management and for example to the use coherent evidence in management decision making and coordination (rf. Heinrich 2007).

Hence, on the basis of focus group interviews, the development of data mining also involves differing expectations and meanings between different occupations and managerial positions. The
situation shows information management and government development that is carried out with different attitudes and expectations that are based on assumptions, experiences and sometimes on information. Electronic government experts see the technological opportunities and assume that practices can be developed on the terms of technologies. At the same time, ICT experts recognize that incompatibility between systems and deficiencies in data warehousing make the development of data mining or e-government approaches more difficult. Expert managers of the field have more realistic view about the possibilities and treats of data mining and ICT in relation to governmental needs and situations. They even show unrealistic belief in technology regarding the ways in which technology could reform operations. Hence, people representing such management and management level view data mining also from both an administrative and public service perspective (Syväjärvi & Stenvall 2007, Chowdhury 2009).

Different actors have varying expectations of what are the problems that would be possible to solve using data mining. ICT experts’ approach to the question is mainly that with data mining you can ensure that investments in data warehousing are not lost. In the management’s point of view, data mining should essentially be utilized in conjunction to promoting, for instance, cost-effective operations, customer information, and administrative preparations. Differing expectations are typical in performance management (e.g. Niiranen, Stenvall & Lumijärvi 2006) but, at the same time they hamper effective promotion of operations regarding the utilization of data. According to current results, top managers or managers not that familiar with information management and electronic government still live with great hope and rhetoric as they believe that good information management and e-government will help almost in everything (rf. Ho 2002, Moon 2002).

The essential question is whether data mining will be used for promoting an organisational structure suitable for complexive operating environments based on flexible and fast utilization of data, or a predictable organisational structure based on administrative, predictable, and reliable practices. This is partly illustrating the critical period city administration is facing at the moment. A transition is taking place from a bureaucratic model of operation towards organisational networking and higher flexibility. The confusion of the transition period is making effective implementation of data mining more difficult. On the other hand, organisational structures need not necessarily be built up with the options either—or, but applying the both-and principle that includes features of both bureaucratic and flexible organisations. This presupposes, however, clear decisions on where the structures are required to produce reliability of operation and where should they be flexible and agile.
Data mining can support predictable operations by, for instance, systematically producing operative information for budget preparations. It can also provide occupational information of different customer groups and changes in the customers’ situations. In a complex operating environment, data mining might be used for producing information according to the needs of the specific situation (Syväjärvi & Stenvall 2009). It can create new kinds of operations, networks, forecasts, discoveries, etc. For instance, if a political decision maker urgently needs information to support his decision, he may contact an authority who will mine out the necessary data from databases. The situation might be similar in complex change situations (eg. Tidd et al. 2005, Brown 2007). As seen data mining and ICT both really challenge to work hard with governmental development. This is also indicated by our conclusion that first priority is typically given for such factors (like security, privacy, standards, etc.) which can be solved by technical or system-based activities.

The material in our study shows the need of systematic approach in the development of ICT based data management practices. As we see it, urban environments need a systematic development program for information based management; also including development of ICT based tools of information management. Especially in management work, management by information requires that decisions and various solutions are based on systematic and active use of information that relates to the managed operation. There are also many attributes regarding information. Good information is defined subjectively but validity, completeness, and correctness can be considered its criteria (Gelders 2005, 377). Validity means that information is communicated in a situation where it is useful and necessary to the recipient. Regarding completeness, the communicated information should indicate the status of the chosen political approach and action. In this case, attention also needs to be paid on the process through which the information was born and produced.
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