Urban Information Systems in Turkish Local Governments

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INTRODUCTION

Since the end of 1980s, different sectors have implemented geographical information systems (GIS) in Turkey. A study on GIS market in Turkey indicates that municipalities are the primary customers (Gülersoy & Yigiter, 1999). One of the earliest GIS projects in Turkey began with the production of digital maps covering the boundaries of Istanbul Metropolitan Municipality in 1987. Since 1994, a rapid development process has occurred with the widespread diffusion of GIS especially in universities and large public sector organizations respectively. However, the early city-wide municipal GIS projects were initiated only after 1996 (Ucuzal, 1999). In recent years, a major change has occurred in the context of GIS projects from small-scale infrastructure projects to city-wide municipal GIS projects for three reasons:

1. After the devastating earthquake in Marmara region in 1999, people suffered from the lack of vitally important information, because such information never existed or was never kept in a systematic way. The importance of accumulation and distribution of up-to-date and accurate data among city-wide organizations was recognized (Tecim, 2001);
2. Rapid development of Internet in Turkey in recent years encouraged the communication efforts within and among the organizations, and among people and organizations, and this triggered the need for inter-organizational GIS (Karas, 2001);
3. Initiatives supporting e-municipality and e-government, and transition from government to governance raised the importance of transparency, communication, and public accountability (Tüzün & Sezer, 2002). In this sense, the concept of "urban information system" (UIS) began to be popular in the context of local governments. At the time of publication, UIS was used as an umbrella term encapsulating all the efforts for an information system—whether GIS or LIS—or information technologies like the Internet within an integrated system that is supposed to be performed in municipal operations in order to support organizational rationality.

Although so-called urban information systems were being marketed by vendors as the panacea for all problems, the implementation of large-scale information systems generally ended up with failure because information systems (IS) require large changes in the organization's existing structure. In the Turkish case, no municipality has been able to complete establishing a city-wide urban information system so far. Ankara, Istanbul, and Bursa are the cities, where implementation processes are still underway (Celik, 2002). Therefore, there needs to be case studies to address implementation problems of UIS and to evaluate the reasons behind the failures.

In this article, the emphasis will be given upon organizational and political aspects of UIS implementation that is critical for the success and failure of such systems. For this purpose, the approach adopted rests on the assumption that "the success or failure of IS projects is dependent on the degree of mismatch between the conceptions of these systems and the organizational realities into which it is introduced" (Heeks, 1999). In the rest of the article, based on Heeks's argument, the assessment of these gaps is evidenced in the case of Turkish metropolitan municipalities, and further evaluations are made guiding further projects and studies.

ORGANIZATIONAL CONTEXT OF INFORMATION SYSTEMS

Information systems today play a vital role in businesses, governments, and other organizations. Because they are so closely tied to organizations, it is necessary to closely understand the nature of organizational realities. Public sector organizations like municipalities are the single largest collector, user, holder and producer of information. The work of these organizations is thus very information-intensive.

Municipalities are responsible for providing the basic urban services (i.e., infrastructure development, fire department operations, garbage collection, planning services, etc.) to the public that requires collecting accurate information about environment and efficient use of this data to perform municipal tasks. The capability for planning, programming and decision making in the municipali-

ties is largely dependent on the collecting, storing, preserving and managing of the spatial information. Municipalities collect and manage both spatial data (i.e., district plan, base maps and cadastre maps) and non-spatial data (i.e., water-system revenues, environmental taxation and building permissions) in their operations. Almost 80% of total data exploited by municipalities are "spatial data". Thanks to advancing technology municipalities are increasingly using geographic information systems (GIS), management information systems (MIS), and the Internet to carry out municipal tasks and services more efficiently. By combining many of the municipal services into an urban information system, the aim is to obtain service unity, reduce service costs and increase revenues.

Information systems differ from information technologies in that they involve people and their actions. Further, they incorporate a set of rational structures, processes and even culture and strategies for the operation (Campbell & McGrath, 2003). Thus, changes in the organizational context are required for information systems to operate rationally.

Considerable declines in the price of information technologies and the increased capacities of technological innovations in supporting municipal tasks and services have increased the implementation of urban information systems (UIS) in Turkish municipalities. Although considerable resources were allocated for UIS projects, a great many "implementation failures" are experienced due to the lack of required interest during the implementation process. Despite the promise of supporting the organizational rationality, the aim of many UIS projects is to get prestige. Municipalities tend to favor large, complex UIS projects supported by generous funding. But the continually changing political context brings an end to the projects started because of prestige, but not supported by organizational rationality.

In this context, Heeks's ITPOSMO model, based on conception-reality gap assessment, allows a suitable framework to reveal the mismatch between the concept of hard-rational design of information systems and soft political realities of organizations.

ITPOSMO DIMENSIONS OF INFORMATION SYSTEM

Richard Heeks's (1999) model of conception-reality gap assessment is an effective technique, which helps to illuminate the causes of an implementation outcome in organizations (Kouroubali, 2002). According to Heeks, there are conception-reality gaps in implementation process of urban information systems. Successful adoption depends on the size of these gaps: "the larger the gap, the greater the risk of failure" (Heeks, 1999, p. 59). After a review of a number of case studies, he concludes that gaps between conceptions and reality can be classified into seven categories summarized by the I-T-P-O-S-M-O acronym:

- **Information:** Provided by the system versus actual information needs, and the extent to which the organization can access the information.
- **Technology:** Technological capacity required for participation and actual technology capacity of target organizations.
- **Process:** Technology features in relation to existing processes.
- **Objectives and values:** In accordance with the objectives and values incorporated in the system in relation to objectives and values of users.
- **Staffing and skills:** How well the system fits with human capability requirements.
- **Management and structures:** How well the system fits within existing organizational structures.
- **Other resources:** How available resources such as time and money match with required ones (Heeks, 2001).

Heeks's model of conception-reality gap based on ITPOSMO dimensions has a great value for the following case study section for three reasons:

1. Conception-reality gap assessment is derived from world-wide examples of IS implementations particularly from the public sector organizations and those of many developing countries;
2. ITPOSMO model has the value to being able to examine the reasons why the introduction of information system projects in similar organizational settings results in a various degrees of success or failure;
3. A knowledge base consisting of ITPOSMO dimensions creates opportunities to share and communicate the reasons of success and failure of different cases systematically.

Further clarifications on the pros and cons of the technique are discussed by Heeks elsewhere (Heeks, 2003).

BURSA URBAN INFORMATION SYSTEM (BUIS)

As mentioned in the previous section, efforts to implement Urban Information Systems (UIS) in Turkish municipalities are in infant stages so there is value in carefully documenting implementation process. The Bursa Urban

Information System (BUIS) was selected for study for three specific reasons:

1. the relatively longer experience of urban information systems (since 1996) in this situation creates a greater chance to observe changes through time based on ITPOSMO dimensions;
2. the availability of more financial resources, and municipality's ready acceptance of the wider implementation of various technological systems;
3. the funding obtained through an international donation-loan, professional consultancy and feasibility study provided a significant impetus for a detailed investigation.

Development of BUIS Project

With automotive and major textile plants, and foodstuff industry, Bursa is one of the prime industrial centers in Turkey. With its current population of 1.6 million, the city is the fifth largest in Turkey. In 1987, Bursa was granted the status of a "metropolitan municipality", encompassing three district municipalities under its jurisdiction.

Bursa Metropolitan Municipality wanted to use UIS for the planning and management of this rapidly flourishing city. With such a motivation, they began BUIS project with a GIS feasibility study conducted by U.S.-based firm "Psomas and Associates" between 1994-1996. Funding for the feasibility study was through "Trade and Development Agency" (TDA), an arm of the United States Department of State. The study had four major steps: needs assessment, study tour, pilot project and feasibility study/ implementation plan (Henstridge, 1999). Meanwhile, an international fund provided Bursa Metropolitan Municipality with a loan from the World Bank for the planning, reconstructing, improving and managing the water and sewerage system of the city. After the completion of feasibility study, Intergraph won the bidding to design and to begin implementing Phase-1 of the project in 1996. In order to provide an interactive system management, Intergraph established a branch in Bursa for the implementation process. Permanent staff members from the Metropolitan municipality and district municipalities of Bursa were assigned for the control of the implementation process from 1996 to 1998. Aside from Intergraph, three different companies that specialize in different categories of data collection and processing signed a contract within the same period. Since 1999, BUIS had been fully operated by local "urban information system division", which was responsible for operating the system, supporting other departments in the organization, and coordinating inter-organizational data sharing among respected local organizations.

ITPOSMO Dimensions of BUIS

Based on the results of field study, interviews, and corresponding materials, Richard Heeks's ITPOSMO model was examined for BUIS.

Information

As a rapidly urbanizing metropolitan region, Bursa is undergoing tremendous infrastructure expansion with associated land titling, land registration and environmental projects. In the implementation phase-1 (1996-1998), the information needs of BUIS were projected and four different firms were commissioned to produce spatial data (i.e., base maps, cadastre maps, etc.) and attribute data (i.e., building details, household data) through surveys and digitization of maps. Then, an inter-organizational network was established. Covering three metropolitan-district municipalities in Bursa, The Cadastre and Title Deed Office, Turkish Telecom, Bursa Natural Gas Company, the BUIS implementation succeeded in the coordination of data management (BUIS, 2003). It also provided a software application developed for 182 "muhtars" (selected headmen of the villages), connecting them to the main system by wide-area network.

The conception-reality gaps for were as follows:

1. there was an absolute need for accurate and up-to-date data in the heart of all information systems. There were some serious problems in the currency of the data that threatened the sustainability of the project: e.g., since the international funding options were not available after 1999 the heavy costs of information maintenance (46% of total BUIS expenditures) became more prone to the political choices of decision-makers;
2. there were serious inefficiencies in the provision of attribute data by respected local bodies: e.g., muhtars were expected to update the database once in a week. In reality, only 20% of them succeeded in operating properly (Erarslan, 1997); and
3. information systems require a clear information management strategy to fulfill the organizational needs and objectives rationally. Yet, the fact that the needs assessments could not be completed by each municipal unit, meant that features of the information systems largely fail to address to the needs and objectives of the organization.

Technology

The hardware and associated GIS software was provided in the implementation phase of the project with the

support of international donors. Both software and hardware are currently operational to perform municipal tasks and services. There is also a fiber-optic network connection between all municipal divisions and corresponding district municipalities.

The conception-reality gap was relatively low for the technology dimension but some issues still need to be improved. These include the coordination of municipal tasks and inter-organizational communication between local bodies, and better provision of municipal services which were the major aims of the BUIS. The telecommunications infrastructure in Turkey, however, is somewhat limited, therefore there some problems occurred in the provision of Web-based services. There was not a fully established network system in and between local public sector organizations and this made the sharing of data more challenging.

Processes

As proposed in the feasibility study, "Urban Information System Division" was founded under the Directorate of Public Works to support functioning of municipal services, in-house production and maintenance of information. Many municipal units adjusted their working processes according to BUIS. For example, citizens' demand for fixing and maintaining of infrastructure system via telephone service was converted into a "task sheet" by local system operator and transmitted to maintenance crews working in the field.

Conception-reality gap was also low for this dimension. Yet, the absence of office automation reduced the opportunity of fully integrated work process that BUIS may have offered.

Objectives and Values

The feasibility report assumed objectives of greater efficiency through increased revenue generated from property tax collection, effective provision of utility services, control of urban development, and delivery of emergency health, safety and police services with BUIS project.

Some of the system objectives mentioned earlier were achieved. On the other hand, there were some problems increasing the size of this gap:

1. an urban information system is a costly investment and may only be profitable in the long run. It requires a strong political and individual commitment to fulfill the objectives of the organization. In this respect, such factors as the international consultants, project contractors leaving at the end of the phase-1 of the project with the expiration of their contracts, international donors withdrawing their support, and the mayor, the founder of the BUIS, not being re-elected, reduced the chance of wide spread adoption of the system;
2. In terms of values, there was a "communications gap" between politicians and BUIS administrators in the determination of current and future needs of BUIS.

Staffing and Skills

Feasibility study paid great attention to training of the staff for the successful system implementation. In this context, consultants provided a comprehensive training program included hardware, software, and training of system administrators, chief managers and system operators.

Staffing and skill gap was not important for the BUIS. Sufficient attention was given to continuous training of the staff in information technology. But innovative use of software packages and reinventing them for specific operations remained relatively small. This was largely because of the problem of public sector employment policy that neither computer skills nor individual productivity was encouraged and rewarded by the administrative system.

Management System and Structures

The design of BUIS proposed strategy to develop an appropriate structure aiming to increase the effectiveness of the organization and its service to its clients or public.

Since BUIS had a city-wide basis, some obstacles were encountered in the sharing and production of the data originating from the country's legal and administrative system:

1. the majority of applications in the GIS market were insufficient to fully perform the responsibilities and coordination role of Metropolitan Municipalities to the digital environment (BUIS, 2003);
2. there was an ongoing challenge between local bodies of central administration and Metropolitan Municipality in the sharing of information. As vital source of BUIS, for instance, cadastre maps were not available free of charge for Municipal organizations; and
3. there was also a conflict between Metropolitan Municipality and associated district municipalities in conjunction with their political stances. In some cases, district municipalities may establish completely different software packages or operating systems that interrupt the city-wide coordination efforts and cause economic loss due to the incom-

patible data production and exchange. BUIS suffers largely from these issues and the gap was higher for this dimension.

Other Resources

For the BUIS case, donor-aid made the money available for the feasibility studies and phase-1 of the project. The time schedule for training and implementation of basic features of the system worked for the first stage as envisaged in feasibility study. Also, some revenues were gained through the marketing of spatial data and digital maps prepared by the BUIS staff (BUIS, 2003).

But significant budget cut-offs were experienced in the second phase due to the lack of political support and wider economic recession in the country. Therefore, the conception-reality gap was gradually increased.

CONCLUSION

The result of the study indicates that several ITPOSMO dimensions namely "information", "objectives and values", and "management structures and systems" seem critical and may lead to "sustainability failure" for BUIS. Broadly, 15 years of GIS experience in Turkish Municipalities confirms that urban information system (UIS) implementation was neither based on a well-designed information management strategy nor utilized in long-run due to the ever-changing political context. A UIS generally incorporates a significant set of rational structures, process, culture, professional strategies and involvement. For this reason, almost all of the implementations realized that failure to complete the pre-requisite conditions and careful management of implementation process may face failure (Pick, 2004).

There is no recipe for success that might be advised to other institutions. But, freezing some ITPOSMO dimensions, getting them smaller and simpler and finding solutions by bringing them closer to organizational realities may open the way leading to a more successful implementation (Heeks, 1999). In this sense, the approach of incrementalism can be applied to avoid over-ambitious UIS projects, which carry high risks of failure. This approach recommends organizations to concentrate on limited applications, which directly meet perceived organizational needs. Such an approach is less vulnerable to organizational and environmental changes and political instability which are very important in developing country context.

Studies in GIS implementation problems especially in developing countries should become a priority issue (Ramasubramanian, 1999). Yet, currently few studies focusing on the institutional dimension of the technology are demonstrated in recorded case studies. In the research pyramid of GIS studies (Obermeyer & Pinto, 1994), institutional issues should be given more attention. As a result, the evidence obtained from Heeks's ITPOSMO model could be suitably extended and updated. This study will hopefully lead to further studies which address the soft organizational realities (cultural, structural, political, people factors) of urban information systems.

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KEY TERMS

Communications Gap: Relates to that part of the knowledge gap which can be attributed to miscommunications between the parties involved (i.e., IT designers understand technology but not the realities of governance. Officials and politicians understand the realities of governance but not the technology).

Geographic Information System (GIS): A GIS is a computerized system for the collection, storage, manipulation, and output of information that is spatially referenced (Obermeyer & Pinto, 1994).

Land Information System (LIS): A GIS specially designed for use with land information. Land rights, ownership, boundaries, utility, land cover, and zoning data are common layers and attributes in a LIS.

Non-Spatial (attribute) Data: Data that relate to a specific, precisely defined location. The data are often statistical but may be text, images or multi-media. These are linked in the GIS to spatial data that define the location.

Spatial Data: Any information about the location and shape of, and relationships among, geographic features, usually stored as coordinates and topology.

Sustainability Failure: An initiative that succeeds initially but then fails after a year or so.

Wide-Area Network (WAN): A computer network that spans a relatively large geographical area. Typically, a WAN consists of two or more Local-Area Networks (LANs). Computers connected to a WAN are often connected through public networks, such as the telephone system. They can also be connected through leased lines or satellites.