DIFFUSION OF GIS AT MUNICIPALITIES IN İSTANBUL

MAHMUT ÇAVUR

BOGAZİÇİ UNIVERSITY

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DIFFUSION OF GIS AT MUNICIPALITIES IN İSTANBUL

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Mahmut Çavur

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Diffusion of GIS at Municipalities in İstanbul

The thesis of Mahmut Çavur

has been approved by:

Prof. Dr. Meltem Özturan _____

(Thesis Advisor)

Assoc. Prof. Dr. Aslıhan Nasır _____

Assoc. Prof. Dr. Mehpare Timor _____

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Thesis Abstract

Mahmut Çavur, "The Diffusion of GIS at Municipalities in İstanbul"

This study aims to develop a better understanding of diffusion of Geographic Information System (GIS) within municipalities and examines the infrastructure of İstanbul municipalities and whether they are ready for this technology or not. Moreover, failure and success factors of implementation of GIS have been analyzed in this study.

This study has two research methods: The first one comprises interviews with the experts of GIS in Turkey. The second one comprises questionnaires conducted with GIS-related departments of İstanbul municipalities. 39 local municipalities and İstanbul Metropolitan Municipality have participated in this questionnaire. Data collected online from these municipalities have been analyzed by using descriptive statistics, reliability tests, Anova and regression to test the hypotheses and provide the findings.

One of the findings is that almost half of the municipalities, which have started to implement GIS, do this without a vision or a plan for the future. Another finding is that GIS is mainly used to perform registration and maintenance functions instead of supporting the decision-making process. Although many of the municipalities accept the superiority of GIS tools over Computer Aided Design (CAD) tools, they are used to employing CAD tools. The main criteria for successful GIS projects are employee, managerial and budget considerations whereas the main problems about GIS projects are employee, budget and data constraints. Finally, there is an optimistic expectation of municipalities regarding the use of GIS in the future.

Tez Özeti

Mahmut Çavur, "Coğrafi Bilgi Sistemlerinin İstanbul Belediyelerindeki Yaygınlığı"

Bu çalışma, Coğrafi Bilgi Sistemlerinin (CBS) belediyelerde yaygınlığı konusunda daha iyi bir anlayış geliştirmeyi amaçlamaktadır ve İstanbul belediyelerinin altyapılarını ve bu teknoloji için hazır olup olmadıklarını incelemektedir. Ayrıca bu çalışmada CBS uygulamalarındaki başarısızlık ve başarı faktörleri analiz edilmektedir.

Bu çalışmada iki araştırma yöntemi vardır: Birinci yöntem, Türkiye'deki CBS uzmanlarıyla yapılan mülakatlardan oluşmaktadır. İkinci yöntem ise İstanbul belediyelerinin CBS bölümleriyle yapılan anketlerden oluşmaktadır. İstanbul Büyükşehir Belediyesi ve 39 yerel belediye bu ankete katılmıştır. Bu belediyelerden İnternet ortamı üzerinden toplanan veriler, hipotezleri test etmek ve bulguları sunmak için tanımlayıcı istatistikler, güvenilirlik testleri, Anova ve regresyon kullanılarak analiz edilmiştir.

CBS'yi uygulamaya başlayan belediyelerin yaklaşık yarısının CBS'yi vizyon ve ileriye dönük bir plan dahilinde kullanmadığı bu çalışmanın bulgularından biridir. Diğer bir bulgu ise CBS'nin karar verme sürecini desteklemek yerine, kayıt ve bakım işlevlerini gerçekleştirmek için kullanılmasıdır. Belediyelerin birçoğu CBS araçlarının Bilgisayar Destekli Tasarım (BDT) araçlarından daha üstün olduğunu kabul etmesine rağmen, BDT araçlarını kullanmak bir alışkanlık haline gelmiştir. CBS projeleri için temel başarı kriterleri çalışanlar, yönetim ve bütçe iken ana sorunlar çalışan, bütçe ve veri kısıtlamalarıdır. Son olarak, belediyeler gelecekteki CBS kullanımına ilişkin iyimser bir beklenti içindedirler.

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CONTENTS

FIGURES

TABLES

ABBREVIATIONS

AAN	Assessment Account Number
AIS	Archive Information System
CIS	City Information System
DSS	Decision Support System
ESRI	Economic and Social Research Institute
GCM	General Command of Mapping
GIS	Geographic Information System
GML	Geography Markup Language
IS	Information Systems
IT	Information Technologies
KMO	Kaiser–Meyer–Olkin
LIS	Land Information System
MIS	Management Information System
OS	Open Source
PCA	Principal Component Analysis
RS	Remote Sensing
TSI	Turkish Standardization Institute
UAVT	Ulusal Adres Veri Tabanı (National Address Database)
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Mapping Service

CHAPTER 1

INTRODUCTION AND OUTLINE OF RESEARCH

Using Information Technologies (IT) is a very common and compulsory issue in all sectors nowadays. Since Geographic Information System (GIS) is a kind of information technology which enables us visualize, question, analyze, interpret, and understand data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts, it is being used inevitably by all sectors. Municipalities are one of the governmental organizations which use GIS mostly to collect, store, use and evaluate data related to geography.

> In early researches, ten Kroode (1994) found that of all the hours spend [sic] on a specific task in a municipality; about 60% of that time is revising of the needed information. About 40% have to do with the actual working with the information related to spend on collecting and that activity. Another outcome was that about 30% of the available data can be directly used, 40% is not directly usable, and what is left is not usable at all. Also, they should give a decision what data are useful for them before collecting and processing them (as cited in Colijn, 2000, p.7).

Due to the reasons mentioned above, municipalities need a new tool or a technology to deal with those data in order to increase their efficiency. The only tool and technology to meet their requirements is GIS tool. Using such tools and techniques, municipalities reduce their work load and time spent. Also, they provide better services and make more profits. On the other hand, they have to share data and information with other

governmental organizations and citizens. Therefore, they have to obey some rules and regulations enforced by the governmental organizations tobring standardization and to have high quality data and information. Also, to be more competitive, they serve those data to their citizens and in this way, they provide better services to their citizens. Because of those regulations, social requirements and special reasons, not only municipalities but also all governmental organizations, which are dealing with spatial data and information, have to use GIS technologies.

The objectives of the study are to understand the diffusion of GIS at municipalities in İstanbul, to determine failure and success factors during implementation, to find out required infrastructure for a successful GIS implementation, to understand the problems related with GIS diffusion and finally to figure out the future expectations of İstanbul municipalities from GIS.

In the literature there are many studies about "Implementation of GIS in a Municipality" in Europe, Canada, Australia and USA, but there are only a few studies about that topic in Turkey. For this purpose, interviews with experts and surveys with municipalities were conducted to study about "The Diffusion of GIS at Municipalities in İstanbul". The interviews were held with three different groups which are academicians, employees in private sector and IT/IS managers in municipalities. The questionnaire was held online with the Metropolitan Municipality of İstanbul and 39 İstanbul districts and the data collected were analyzed through various statistical methods using SPSS15.

As mentioned above, there are not many studies about "Diffusion of GIS at Municipalities", therefore, this study can be accepted as the first study conducted for İstanbul municipalities.

This thesis is composed of the following chapters:

- Chapter 1 includes the introduction as an overview of the study.
- Chapter 2 summarizes the background of diffusion of GIS at municipalities.
- Chapter 3 reviews the literature about diffusion of GIS at municipalities.
- Chapter 4 introduces the model and the hypotheses of the study.
- Chapter 5 presents the methodology of the study.
- Chapter 6 presents the analyses and findings of the study.
- Chapter 7 covers the discussion of findings, implications, and limitations of the study.

CHAPTER 2

BACKGROUND

In this section, data, information, knowledge and GIS terms are discussed in order to have a clear understanding of the study.

Data, Information and Knowledge

Data, information and knowledge are important terms used to define GIS. Therefore, it is crucial to define them clearly.

Data is converted into information after processing. According to Hicks (1993), information is a processed version of data which is meaningful to a decision maker. Longley *et al.* (2001) state that data comprise numbers, text or symbols which are unbiased and virtually context-free. The definition of data by Martin and Powell (1992) is that it also includes disconnected words and syllables about the events and processes of the business. Data are meaningless without processing and interpretation. Therefore, it should be converted into a new form that is easier to be understood by the users. In this way, the user can understand and use information for their purposes and make decisions with respect to this information. Evaluating data provides a healthier decision for the decision-maker.

Longley et al. (2001) assert that information is distinct from data in terms of selection, organization and preparation for a specific purpose. Information serves some

ideas which means an interpreted version of data. As can be seen from the definitions, it is clear that the words data and information have different meanings. Knowledge can be considered as the next step that follows information. Information with the experience is converted to knowledge. According to Harris and Batty (1992), knowledge can be achieved through information, which is the processed form of data, after it goes through some scientific processes and investigation of cause and effect.

Figure 1 shows the relation between reality, data, information and knowledge.

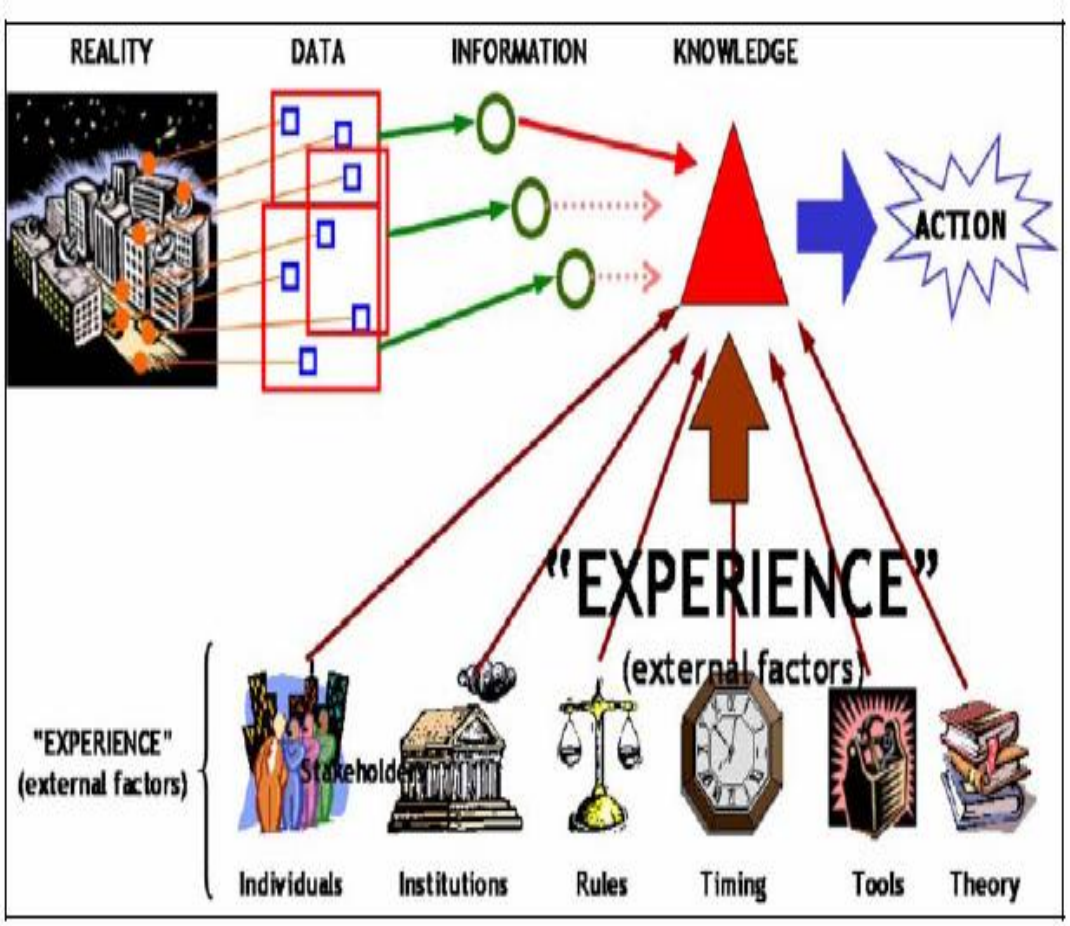

Fig 1. The relation between data, information, and knowledge. (Carrera, 2004, p.26)

Geographic Information System (GIS)

Since GIS is an interdisciplinary method of solution for different areas, there are varying types of GIS definitions with respect to different perspectives. Each profession uses a specific part of GIS extensions or modules; therefore they have different definitions for GIS.

De Man (1988) and Carter (1989) affirm that GIS are perceived as distinctive instances of information system. This is the purest definition of GIS. Indeed, it is clear that information is very important for GIS. GIS mainly consists of two different types of data which are called spatial (geographical) and non-spatial (non-geographical), and has a relational database between these two types of data and has been accepted as a remarkable information system tool. Roads, rivers, buildings, and traffic lamps are considered as spatial tangible elements. These elements can be represented as points, lines and polygons. On the other hand, non-spatial elements contain information about those spatial elements. Maguire (1991) and Burrough (1990) set GIS apart from other information systems because the former places more importance to spatial data than attribute data. Department of Environment (DoE) (1987) declares that GIS captures, stores, checks, manipulates, analyzes, and displays spatially referenced data. (as cited in Maguire, 1991). This is the most common definition of GIS.

> Dueker (1979) states that GIS is a special case of information systems where the database consists of observations on spatially distributed features, activities , or events , which are definable in space as points, lines, or areas . A GIS manipulates data about these points, lines, and areas to retrieve data for ad hoc queries and analyses (p.106).

Smith, Menon, Starr and Estes (1987) have almost the same definition with Dueker, which is a technical one. "Smith, *et al.* (1987) state that GIS is a database system in which most of data are spatially indexed, and upon which a set of procedures operated in order to answer queries about spatial entities in the database" (p.13).

As mentioned previously, GIS has a strong connection with other technologies. Management Information Systems (MIS) is one of them which work with GIS in a good coordination. City Information Systems (CIS) and Archive Information System (AIS) are two concrete examples which use both GIS and MIS technologies simultaneously. Devine and Field (1986) express a type of MIS (Management Information System) that permits map presentation of overall information.

The most widely used GIS software producer, ESRI, has also a good definition for GIS. "ESRI (1997) state that GIS is a computer-based tool for the inventory, analysis and visualization of spatial information. Through their interdisciplinary nature, institutional networking is also facilitated" (as cited in Noongo, 2007, p.21).

GIS has also some components like every information technology. Dangermond (1988) maintains that GIS comprise five rudimentary parts: data, hardware, software, procedure and people. Also, DeMers (1997) states that GIS is mainly composed of hardware, software, data, people and methods.

One wants to use technologies mainly to benefit from them. Indeed, using GIS brings many advantages to governmental and private organizations. Time, efficiency and money are the main advantages of GIS for organizations. Carter (1989) stresses that implementation of GIS requires an organizational structure which combines technology, database, expertise and ongoing financial support. It is for certain that GIS will also bring some financial advantages in time for the organizations using GIS.

Although GIS has been viewed as merely a drawing tool for many years in Turkey, nowadays it is accepted as a useful scientific tool. It has been used by engineers, social scientists, geographers as a Decision Support System (DSS) tool, a drawing tool and a management tool. Since GIS is an interdisciplinary profession, this profession needs to acquire knowledge about different fields. Goodchild (1992) proposes that GIScience, which includes GIS, remote sensing, cartography and surveying, is to be nurtured to make sure that the discipline has a lasting future.

Zietsman (2002) also talks about GIScience and its relationships with other disciplines such as geography, computer science, surveying, geodesy, physics, mathematics, statistics and applied sciences such as geology, forestry and planning.

Since GIS has different applications, different professions use different parts of GIS. Table 1 summarizes the application areas of GIS. It is also possible to consider these as alternative names for GIS.

Table 1. Types of GIS According to the Application Area

Cadastral information system
Image based information system
Land data system
Geographically referenced information system
Natural resource management information system
Market analysis information system
Multipurpose cadastre
Planning information system
Property information system
Soil information system
Spatial information system
Spatial decision support system
Urban information system

(Source: Maguire, 1991., p.12)

Resource managers, planners and cartographers define GIS as "…a tool for performing operations on geographic data that are too tedious or expensive or inaccurate if performed by hand" (Noongo, 2007, p.22). Scientists and investors define GIS as "…a tool for revealing what is otherwise invisible in geographic information" (Noongo, 2007, p.22). Utility managers, transportation officials and resource managers define GIS as "…a mechanised inventory of geographically distributed features and facilities" (Noongo, 2007, p.22). Decision makers, community groups, and researchers define GIS as "…a computerized tool for solving geographic problems" (Noongo, 2007, p.22). The general public defines GIS as "…container of maps in digital form" (Noongo, 2007, p.22).

The History of GIS

According to Clarke (1997), GIS development has started in the 1950s. Data, land elevation, surface geology, hydrology/soil drainage and farmland layers have been combined to make a land chatacteristics map. In those years, transparency has been a very important feature of GIS tools which involves more than one layer. The development history of GIS has been explained chronologically in Table 2.

Table 2. Development of GIS

YEAR	DEVELOPMENT of GIS
1950	On 13th November, the policy of restriction on maps is first enunciated vide Ministry of Defence, Government of India, letter No. F.119/49/D-1.
1951	Planning in India starts with the First Five Year Plan (1951-56).
1954	The Naval Hydrographic Office is established, which is responsible for hydrographic surveying and charting of the Indian Waters.
1956	The Institute Geographique National, Paris, publishes the 'Relief Form Atlas' in French and English editions.
1957	With the launch of Sputnik, mounting of cameras on orbiting spacecraft becomes possible.
1958	National Aeronautics and Space Administration (NASA) is established.
1959	The US AMS series of maps covering the Himalaya Range from Bhutan to Pakistan on 1:250,000 scale is published.
1960	First meteorological satellite (TIROS-1) is launched.
1962	USSR's first Cosmos satellite is launched.
1963	Development of Canada Geographic Information Systems (CGIS) commences, led by Roger Tom Linson, to analyse Canada's national inventory.
1964	The Harvard Lab for Computer Graphics and Spatial Analysis, Harvard University, US is established by Howard Fisher.
1965	Inception of Forest Survey of India (FSI). Space Science & Technology Centre (SSTC) established at Thumba, India.
1966	Howard Fisher developes SYMAP (Synagraphic Mapping System), a pioneering automated computer mapping application, at the Northwestern Technology Institute, University of Chicago and completed it at the Harvard Lab for Computer Graphics and Spatial

	Analysis. The second edition of the best known atlas of the United States, 'National Geographic Atlas of the World' is published.
1967	Aerial photographs in India are graded secret unless advised to be graded top secret vide Air Headquarters No. Air HQ / S_20173 / Air Int., dated 11.04. 67
1968	The first Geostationary Operational Environmental Satellite (GOES) is developed and launched by NASA in 1968. Later on it was transferred to NOAA for day-to-day activities
1969	Indian Space Research Organisation (ISRO), is established. Environmental Science Research Institute (ESRI) is founded by Jack and Laura Dangermond as a privately held consulting group.
1970	The French Institutes of Pondicherry launches a cartographic programme for the Western Ghat area.
1972	ISO establishes various centres like Vikram Sarabhai Space Centre (VSSC), Shar Centre, ISRO Satellite Application Centre (ISRO), Space Application centre (SAC), ISRO is brought under Department of Space. The first Landsat satellite is launched (originally known as ERTS-1) by NASA that was dedicated to mapping natural and cultural resources on land and ocean surfaces. General Information System for Planning (GISP) is developed by the US Department of the Environment.
1973	Society of Photogrammetry is established and formally registered with the ideas sown in 1969, which is renamed as Indian Society of Remote Sensing by 1980s. Maryland Automatic Geographic Information (MAGI), one of the first statewide GIS projects begins in US
1974	The first Synchronous Meteorological Satellite, SMS-1 operational prototype is launched.
1975	India's first indigenous scientific satellite Aryabhata is launched by the Soviet launch vehicle. National Remote Sensing Agency (NRSA) is established at Hyderabad for acquisition and distribution of data from various satellites.
1976	Indian Photogrammetric Institute, (presently known as Indian Institute of Remote Sensing) comes under NRSA. National Informatics Centre (NIC) is established. Minnesota Land Management Information System (MLMIS), another significant state-wide GIS, begins as a research project at the Centre for Urban and Regional Analysis, University of Minnesota.
1977	The USGS developes the Digital Line Graph (DLG) spatial data format.
1978	ERDAS is founded. A Radar Imaging System - the main sensor on Seasat, US is launched. Coastal Zone Color Scanner (CZSC) instrument is flown on-board the NIMBUS 7 platform that collected ocean colour data from November 1978 to June 1986.
1981	The use of automation and digital cartography starts in Naval

	Hydrographic Office (now National Hydrographic Office) with acquisition of new ships, modern automated equipments, automated data logging and plotting system, automated Cartographic & Printing system. ESRI launches ARC / INFO.
1985	Survey of India initiates theDigital Mapping project to convert 1:50,000 toposheets into digital format for public use. The GPS (Global Positioning System) becomes operational. Development of GRASS (Geographic Resources Analysis Support System), a raster based GIS programme, starts at the US Army Construction Engineering Research Laboratories. Remote Sensing Instruments Pvt. Ltd., a GIS company is formed in Hyderabad
1986	Mapinfo is founded.
1988	Indian Remote Sensing Satellite (IRS) system is commissioned with the launch of IRS-1A. The National Centre for Geographic Information and Analysis (NCGIA) is established in the USA. 'SMALLWORLD' is established. Ezra Zubrow, State University of New York at Buffalo starts the GIS-L Internet list-server.
1989	The National Remote Sensing Agency prepares the first Wasteland Atlas. The 'Association of Geographic Information' (AGI) is formed in the UK.
1991	MapInfo Professional is launched. The first European Remote-Sensing Satellite (ERS-1) launched that carried radar altimeter.
1992	Integrated Digital Systems, a GIS company is establishedin Calcutta. First Issue of 'GIS Today', now known as 'GIS India' is published by Geomap Society of India. RAMTECH Corporation, established in 1965, starts GIS activities, with prime emphasis on AM/FM/GIS and CAD/CAE solutions.
1993	The Election Commission, India creates Pollmap, a digital cartographic database, during the Assembly Elections. The European Umbrella Organisation for Geographic Information (EUROGI) is established in Europe.
1995	Integrated Digital System (IDS), a Calcutta based GIS company, surveyes all the Calcutta retail outlets by its own team to provide the retail data clubbed with the map data on a GIS.
1996	ESRI India is formed. Japan's 'Advanced Earth Observation Satellite' is launched. IRS-P3 is launched by India. NASA and JPL begin America's study of Mars by launching 'Mars Global Surveyor' (MGS) spacecraft
1998	CSDMS organises India's first and largest conference and exhibition on GIS/GPS/Remote Sensing - "Map India' 98".

	For sustainable industrial development of the State, the Government of Uttar Pradesh through the state Industries Policy 1998, proposes a zoning atlas for the entire state so that industry can easily take the decision on the location of a unit.
1999	The first "GIS Forum South Asia'99" is organised jointly by CSDMS and ICIMOD at Nepal. Autodesk India Ltd. is formed.
2000	GIS@development becomes monthly.

(Geospatialworld, 2011)

CHAPTER 3

LITERATURE SURVEY

In the diffusion cycle, the technology is to be accepted and implementation phase is to be achieved following the satisfaction of the citizens or end users. Investing more money, time and people for a new technology brings about more success and implementation evolves into to adoption. Last stage is to develop and invest some more money for a new technology. It means that the new technology is the part of that governmental organization which has to use this technology. After this stage, the new technology not only provides intangible satisfaction for management, end users and citizens; but also provides some tangible benefits. The resources can be used inmore efficiently and costs of services to the organization are reduced. According to Medlin (2001) and Parisot (1995), the proposal of Rogers' diffusion of innovations theory is the most well-known theory explaining adoption of diffusion.

Figure 2 shows the steps of diffusion of a new innovation.

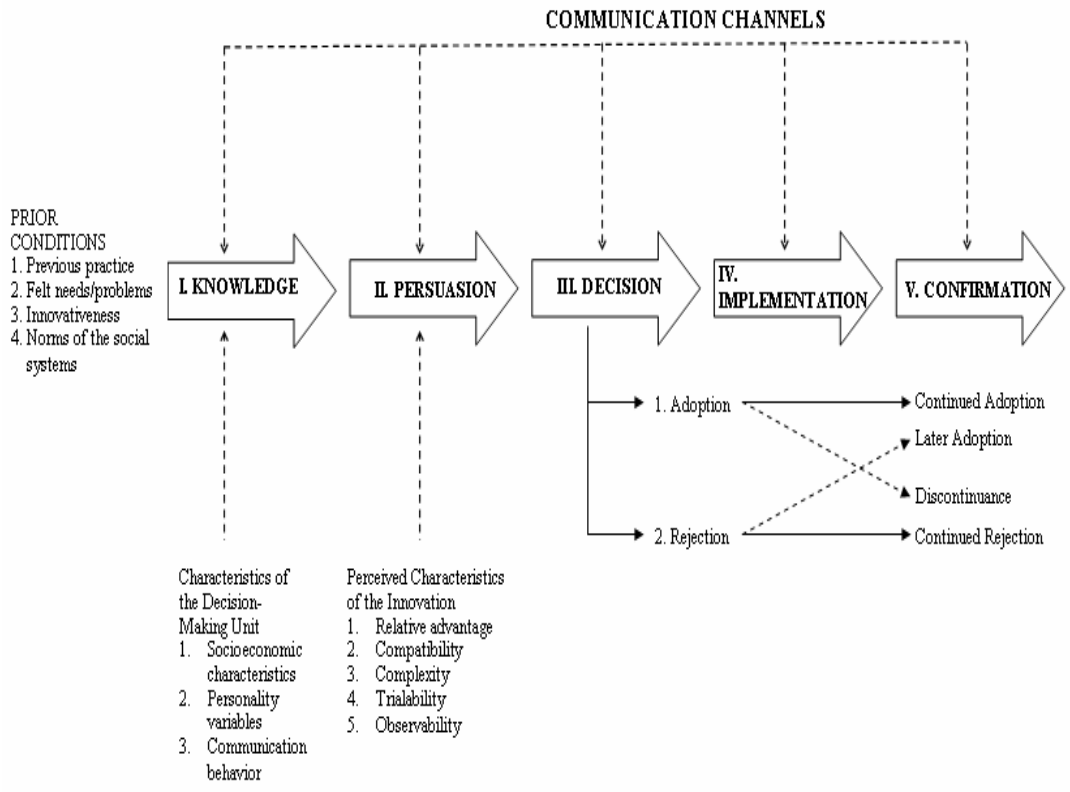

Fig 2. A Model of five stages in the innovation-decision process (Rogers, 2003, p.17)

The factors affecting the diffusion of GIS in governmental organizations should also be explained. According to Chan and Williamson (1999), "…a GIS vision is the driving force behind the decision for GIS adoption and diffusion. It also takes at least the concerted effort of junior and middle managers with a common or aligned GIS vision to sustain GIS diffusion" (p.15).

According to Sahin (2006):

> To increase the rate of adopting innovations and to make relative advantage more effective, direct or indirect financial payment incentives may be used to support the individuals of a social system in adopting an innovation. Incentives are part of support and motivation factors. Another motivation factor in the diffusion process is the compatibility attribute (p.18).

Chan and Williamson (1999) note that there are four perspectives of GIS; namely identificational, technological, organisatinal and productional. Actually, identificational perspective differentiates GIS from other information systems for organizations that want to adopt this new technology. Efficiency in data management of GIS technology is the first reason to use it for municipalities. Second, it is believed that this technology enables easier decision-making considering spatial information and its usage and relation with other information. "Ten Kroode (1994) states that collecting and revising of required information takes 60% of time of employees, they do their actual work just remaining 40% of their time" (as cited in Colijn, 2000, p.7). These words imply that GIS adds positive value to a municipality. It increases the amount of reliable data, facilitates better and quicker services and accurate decision-making with high efficiency.

The findings of Colijn's (2000) study are as follows:

> Not only civilians and other public organizations ask for more and accurate information, they also want the information handed to them in a quick and nice manner. The possibilities to increase the accuracy and to make combinations of all kinds of information sources are available through the new technologies (p.7)

Colijn (2000) states that "…to pursue their tasks, the municipalities have to rely on their data management. At present, many municipalities find themselves in a situation where efficient storage and search methods of analogue yet, increasingly digital data are hardly common" (p.9). Data are the main part of GIS projects. To produce high quality information and to make high quality analysis, the quality of data is very crucial.

In summary, governmental organizations have to perform certain mandatory duties. They have to create a map of their responsibilities. It means that they have to

identify the groups that they are responsible for. They can do it with a well-prepared organizational structure by using correct technological advances which can be stable and productive.

The Diffusion of GIS in the World

Information and communication technologies are developing very fast. Therefore, technological advances related to information and communication technologies are also developing rapidly. Since governmental organizations are citizen-oriented organizations, they want to implement and adopt themselves to the new technological advances, especially information and communication technologies. In this context, municipalities use GIS to provide better services to their citizens, to increase their profit, to make their daily tasks easier; by decreasing the time spent in performing these tasks, to mitigate risks such as traffic accidents, landslides, the negative effects of natural disasters, to increase communication among municipal departments and between municipalities and citizens, to increase accuracy, etc.

In the beginning of 1960s, manual methods were used in all sectors whether it was a private or governmental organization.

As Harris (1992) notes:

> Computer applications and operations of complex systems were in the hand of public sector in 1960s for two reasons. First, their prevailing social importance dictates that their planning, management, or control cannot be given to nonpublic bodies. Second, the decisions in complex systems such as urban land allotment, health care, education, national defense, energy supply, environmental management, transportation, housing, science and technology development must be taken jointly, and there is no automatic mechanism, market or something else, which will lead to find the optimum set (as cited Velibeyoglu, 2004, p.30).

As explained above, GIS is exploited for different purposes in public organizations. Besides, GIS technologies have evolved from manual methods into computer-aided methods. After 1960s, the computer aided drawing (CAD) systems were used by public sector in all lines of business and science, especially in geography. Yet by the end of 1980s, CAD systems were insufficient to meet the requirements of the public organizations. It was not a kind of decision support tool. Decision-makers wanted to analyze and make decisions using information technologies. Therefore, demand for a new and better system brought about a new technology called Geographic Information Systems (GIS). Public organizations, especially municipalities, started to use that technology for their specific needs and purposes. Van Driel (1991) explains the role of GIS techniques in the collection, manipulation and analysis of the environmental data which enables more efficient and cost-effective use of the same data series for different types of risk.

Natural Hazards and Accidents

GIS is being used to estimate natural disasters and accidents. Therefore, municipalities also want to use it as an analysing tool and try to estimate possible disasters before they occur. Doing so, they can take necessary precautions before disasters and accidents occur. Carrara et al. (1999) set forth potential uses of such as dealing with natural disasters like landslides. Another project by Finnish government is also about accidents and natural hazards. Ilmavirta (1995) gives an example of a up-to-date and open GIS-system which is built for the rescue brigades and environmental offices in typical Finnish communities (SNI). As can be comprehended, GIS has been used as an

analyzing tool for prediction of natural hazards and accidents. Using GIS tools mitigates or totally eliminates the negative effects of natural hazards and accidents. Service Nova Scotia and Municipal Relations (2001) discuss the benefits of GIS for the designation and modification of the response areas for fire, police and emergency facilities.

Land Management

Land management is very significant for governmental organizations, which allocate the land of their citizens, give licenses to their citizens, and collect taxes with respect to the information they have at hand and follow and monitor changes about land within their boundaries. GIS is used by municipalities as a decision support system for the management and use of land. Kumar (n.d.) points out that GIS is a useful tool to make strategic decisions about land use, community development, environmental , economic and spatial issues.

Web Services

The new trend in the world is to use GIS tools and share services such as map or data with other clients, users and citizens. These clients or users can be governmental organizations or citizens. Google Earth is one of the most well-known projects that share some of its services. Samadzadegan et al. (2008) claim that geospatial web services are appropriate for supporting distributed computers since such services use the globally accepted GML (Geography Markup Language) format to share geospatial data. According to Sahin and Gumusay (2008), Web Feature Service

(WFS), Web Mapping Service (WMS) and Web Coverage Service (WCS) are some of the examples that provide data for other clients or municipal departments.

Network Services

Requirements trigger the use of a new technology in both public and private sectors. When one believes that using GIS brings in some advantages, it will inevitably be used.

ESRI (n.d.) states:

> After the need assessment, it became clear that other departments wanted to use GIS, so the city decided to make GIS available for engineers in the electric and gas departments to use it for network design. Also fresh water, electicity, sewer services are other services to be provided by municipalities to their citizens (p.5)

ESRI (n.d.) points out that the utility services of Painesville, Ohio comprise water, electric, storm water, and sewer services. The city has inaugurated a system to oversee compliance to government regulations by using GIS.

According to ESRI (n.d.):

> The city contracted with Metcalf & Eddy (M&E) to implement a GIS for utility management built on ArcGIS. The first GIS project was for sewer services. Its success led to applications for electric and water services. M&E set up the GIS database structure using ArcSDE. A utilities data collection service, TransMap Corporation, performed citywide infrastructure data inventory including manholes, utility poles, roadway systems, traffic signals and signage, fire hydrants, and so forth (p.6)

Network analysis is another useful feature of GIS to be used widely by public and private sectors. By using network analysis feature of GIS, road requirements, electricity and gas distribution can be analyzed, and shortest way analysis for emergency situations can be carried on with GIS. Monitoring is another use of GIS

that is integrated with Remote Sensing (RS) technologies nowadays. Not only public organizations, but also private organizations use it as a monitoring tool to keep track of their resources. According to ESRI (n.d.), GIS can be used as a dispatching system to follow the trucks and crews which are assigned to various tasks in an outage management system, thanks to real time maps.

According to Geoplan Consultants (2001), fire protection, street lighting, sewer, fire hydrants and solid waste or garbage collection zones are some of the service areas, whose properties can be determined by GIS tools and techniques.

Adress Information System (AIS) and City Information System (CIS)

City Information Systems and Address Information Systems are the two most common applications and projects which are used by municipalities.

Geoplan Consultants (2001) explains:

> This application provides the update and maintenance of the two main municipal map databases the street file and the building location on the street with the civic address number. GIS has the ability not only to quickly locate and edit data related to the civic number but relate it to other mapped themes such as property ownership or voter enumeration (p.19).

Another useful application for municipalities is to gather information about their citizens and use it for different purposes. Doing so, they have a chance to provide better and faster services to their citizens. Besides, their workload decreases and their profits increase. In this way, a municipal employee has the ability to locate land parcels with the combination of civic address, PID, owner name and assessment account number.

Moreover, citizens can enjoy this service by using a simple GUI (Graphical User Interface) to make a search about their land.

Geoplan Consultants (2001) note:

> This application encompasses the entire range of functions required to build and maintain a municipal permit tracking system. The Permit System links permits to property parcels and civic number. It includes the ability to track applications, inspections, and approvals by type. The application further allows for the monitoring of subdivision activity by type (p.20).

This kind of GIS applications will reduce the workload of municipalities and complexity of their works.

Geoplan Consultants (2001) note :

> This application includes the identification and update of recreational facility locations. The Recreational Facility Locations application includes facility classification, ownership and land use, facility inventory maintenance, inspection status and deficiency identification (for liability purposes) (p.23).

Ferreira and Duarte (2005) imply that "the integrated system will permit to combine efficiently tabular and spatial data that support queries, analysis, and report generation" (p.6).

All in all, GIS is widely used in public sector for network analysis around the world. The purpose of use of GIS depends on the specific requirements of the user. However, it can be seen that municipalities try to use it in every line of work available. They use it in sanitary sewer system, water system, automated work order system, public safety, land management and use, environmental planning, system maintenance, capital planning, electricity planning, asset management, economic development, network

analysis, shortest-path analysis, document tracking, providing services to their citizens, communication with other departments and other governmental organizations.

Structure of Governmental Organization in Turkey

Each governmental organization has specific purposes; therefore, their concentrations vary with regard to their purposes. Indeed, municipalities are citizen-oriented governmental organizations. Before talking about the diffusion of GIS in municipalities and in Turkey, its diffusion in governmental organizations should be discussed shortly. First of all, the term 'governmental organization' should be defined clearly. Matto (2009) defines it as follows: these kinds of organizations are established for the purpose of giving services to a part of public or for entire of the public.

According to Rogers and Agarwala-Rogers (1976), "an organization is a stable system of individuals who work together to achieve common goals through a hierarchy of ranks and a division of labor" (p.26). It is clear that a governmental organization consists of individuals working together and providing better service to their citizens. Since this kind of job requires well-organized collaboration in public organizations, they have to increase the collaboration between each department and other governmental organizations. Actually, collaboration can only be achieved by well-established communication with each other. As people live in a world of communication and information, all governmental organizations should adopt new technologies. On the other hand, acceptance of a new technology is not an easy task for bureaucratic organizations even if they are independent in their internal affairs like municipalities. Chan and Williamson (1999) state that official recognition with the proper justification

or feasibility study through the right channels should be evaluated before any major change can be formally adopted and accepted. Following properjustification and feasibility study, organizations make investments to a new technology by accepting that technology brings in the diffusion. A useful innovation should diffuse through some channels to provide useful communication between social systems. Besides, Rogers (1983) says that "GIS adoption is typically a contingent innovation-decision as its adoption decision by an organization normally proceeds that of the individuals owing to the high capital outlay required" (p.347). As Campbell and Masser (1995) point out, "…this type of decision by an organization involves interaction between complex sets of personal, organizational and cultural" (p.5). But, diffusion is not the actual achievement. Diffusion is the way of raising awareness, adoption and benefits of that technology. So many employees and managers of municipalities confuse the term 'diffusion' with a successful 'implementation'. According to Zwart (1993), the last stage of GIS diffusion is the embodiment of GIS through the whole organization. According to Rogers (2003), if an organization adopts a new innovation, it uses this new technology as the best option whereas if there is no adoption, rejection will be inevitable. As mentioned before, organizations should be stable and this stability is achieved by their formal and informal settings. Rogers (1983) defines the formal setting by scheduled objectives, agreed upon roles, power structure. In addition, rules and regulations outline how the internal production procedure is organized to attain the organizational aims. Chan and Williamson (1999) state that "…before any major change can be formally adopted and accepted, it must first gain official recognition through the formal setting, e.g., by means of proper justification or feasibility study etc. through prescribed channels" (p.9).

Chan and Williamson (1999) summarize the diffusion of GIS with the following words:

> Traditionally, recognition by the formal setting is achieved through justification exercises or feasibility studies. If successful, this is often followed by purchasing and installation of the hardware and software. At this stage, GIS enters into the internal production process as an entity in the production infrastructure. Through a process of data conversion, applications development, and training, GIS may be used to varying degrees to produce the product mix required of the organization. Often problems arise at this stage in the diffusion process. Though the unique abilities of GIS may have been accepted in the formal setting, it has not gained the recognition of the informal setting. Unless it has, it will be difficult for GIS to be integrated into the internal production process. As a result, the progress of diffusion may be delayed or even stopped (p.9).

The Diffusion of GIS in Turkey

In Turkey, there was not enough research about GIS until 2000s; therefore, there was no successful GIS implementation until that time due to lack of knowledge. The use of GIS technology was initiated by many local authorities. In municipalities, like all other technologies, GIS technologies, tools and methods were started to be used when there was a rising need for exploiting this technology. Yomralioglu (2004) mentions the Izmit Earthquake in 1999 when several Turkish GIS projects started to focus on risk analysis related activities. Since then, local authorities, in particular, have been using this technology in many areas such as land management, environmental usage, earthquake based projects, urban spatial information, digital archiving, city planning system, decision support system, map drawing, and land use, etc. The rising requirements of local authorities forced private sector to make investment in this technology. Yomralioglu (2004) stated that the usage of GIS technology was initiated by the General

Command of Mapping (GCM) in Turkey. Also, some universities started to use GIS for education purposes after 1990s. Yomralioglu (2004) contends that the first GIS projects in Turkey were commenced in 1986 by the General Command of Mapping (GCM) to produce digital maps for military intentions. Besides, Turkish land registration system required some cadastral information and strived to use the technology to collect and manipulate some data about land.

Yomralioglu (2002) notes:

> For Turkey, these activities can be categorised under three main sections, which are public, private and education sectors. One of the project which is called national security based GIS projects were developed by the General Command of Mapping, Land Information System which are related to national property information systems and land management projects, environmental, earthquake based GIS works, and urban spatial information system projects are followed by local authorities can be given as main public GIS activities (p.1).

Table 3 shows the milestones of GIS technology in Turkey.

Table 3. Milestones of GIS in Turkey

Milestones of GIS	Year
The first use of GIS by a private company	1981
The first use of GIS by General Command of Mapping	1986
The use of GIS by public sector such as general directorate of land registry and cadastre	1990
The use of GIS by Turkish Statistical Institute, and state meteorological service	1990
The first use of GIS in higher education	1991
The first national conference on GIS	1994
The first use of GIS by municipalities (Metropolitan Municipality of Bursa)	1996
The first GIS course in a geography department	1998
The first GIS education laboratory in a geography department	1998
The first national GIS conference organized by a geography department	2001
The first GIS for teachers workshop	2004
The first national geography curriculum including GIS-related activities	2005
The first international conference on GIS organized by a geography department	2008

The first GIS course materials (books, CDs, and course activities) for secondary schools	2008
The first GIS-based civil involvement project concerning secondary school students aiming at integration GIS-based activities into geography courses	2009

(Source:Yomralioglu (2002, p.835-839))

The Diffusion of GIS at Municipalities in Istanbul

It is known that İstanbul is the largest city of Turkey with its population and 39 local municipalities. Since it is the largest and the most crowded city , management of Istanbul is a difficult task. For this reason, it had been divided into different districts throughout history. As of the publication date of this study, the number of district municipalities in Istanbul is 39. 8,156,696 people live in the European side and 4,416,867 people live in the Asian side. 25 municipalities are on the European side and 14 municipalities are on the Asian side (Istanbul,Nüfus, trans.)

Municipalities are founded for the sake of citizens, therefore, they are the representatives of government which encounter with citizens mostly. Their main purpose is to provide better services to citizens pertaining to fresh water, electricity, real estate, tax, natural gases, sewage and more. Because of this, municipalities have to provide better and higher quality services to their citizens using correct tools and techniques.

The complexity of tasks, such as distribution and control of power, fresh water and natural gas, sewage, telephone, school and hospital networks, has been forcing municipalities to find a way to organize these tasks. Besides, some problems about these tasks that are mentioned above occur. For instance, traffic accidents, natural hazards and fire incidents all force the municipalities to come up with fastest and the most efficient

solution. In order to organize these tasks and overcome related problems, appropriate tools and techniques are needed. At this point, GIS is accepted as one of the best solutions for municipalities nowadays.

> For that reason, "information management" and "management mechanism" required to be constructed. Also, local authorities, such as municipalities have to adapt to this technology to overcome their specific problems and to provide better services to their citizens. At this point, the most effective technology of GIS that is City Planning System (CPS) has been developed (Yomralioglu, n.d., trans.).

Filiz, Yalın, and Türker (2005, trans.) note:

> City Planning System is a kind of GIS system that is used by municipalities mostly. It is used to provide better services to their citizens. In addition, it makes job easier to employees of municipality, increases the profit of municipality and decreases work load of their employees. To be more specific, municipalities can give spatial infromation on their web pages. Real estate, building license, visa
> plan, application plan, and other document may be provided over internet. Information about parcel users can access information over internet just only one clicking. Problem related about those things menitoned above can be solved by using information technologies like GIS.

Since municipalities are one of the governmental organizations which have relations with citizens mostly, they use this technology especially for their citizens. The awareness for this technology began at the beginning of 1990s; however, it was started to be used at the beginning of 2000s. Municipalities of metropolitan with respect to their populations, such as Ankara, Bursa, Istanbul, Izmir and Konya, started to exploit the advantage of this technology firstly. However, smaller municipalities have not used it effectively due to lack of awareness and budget. . Yomralioglu (2002) says that only

some municipalities, such as in Istanbul, Bursa, Ankara, Izmir, Aydin and Antalya, utilize GIS more realistically than the rest.

> According to a research which is conducted by TUIK (2006) with 3066 municipalities in Turkey in 2005, there is an address information system in 543 (%18) municipalities in Turkey. 104 of them keep updated information; however, only 17 of them enter this updated information into digital media. Furthermore, 126 (%4) municipalities use city planning system (as cited in Yomralioglu, n.d., trans.).

It is clear that only 4% municipalities attempt to exploit that technology effectively. Should a further research on exploitation of this technology conducted, the percentage will surely increase.

> "After all, there are only so many functions that a city government is called upon to perform. Roughly speaking, one could divide the main administrative areas of a city into:
>
> - Political and executive branches
> - Internal Services
> - Public Health and Safety
> - Culture and Leisure
> - Education
> - Physical Services "(Carrera, 2002, p.22).

Municipalities in Turkey use GIS technologies for the following purposes:

- Determining the location of real estate of municipality,
- Archiving paper-dependent documents into digital media,
- Collecting taxes,
- Following documents of citizens and internal documents through the municipality,
- Providing services over the Internet for their citizens,

- Providing navigation of their municipalities services to their citizens,
- Licensing and permission of buildings,
- Maintenance operations,
- Analyzing and reporting,
- Resource planning and controlling,
- Land management.

Yomralioglu (2002) challenges the key drives of municipalities, that is awareness of thematical, topographical and administrative structure of all provinces, and adds other motives such as accomplishing health, security, population, communication and road networks, etc. In addition, municipalities actively use GIS especially in solving important local problems such as urban planning, land development, urban management, supervision, and tax collection.

Even though there are many problems and obstacles about the use of GIS at municipalities in Istanbul, an understanding and awareness have been heightened about this technology after 2000s. Today, almost all municipalities in Istanbul are using GIS tools, techniques and projects.

The success of IT/IS implementation is too low, especially in governmental organizations like municipalities. For this reason, some problems may occur during implementation. According to the opinions of experts and IT or GIS managers of municipalities in Istanbul, the problems are stated below.

Management is an important issue in municipalities that should be explored in detail because the acceptance and success of IT/IS projects start from top management and pass down to lower levels of management. It means that decision-makers should be

consistent with their decisions and support. On the contrary, proposal of a project moves from down to top; therefore, low-level employees or managers should inform the top-level decision-makers with each and every detail.

Another problem related to IT/IS projects at municipalities in Istanbul are bureaucracy problems. Governmental organizations are bureaucratic organizations; therefore, there are certainly bureaucratic relations among each other.

Governmental organizations are founded for the sake of citizens. Therefore, citizens should be at the center of each service project. It means that citizens should participate in the project; otherwise, some problems with the project may arise. In every organization, whether it is a governmental or private one, there is an internal resistance to a new system.

To be successful in a IT/IS project, time should be evaluated and decided upon very carefully because IT/IS projects are intangible. Therefore, time constraint should be calculated by taking into account error tolerance, which should be added on top of the decided time. Otherwise, the project will most probably fail.

Budget is another factor that is critical for a successful implementation; therefore, enough budget should be allocated for the project. Provision of adequate infrastructure to IT/IS projects is another issue that is the determinant of IT/IS project success. RAVI (The Dutch Council for Real Estate Information to advise the minister for housing, spatial planning and the environment) holds the view that legislative rules, developments and improved inter-governmental affairs show that municipalities must achieve a junction-role on generating, distributing, collecting, and transferring all types of information to all types of institutions.

Determination of actual problems in detail is very important to find the correct and optimum solution. For that reason, this part is elaborated in addition to interviews held with experts in the GIS field. These are the main problems which may occur in every organization while implementing such a project.

CHAPTER 4

THEORETICAL MODEL AND HYPOTHESIS

Problem Statement

Today, almost all sectors are dealing with GIS technology in one way or another. When these sectors are divided into different parts with respect to their usage level, it is found out that governmental organizations use GIS technology more heavily than private sector. If a comparison is made among governmental organizations, it is seen that municipalities use GIS tools and software mostly with respect to others. Almost all departments use GIS technologies directly or the products of GIS technologies indirectly. Department of Health and Social Services, Department of Municipal Police, Department of Support Services, Department of Editorship and Conclusions, Department of Housing and Urban Development, Department of Earthquake Risk Management and Urban Development, Department of Environmental Protection & Development, Department of Information Technologies, Department of Fire Brigade, Department of Transportation, and Department of Real Estate & Expropriation are some of those departments that use GIS directly or indirectly. They use this technology for management, survey, navigation, services, tax occupation, inspection services, transportation, development services, planning, verdure, sewer, control, maintenance, map drawing and other tasks and applications.

Although municipalities are governmental organizations, they are independent within their internal affairs and policies in Turkey. It means that they have the authority to manage their own policies. Therefore, they can easily accept and implement new systems or projects for their use and enjoy the advantages without dealing with too much bureaucracy.

İstanbul has two different sides, namely European and Asian sides. There are 39 regional municipalities in İstanbul and some local municipalities are controlled by those district municipalities. Since each municipality is independent from others, there is no competition among them. For that reason, they can support each other with their experiences. In Figure 3, you can see the complexity of municipal jobs.

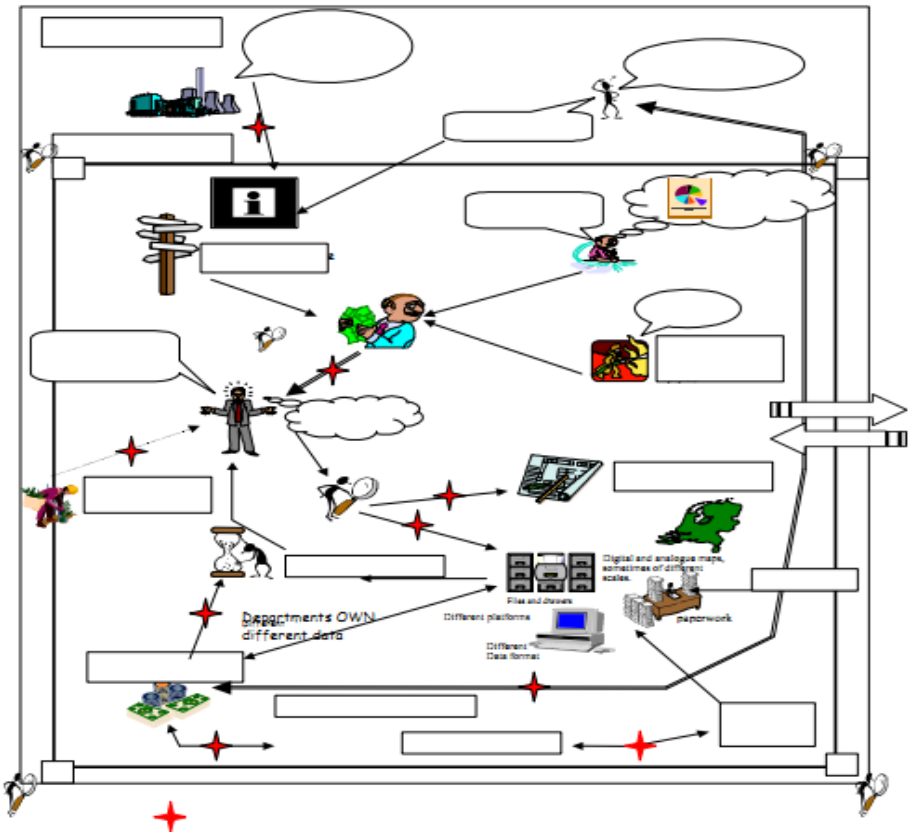

Fig 3. Rich picture analysis of a municipality (Colijn, 2000, p.9)

As it is clear that all types of departments in municipalities may benefit from GIS more or less, it can be used in planning, survey, maintenance, control tasks, tax collection, property registration, severe and verdure operations. In this way, they can provide better and faster services with higher quality to their citizens. On the other hand, as it can be seen in the Figure 3, municipalities have too many complex duties and responsibilities. For this reason, they have too many problems to overcome.

Aim and Objectives

The aim of this study is to explore the usage and diffusion level of GIS at municipalities in İstanbul and opinions of their employees about the following issues:

- Development of GIS at municipalities in İstanbul
- Research about GIS implementation at municipalities in İstanbul and Turkey
- Failure and success factors during implementation of GIS at municipalities in İstanbul based on literature survey, expert opinion and survey results
- Type of infrastructure required for a successful GIS implementation at municipalities in İstanbul
- Kind of problems that may occur during GIS implementation at municipalities in İstanbul
- Anticipation of the future of GIS in the short term (5 years) and long term (10 years) at municipalities in İstanbul

Key Questions

Asking relevant questions surely brings the correct answers; therefore, well-targeted questions will be asked before starting research and collecting information. Based on the objectives, the following research questions are prepared;

- What are the main requirements to implement GIS at municipalities successfully?
- What are the failure and success factors for municipalities during implementation of GIS at municipalities?
- What kind of purposes are there for using GIS at municipalities?
- What kind of problems may occur during implementation of GIS projects at municipalities?
- Through which processes is GIS implemented at municipalities in İstanbul?
- What are the driving forces for GIS implementation in a municipality?
- What are the strategies that municipalities apply during the implementation process of GIS?
- Who are the actors and what are their roles during implementation of GIS?
- What does GIS bring to a municipality?
- What is the future of GIS at municipalities in İstanbul.

Hypotheses

Based on the aim and objectives, the following hypotheses are determined. Each hypothesis is analyzed with different test.

Table 4. Hypotheses about "Diffusion of GIS at Municipalities

NO	HYPOTHESES
H1	There is a relationship between the level of knowledge about GIS and geography- related areas with the success level of GIS diffusion.
H2	There is a relationship between the usage frequencies of GIS in municipalities' departments with the success level of GIS diffusion.
H3	There is a relationship between the levels of acceptance of GIS projects with the success level of GIS diffusion.
H4	There is a difference between municipalities with different longitude of use of GIS in terms of the success of GIS diffusion.
H5	There is a difference between municipalities with different population groups in terms of the success of GIS diffusion.
H6	There is a difference between municipalities with different numbers of employee groups in GIS departments in terms of the success of GIS diffusion.
H7	There is a difference between municipalities with different number of employee groups in municipalities that use GIS tools in terms of the success of GIS diffusion.
H8	There is a difference between municipalities with different satisfaction levels of GIS applications in terms of the success of GIS diffusion.

CHAPTER 5

RESEARCH METHODOLOGY

The methodology of this research consists of two important stages. The first stage comprises interviews with the experts of GIS. The second stage comprises a survey focusing on local municipalities of İstanbul.

Interviews

Interviews, which were held with end users, consultants, technical users, developers and managers of municipalities responsible for GIS department or projects, were conducted using face-to-face method. Interviewees were chosen with regards to their expertise in their field. Since this study is about "Diffusion of GIS at Municipalities in İstanbul", the interviewees are expected to have experience about the use of GIS at municipalities in İstanbul. Therefore, interviews were held with the managers of the GIS-related departments of three municipalities in İstanbul. Subsequently, interviews were conducted with an academician and a private GIS company manager. Finally, project coordinators of private GIS companies were interviewed. The names of the people interviewed and their functions in the companies they work for are shown in Table 5.

Table 5. Name of Interviewees and Companies They Work For and Their Roles

Name/Surname	Company	Role
Hamdi Çinal	İstanbul Municipality	GIS Manager
Ramazan Yalçın	Bağcılar Municipality	IT/IS Manager
Tahsin Uysal	Zeytinburnu Municipality	IT/IS Manager
Prof. Dr. Şebnem Düzgün	METU	GGIT Chairperson
Tuncay Küçükpehlivan	Başarsoft	Project Manager
Sercan Erhan	ESRI Turkey (İşlem GIS)	Project Coordinator
Tuğçe Gazozcu	ESRI Turkey and Zeytinburnu Municipality	Project Coordinator

The details of the interviews are reported in Chapter 6 of this study.

Questionnaire

The research was conducted during the spring semester of 2010-2011 by means of a questionnaire (Appendix A), which had been developed based on previous researches and theories as well as interviews with GIS experts. Municipalities in İstanbul were decided to be of concern in this study because İstanbul is considered an important research area. It is the biggest city in Turkey and has 39 local municipalities. Although many of them use GIS technologies, some municipalities have not used GIS technologies as of the publication date of this study. The questionnaire, which covers the GIS-related departments in municipalities, includes five sections and a total of 36 questions. The questionnaire is distributed to the municipalities in İstanbul via Internet. 40 İstanbul municipalities are targeted for the survey. All municipalities have replied to the survey questions. Each municipality has answered only one questionnaire. In light of the opinions of the interviewees, it was decided that the following departments are

responsible from GIS projects and applications at municipalities in İstanbul. Therefore, the questionnaire is sent to only one of the following departments for each municipality.

- Department of Housing and Urban Development
- Directorate of City Planning
- Directorate of Planning
- Directorate of Cartography
- Directorate of IT
- Directorate of Geographical Information Systems
- Department of Survey and Projects

The aim of the questionnaire is to obtain a qualitative and quantitative result. Standardization and precise measurement are the aims of quantitative research. On the other hand, information about processes and usage is provided by qualitative measurement. Finally, the data acquired are coded and analyzed with SPSS 15.
The questionnaire is composed of 5 different parts, and the aim of each part is as follows.

Part-I includes 9 questions which are "Personal Questions" about participants. In this part, it is aimed to understand the education level of the participants, whether they are familiar with GIS tools or not and their perception about these technologies.
Part-II includes 12 questions which are about "The Municipality". In this part, it is aimed to understand the size of the municipalities, whether they are using GIS or not, and what kinds of purposes they use GIS for. Non-users of GIS tools skip Part-II and Part-III of survey and continue with Part-IV.

Part-III includes 13 questions which are about “Acceptance, Usage and Development of GIS at Municipalities”. In this part, it is aimed to understand which department is responsible for GIS projects and applications. Moreover, it examines the ideas before and after GIS implementation and the satisfaction of municipalities about the use of GIS. Finally, it shows the future expectation of GIS at municipalities in long and short terms.

Part-IV includes 2 questions which are about “Non-User Municipalities of GIS”. In this part, it is aimed to understand reasons why they do not use GIS and when they plan to use that technology.

Part-V is about other comments of the respondents.

CHAPTER 6

ANALYSES AND FINDINGS

Interviews

In this part, summarized opinions of interviewees are reported under five main headings: overview of GIS, purpose and usage of GIS at municipalities in İstanbul, main problems related with GIS diffusion at municipalities in İstanbul, future of GIS for İstanbul municipalities, and criteria for a successful GIS implementation.

Overview of GIS

- GIS is a technology that is built for the needs of humanity. GIS is actually a tool library. This library is used to get new values, to make analysis on a spatial database, and to provide solutions for the needs of humanity.
- Because of its layer configuration, database and featured information inclusion and renewable structure; GIS can be accepted as a decision making tool.
- GIS is absolutely not a simple drawing tool. Depending on its visual contents, retention of data in a relational database makes the GIS a decision support tool.
- GIS is a combination of software, hardware and human resources that one cannot think any of the components apart from each other.

- GIS and CAD are totally different from each other with respect to their functions. GIS, for instance, contains a huge database in the background; however, CAD, having topological properties, includes specific tools that create 3-D drawings. In fact, both CAD and GIS are converging to each other and will be combined in near future.
- GIS is a kind of information system that gives you a chance to collect, create, visualize, retrieve, manage geographic data in terms of analytical analyses and reporting and eventually to make strategic decisions.
- Another interesting definition is that GIS is an entire support system that articulates the area information in terms of the attributes of a coordinate system. Finally, the analysis of such information facilitates strategic decision-making
- The rapid increases in the world population and heightened environmental and social awareness make GIS smarter. It has a strong spatial analysis, data processing, relational database, management systems, integration and numerical and verbal features. Using all the data in the form of a set of systems has proved the superiority of GIS in many ways.

Purpose and Usage of GIS at Municipalities in İstanbul

- The order of priority in using GIS, in order of first priority to last is, emergency issues such as people in a difficult conditions, fire, ambulance, etc. then citizens, and finally institutions. From parcel-sale and social aid to flooding and property analysis are for what GIS is utilized.

- Some GIS projects and plans, which are handled by İstanbul municipality are as follows:
  - Planning: 5,000 construction plans on digital environment.
  - AKOM (Coordination Center for Catastrophic Events): Flooding analysis.
  - Meteorology Stations: Showing measured values on GIS.
  - Infrastructure: Permits and registrations are handled online.
  - State work: Survey on any specified area (parcel) is handled.
  - Transportation: Mass transportation, shortest-path analysis.
  - Public Work: Three-dimensional analyses.
- GIS is about spatial information but MIS is about human information. With the perfect integration of both, it provides services to citizens with maximum performance. For example, handicapped or educated citizens can easily be followed by the integration of MIS and GIS. In this way, more accurate decisions about them can be made.
- The workload of employees of municipalities in İstanbul has been decreased with the use of GIS. Therefore, this convenience surely is reflected on the citizens. They are now enjoying faster services with higher quality. Since the number of complaints has been decreased, the management is satisfied with this new system.
- GIS is used in every task including numbers, such as road and real estate information. Briefly, it is used in everything that includes geography at municipalities in İstanbul.

- The communication between external institutions and municipalities in İstanbul has increased; so the number of mistakes has decreased. For example, determination of the rate of incomplete declaration and defective buildings is now easier thanks to the usage of GIS at municipalities in İstanbul. In this system, the problems that used to be solved in 3-5 days are dealt with one click.
- Departments which use GIS tools and their purposes are as follows:
    - Department of Housing and Urban Development: They use it to make islands and plot of land.
    - Department of Survey and Projects: They use it to learn about the sections, plot of land and island information.
    - Department of Financial Services: They use it for tax collection.
    - Department of Real Estate & Expropriation: They use it to learn about the graphical and non-graphical information before they issue the licenses to new businesses.
    - Department of Transportation: They use it for roads, sidewalks and other maintenance purposes. They use it to provide better transportation services and to analyze the shortest path for different purposes such as emergency services.
    - Directorate of Revenues: They use information extracted from MIS to locate the person responsible for taxes.
    - Directorate of Parks and Gardens: They use it to determine which location is green or which location should be green. They also designate parking or game areas.

- Each municipality has a different organizational structure; therefore, there may be different departments using GIS for different purposes. In general, Directorate of License and Supervision, Department of Housing and Urban Development, Department of Earthquake Risk Management and Urban Development, Department of Environmental Protection & Development, Department of Information Technologies, Department of Survey and Projects, Department of Transportation and Department of Real Estate & Expropriation use GIS more than other departments at municipalities.
- Since municipalities are not service-oriented organizations, they use CAD tools just to create maps. Therefore, they waste their time with these tools. Almost 90% of them use CAD tools instead of GIS tools.
- All matters that require the use of spatial analysis are of interest, especially the control of numeric identification, creation of a new numeric identification numbers, problem identification, detection and correction of false addresses, National Address Database System (UAVT) updates, queries of demographic data, and selection of the most appropriate site.
- Municipalities mostly outsource GIS projects. Municipalities are not eligible enough to develop projects in-house due to lack of know-how.

Main Problems Related with GIS Diffusion at Municipalities in İstanbul

In this part, the interviews are reported with respect to each problem area that has occurred during the diffusion process of GIS.

Management

- Decision-makers should make strategic and critical decisions using GIS tools, but decision-makers do not know what they want since they are not well-informed about GIS.
- Completed projects are not updated by the municipalities. Besides, municipalities do not have enough employees and determination to keep existing projects.
- Since departments in municipalities have no strong relations with each other, their coordination and collaboration are too weak and the frequency of data-sharing is low. Those are some of the underlying reasons why many projects are unsuccessful.

Bureaucratic

- There are bureaucratic problems because organizations like municipalities prefer to work in their localities.
- Different departments in a municipality hesitate to share their data.

Citizens

- Even if everyone shares their personal information in social networks, they resist giving their ID numbers for GIS services.

Employee Resistance

- The adaptation process is too long for the employees.
- Employees are accustomed to the CAD applications. It is very difficult to break that habit.
- There are not enough employees with expertise to carry out and update projects. Once projects are done, decision-makers usually leave the projects as they are.
- Human factor is the most problematic part for the implementation of a new system at municipalities. There may be some internal resistance to use such a new system from some employees. They think new employees will be hired and they will be redundant due to the upcoming system. This is one of the reasons why they resist to a new system.

Time

- It is not correct to categorize the failure reasons of projects, because each project has different objectives, but private companies have problems mostly with the time constraint set by municipalities, which try to limit the project time due to lack of know-how.

Budget

- Money has always been a problem for municipalities. They have a lot of problems with their budgets because administrators tend to invest the money in the projects that they can see tangible results, but the results of IT/IS projects are not generally visible.
- Medium and large size municipalities allocate enough money for projects but small municipalities have problems about their budgets. On the other hand, a large percentage of municipalities which allocate enough money to projects do not know how to use money. This also creates some problems between the municipalities and private sector.

Data

- Data used in GIS projects are inaccurate and mostly duplicated.
- Municipalities use low-quality data without metadata which causes a waste of time and money.

Infrastructure

- The required infrastructure comprises software, hardware and human resources. Small size municipalities cannot afford to software, hardware and human resources to carry out projects.

Other Problems

- GIS on web technology should be developed; this is one of the problems that should be solved in near future.
- GIS has the same principles with maps, and there are some problems about map standards. GIS uses municipal standards which are announced by Turkish Standard Intuition (TSI) and GCM.
- Desktop software and server-based software along with their updates are expensive; therefore, open source software like QuantumGIS and Grass should be used.
- Private companies are fully responsible for the projects that they make for municipalities. For that reason, the quality of private companies working for municipalities increases the success rate of GIS diffusion at municipalities.
- Municipalities are political organizations; therefore, their management may change every four years. If so, new management can leave out some of the old projects. In this situation, municipalities can lose concentration, money and references for the following projects.

Future of GIS for İstanbul Municipalities

In this part of study, the future of GIS for municipalities in the short term (5 years) and in the long term (10 years) is discussed.

- GIS is being developed along with the Internet technology, mobile and band communications. To this extent, developments in aerial technology, 3D, video, and cell phone processing units will have a direct impact on GIS adopted by social networks. For example, before you leave home; GIS will provide the nearest restaurant to you or a list of restaurants that you might go with respect to your preferences. It is believed that GIS will mostly be preferred in mobile communications, and web applications in the future.
- Database experts generally avoid using GIS. Actually, the users of GIS stay away from databases. There is an increasing trend of using spatial servers, which are the center of GIS management, along with the classical database applications. As long as the users forming GIS as a normal database clearly understand it, GIS applications will be geometrically integrated with MIS. Thus, the use of GIS will be shifted through the MIS.
- GIS will inevitably be used not only in municipalities but also in all governmental organizations; however, they are not ready in terms of culture and the quality of employees. It is believed that GIS will be used in the daily lives of citizens and municipalities in the near future. Moreover, CAD, GIS and RS will be merged and 3-D functions of GIS will be improved soon. The new developments in network technology and web technology will improve GIS technology.

- The importance of local governments and the stress of European Union are increasing every day. For these two reasons, the use of GIS is inevitable for all municipalities in Turkey.

Criteria for a Successful GIS Implementation

In this part, the criteria for a successful GIS implementation are explained as follows:

Management Support

- Hardware, software and human sources should be chosen correctly and fairly.
- Not only the employee quality, but also management approval and support are necessary, where the latter is the most important criterion to be successful in GIS projects.

Perception of Employees

- Technical staff should be well educated.
- Human resources are the most critical part of GIS projects at municipalities. In addition, municipalities should fulfill software, hardware, and data requirements as much as possible with regard to the size of GIS projects. Open source software is recommended to be used especially in small municipalities. But, it is believed that small

size municipalities cannot afford to software, hardware and human resources to carry out GIS projects.

- There may be internal resistance of some employees to use such a new system. Employees are accustomed to the CAD applications. It is very difficult to break that habit.

Data

- The correctness, the quality and the metadata of data are very important. However, data are usually inaccurate and duplicated at municipalities.

In House/Out-Sourcing

- The success of the companies working for municipalities affects a successful implementation.
- Municipalities are not eligible enough to make in-house projects. Outsourcing is more logical for them with respect to budget, employees, success and for some other constraints.

Infrastructure

- İstanbul municipalities have infrastructure problems in implementing GIS projects or using GIS tools.

Bureaucracy

- Despite being the most successful municipality, even İstanbul Metropolitan Municipality (IBB) has bureaucratic problems within each department.
- Departments do not obey the intra-departmental protocols. Sharing information has always been a problem which slows municipalities down.
- Protocols that increase the reliance between the departments should be signed so that the information flow would be easier and projects are not sabotaged by any department or municipality.

Project Updates

- Many municipalities invest enough money for the completion of projects initially, but they miss something very important about such projects; that is continuous updates. Otherwise, these projects usually are put in the trash. Therefore, they have to reserve some money to update projects.

Time

- Private companies complain about time constraints of municipalities. They think that the time allotted for GIS projects is unrealistic.

Questionnaire

In this study, data are collected using online questionnaires administered to municipalities in İstanbul and explained by using descriptive statistics, reliability tests, linear regression analyses, and ANOVA to test the hypotheses and provide findings. In addition, some graphical representations are used to explain the use of GIS at municipalities in İstanbul

40 İstanbul municipalities are included at this survey and all of them have responded to the questionnaire. The cover mails with the online questionnaire links are sent to GIS-related departments at municipalities in İstanbul. The respondents, who have received the questionnaire but did not give a response in a week, have received a reminder phone call. The questionnaires are successfully delivered to 40 respondents and 40 completed questionnaires are returned. Response rate is 100%. Explanation of each analysis type is explained before the results.

Descriptives

"As of 2007, according to official census data based on the "Address Based Population Registration System, which was conducted by Turkish State Institute of Statistics" internal migration to Istanbul still continues at a great speed. Moreover, the study shows that the population of Istanbul has increased as much as the city of Bursa in the last seven years and has reached 12,573,000 people. (Istanbul Metropolitan Municipality, 2008). Istanbul is managed by the Istanbul Metropolitan Municipality which runs the

thirty-nine districts of the city-province. In this study, Istanbul Metropolitan Municipality and thirty-nine districts have responded to the questionnaire. Bağcılar is the largest district of Metropolitan Municipality of İstanbul with its population of 719,267 people. On the other hand, Adalar is the smallest district with its population of 10,460 people. The characteristics of these municipalities are shown in Table 6.

Table 6. Characteristics of Municipalities in İstanbul

	Districts	Side	Population	Surface Area(km^2)	Density (population/ km^2)
1	Adalar	Asia	10,460	11,05	946
2	Arnavutköy	Europe	148,419	506,48	293
3	Ataşehir	Asia	345,588	25,87	13.358
4	Avcılar	Europe	322,190	41,92	7.685
5	Bağcılar	Europe	719,267	22,40	32.110
6	Bahçelievler	Europe	571,711	16,57	34.502
7	Bakırköy	Europe	214,821	29,65	7.245
8	Başakşehir	Europe	193,750	104,48	1.854
9	Bayrampaşa	Europe	272,196	9,5	28.652
10	Beşiktaş	Europe	191,513	18,04	10.616
11	Beykoz	Asia	241,833	310,36	782
12	Beylikdüzü	Europe	186,847	37,74	4.950
13	Beyoğlu	Europe	247,256	8,96	27.595
14	Büyükçekmece	Europe	151,954	157,68	963
15	Çatalca	Europe	61,566	1,040,42	59
16	Çekmeköy	Asia	135,603	148,02	916
17	Esenler	Europe	468,448	18,51	25.307
18	Esenyurt	Europe	335,316	43,12	7.776
19	Eyüp	Europe	317,695	228,14	13.924
20	Fatih	Europe	455,498	15,93	27.965
21	Gaziosmanpaşa	Europe	464,109	11,67	39.769
22	Güngören	Europe	318,545	7,17	44.427
23	Kadıköy	Asia	550,801	25,07	21.970
24	Kâğıthane	Europe	418,229	14,83	28.201
25	Kartal	Asia	427,156	38,54	11.083
26	Küçükçekmece	Europe	662,566	37,51	16.597
27	Maltepe	Asia	415,117	53,06	7.823

28	Pendik	Asia	520,486	180,20	2.888
29	Sancaktepe	Asia	223,755	61,87	3.616
30	Sarıyer	Europe	276,407	151,26	1.827
31	Silivri	Europe	118,304	869,51	136
32	Sultanbeyli	Asia	272,758	28,86	9.451
33	Sultangazi	Europe	436,935	36,24	12.056
34	Sile	Asia	25,169	781,73	32
35	Şişli	Europe	314,684	34,98	8.996
36	Tuzla	Asia	165,239	123,86	1.334
37	Ümraniye	Asia	553,352	45,30	12.215
38	Üsküdar	Asia	529,550	35,34	14.984
39	Zeytinburnu	Europe	288,743	11,31	25.529

(Source: Instanbul District Municipalities: Population & Density: Demographia, 2000)

It is claimed that GIS tools are more plausible for the requirements of municipalities than CAD tools. In Table 7, the analysis of the advantages of GIS tools in terms of their functionalities over CAD tools can be seen. 33 participants (82%) accept that ease of use is one of the most cited advantages of GIS tools. On the other hand, 8 participants (20%) claim that analysis feature is the least cited advantage of GIS over CAD tools. Almost all municipalities which use GIS tools and applications accept that GIS has concrete superiority over CAD tools. Therefore, it may be accepted that GIS tools are more efficient than CAD tools in increasing the productivity of municipalities and decreasing their workload.

Table 7. Frequency Table of Superiority of GIS over CAD Tools

GIS Superiority	Yes	No	Total
Relational database	9 (22%)	31 (78%)	40
Layer system	20 (50%)	20 (50%)	40
Visualization	17 (42%)	23 (58%)	40
Matching geographic data with attribute data	10 (25%)	30 (75%)	40
Decision Support System	25 (62%)	15 (38%)	40
Reporting	12 (30%)	28 (70%)	40
High performance	25 (62%)	15 (38%)	40

Analysis feature	8 (20%)	32 (80%)	40
User interface	28 (70%)	12 (30%)	40
Ease of use	33 (82%)	7 (18%)	40
Nothing	39 (97%)	1 (3%)	40
Others	38 (95%)	2 (5%)	40

Table 8 shows the use of GIS at municipalities in İstanbul. 29 municipalities (%73) use GIS tools for cadastre information and town and country planning. On the other hand, GIS tools are rarely used for cartography by only 9 municipalities (%23). It can be seen clearly that municipalities use GIS tools in every line of their work. Almost all of their departments use GIS tools to their advantage.

Table 8. Frequency Table of Usage of GIS at Municipalities in İstanbul

Usage of GIS	Yes	No	Total
Road maintenance	15 (38%)	25 (62%)	40
Verdure maintenance	15 (38%)	25 (62%)	40
Environment maintenance	10 (25%)	30 (75%)	40
Cadastre information	29 (73%)	11 (27%)	40
Town and country planning	29 (73%)	11 (27%)	40
Cartography	9 (23%)	31 (77%)	40
Environmental policy	10 (25%)	30 (75%)	40
Location policy	12 (30%)	28 (70%)	40
Tax planning	21 (53%)	19 (47%)	40
Counter service	10 (25%)	30 (75%)	40
Information	20 (50%)	20 (50%)	40
Others	2 (5%)	38 (95%)	40

Table 9 shows preliminary preparations for the use of GIS at municipalities in İstanbul. 21 municipalities (%53) examine successful projects before GIS implementation whereas only 8 of them (20%) educate their employees before GIS implementation.

Table 9. Frequency Table of Preliminary Preparation of Municipalities about GIS

Preliminary Preparation	Yes	No	Total
Pilot study	12 (30%)	28 (70%)	40
Financial analysis	10 (25%)	30 (75%)	40
System analysis	13 (33%)	27 (67%)	40
Gathering information from the user municipalities	20 (50%)	20 (50%)	40
Gathering information from the suppliers	11 (28%)	29 (72%)	40
Inquiries	11 (28%)	29 (72%)	40
Examining successful projects	21 (53%)	19 (47%)	40
Education	8 (20%)	32 (80%)	40
Others	1 (2%)	39 (98%)	40

Table 10 shows the frequency of investment for GIS in the future, and future expectations of municipalities from GIS and its use. 17 municipalities (%43) are planning to invest more money for development of several applications in the future whereas only 8 of them (%8) think that additional GIS products will be bought from different suppliers and that GIS tools will be developed in the future. It can be seen that municipalities believe they will develop more GIS applications in the future and invest more money in this type of development. However, fewer of them believe that they can change their GIS suppliers in the future.

Table 10. Frequency Table of Municipalities' Investment for GIS in the Future

Investment	Yes	No	Total
Additional GIS products will be bought from the same supplier.	8 (20%)	32 (80%)	40
Additional GIS products will be bought from another supplier.	3 (8%)	37 (97%)	40
Several GIS systems will be in use within several departments.	8 (20%)	32 (80%)	40
Several GIS systems will be in use through the entire organization.	16 (40%)	24 (60%)	40
Development of several applications.	17 (43%)	23 (57%)	40
Development of several applications for citizens.	15 (38%)	25 (62%)	40
Development of on-line GIS tools and services.	13 (33%)	27 (67%)	40
Municipalities that source GIS tools and projects.	8 (20%)	32 (80%)	40
Development of mobile GIS applications	12 (30%)	28 (70%)	40
Municipalities that develop GIS tools.	3 (8%)	37 (97%)	40
Others	0 (0%)	40 (100%)	40

On the other hand, there are some municipalities in İstanbul that have not used GIS tools and applications. Since most of the İstanbul municipalities use GIS tools or implement GIS projects, the number of respondents who have answered this question is remarkably low. Even if the number of the respondents is too low, it is worthwhile to examine these data. By doing so, it may be understood in what situations or conditions GIS will be used by these municipalities in the future. In Table 11, the answers of non-user municipalities regarding the expectation of features of GIS tools can be seen. 5 of them (%71) claim that "Reasonable Budget", "Support of Top Management" and "Availability of Useful Digital Data" are the most important reasons that force municipalities to use GIS in the future. On the other hand, only 1 of them (14%) claims that there should be more functional GIS products.

Table 11. Frequency Table of Reasons to Use GIS for Non-User Municipalities

Decision to seriously introduce GIS into the organization	Yes	No	Missing	Total
Improved functionality	1 (14%)	7 (86%)	-	8
Proved benefits	4 (57%)	3 (43%)	1	8
More user-friendly systems	2 (29%)	5 (71%)	1	8
Availability of useful digital data	5 (71%)	2 (29%)	1	8
Support of top management	5 (71%)	2 (29%)	1	8
Reasonable budget	5 (71%)	2 (29%)	1	8
Reasonable number of employees	3 (43%)	4 (57%)	1	8
Reasonable quality of employees	2 (29%)	5 (71%)	1	8
Others	0	8 (100%)	-	8

It is stated that larger municipalities should have specific departments such as "Department of Information Technologies" or "Department of Real Estate & Expropriation" which should be responsible for GIS projects. In Table 12, 14 municipalities (%35) state that IT/IS department is responsible for GIS tools and projects whereas only 1 municipality (%2.5) states that "Department of Real Estate & Expropriation" is responsible; and again, 1 municipality (%2.5) states that "Department of Survey and Projects" is responsible for GIS projects and tools.

Table 12. Frequency Table of Responsible GIS Department in Municipalities

GIS Department	Yes	Total
Department of Information Technologies	14 (35%)	40
Department of Real Estate & Expropriation	1 (2.5%)	40
Department of Survey and Projects	1 (2.5%)	40
Department of Housing and Urban Development	12 (30%)	40
Others	12 (30%)	40

Table 13 shows "Responsible Authority of GIS Projects at Each Municipality in İstanbul". 39 municipalities (%98) outsource GIS projects to consultancy firms.

Also, 20 municipalities (%50) outsource GIS projects to private companies. On the contrary, 10 municipalities (%25) implement GIS projects in-house. Finally, they believe that the effect of universities and governmental organizations on municipalities' decision is worthless.

Table 13. Responsible Authorization of GIS Projects in Municipalities

Decision to seriously introduce GIS into the organization	Yes	No	Total
Municipalities	10 (25%)	30 (75%)	40
Private companies	20 (50%)	20 (50%)	40
Consultants	39 (98%)	1 (2%)	40
Governmental institutions	0	40 (100%)	40
Universities	0	40 (100%)	40
Others	0	40 (100%)	40

Reliability

According to Field (2009), one should look at the consistency between each item in a set and the overall questionnaire to test the reliability before applying regression test.

A commonly accepted rule of thumb for describing internal consistency by using Cronbach's alpha is shown as $\alpha>0.7$.

To test each hypothesis, reliability analysis is conducted. After finding Cronbach's α (alpha) value for each piece of data, regression analysis is made for the data whose Cronbach's α value is higher than 0.7 . Table 14 shows the Cronbach's α (alpha) value for each piece of data.

Table 14. Cronbach's α (Alpha) Value for each Data

Hypothesis	Number of Item	Cronbach's α (Alpha)
Knowledge about GIS-related areas	7	0.777
Frequency of GIS usage	8	0.770
Acceptance of GIS projects	12	0.867

Hypotheses Test

Linear Regression Analysis

Linear regression analysis is used for specifying the one to one relations between two or more different variables. The linear regression's dependent variable is the success in diffusion of GIS and the independent variables vary. Regression analysis is used to test Hypothesis 1, 2 and 3.

According to the F statistics significance (Sig.) values in Table 15, all of the constructs are meaningful because they are below 0.05, which means that these constructs can be accepted as statistically meaningful with the confidence level of %95 and the GIS diffusion success can be explained by the related hypotheses. The R^2 values for the significant constructs show the percentage of the variance in GIS project success which is explained by the related hypotheses. B values indicate the path coefficients which mean that 1 unit change in the related independent variables will affect the GIS project success by the proportion of B values.

Hypothesis 1

Table 15 shows the result of regression analysis for Hypotheses 1. Knowledge factor about GIS-related areas explains %33 of the variance in diffusion success, and has a positive impact by the proportion of 1.466 on GIS diffusion success.

Hypothesis 2

Table 15 shows the result of regression analysis for Hypothesis 2, which explains the frequency of GIS use by the departments of municipalities. The significance value for this relation coefficient is less than 0.01 (*Sig*= 0.000); therefore, it can be concluded that there is a significant relationship between success scores and the frequency of GIS use at municipalities. Please note that the relationship is positive: as the intensity of GIS use at municipalities increases, the success in GIS diffusion increases. Therefore, our hypothesis is supported: as usage of GIS increases, so does success in the diffusion.

Hypothesis 3

As mentioned previously, municipalities need employees of high quality to implement successful GIS projects. Table 15 shows the result of linear regression analysis for Hypothesis 3. For GIS diffusion to be successful, acceptance factor of GIS projects explains %54 of the variance and has a positive impact by the proportion of 0.486 on GIS diffusion success. It is shown that there is a positive relationship between success

and knowledge about GIS-related areas. The more educated employees are, the more successful GIS implementation is.

Table 15. Linear Regression Analysis of Hypotheses

Hypothesis Explanation	R^2	*Sig.*	*B*	*Hypothesis*	*Hypothesis Acceptance*
Knowledge about GIS-related areas	0.331	0.001	1.466	H1	Accepted
Frequency of GIS usage	0.619	0.000	0.624	H2	Accepted
Acceptance of GIS projects	0.535	0.000	0.486	H3	Accepted

Hypothesis 4

To test Hypothesis 4, ANOVA analysis has been conducted so that GIS diffusion success is differentiated according to their usage time.

> When we performe a t-test, we test the hypothesis that the two samples have the same mean. Similarly, ANOVA tells us whether three or more means are the same, so it tests the null hypothesis that all group means are equal. An ANOVA produces an F-statistic or F-ratio, which is similar to the t-statistic in that it compares the amount of systematic variance in the data to the amount of unsystematic variance. In other words, F is the ratio of the model to its error. (Field, 2009, p.349)

Table 16 describes the results of the ANOVA analysis that has been conducted in order to see whether municipalities using various GIS tools for different durations differ in terms of their average success. It summarizes that some municipalities have been using GIS tools and application for long time, but some other municipalities are more successful in garnering benefits from GIS projects.

Table 16. ANOVA for Duration of Use of GIS and Success in GIS Diffusion

		Mean	F/t Value	Sig.
Hypothesis 4 (Rejected)	0-1 year	3.7326	F=0.291	0.881
	1-2 years	4.3032		
	2-5 years	3.9746		
	5-10 years	4.0500		
	More than 10 years	3.8750		

It can be seen from Table 15 that the hypothesis is rejected since the significance value (.881) is higher than .05. Therefore, there is no difference among using various GIS tools for different durations in terms of their average success.

Hypothesis 5

To test Hypothesis 5, ANOVA analysis has been conducted so that GIS diffusion success is differentiated according to the number of inhabitants in a specific municipality. Table 17 describes the results of the ANOVA analysis that has been conducted in order to see whether municipalities using various GIS tools differ in terms of their population groups. Larger municipalities in Istanbul are indeed using GIS techniques but there is no concrete relation between the size of municipalities and GIS success. Even if they are the early adopters of GIS, it does not give rise to a successful diffusion. It can be concluded from Table 17 that the largest group of GIS users, who use GIS in several departments at least, is between 50.000 and 150.000. On the other hand, relatively smaller organizations implement GIS in GIS-related departments rather than in the entire organization.

Table 17. ANOVA for Population Groups of Municipalities and Success in GIS Diffusion

		Mean	F/t Value	Sig.
Hypothesis 5 (Rejected)	Less than 20,000 people	3.3750	F=0.377	0.823
	20,000-50,000 people	3.6303		
	50,000-150,000 people	4.1771		
	150,000-300,000 people	3.9531		
	300,000-500,000 people	4.0021		
	More than 500,000 people	4.0010		

It can be seen from Table 17 that the hypothesis is rejected since the significance value (.823) is higher than .05. Therefore, there is no difference among using various GIS tools in terms of population groups living in a specific municipality.

Hypothesis 6

In addition to the size of municipalities, it is worthwhile to examine the number of GIS users in municipalities to see whether there is an effect on success of GIS diffusion or not. To test Hypothesis 6, ANOVA analysis has been conducted so that GIS diffusion success is differentiated according to the number of employees in GIS departments of municipalities. Table 18 describes the results of the ANOVA analysis that has been conducted in order to see whether the number of employees working in GIS-related departments differs in terms of their success in GIS diffusion. Similar to the finding regarding direct users of GIS, the total number of GIS users, no matter if they use it directly or indirectly, have no effect on success of GIS diffusion.

Table 18. ANOVA for Number of Employees in GIS Department and Success in GIS Diffusion

		Mean	F/t Value	Sig.
Hypothesis 6 (Rejected)	Less than 5 employees	3.9624	F=0.773	0.662
	6-10 employees	3.5122		
	11-50 employees	4.4216		
	More than 50 employees	4.5000		

It can be seen from Table 18, the hypothesis is rejected since the significance value (.662) is higher than .05. Therefore, there is no difference among the number of employees working in GIS-related departments in terms of success in GIS diffusion.

Hypothesis 7

To test Hypothesis 7, ANOVA analysis has been conducted so that GIS diffusion success is differentiated according to the number of employees using GIS in a municipality. Table 19 describes the results of the ANOVA analysis that has been conducted in order to see whether the number of employees in municipalities using GIS differs in terms of their success in GIS diffusion.

Table 19. ANOVA for Number Employees in Municipalities and Success in GIS Diffusion

		Mean	F/t Value	Sig.
Hypothesis 7 (Rejected)	Less than 25 employees	3.5744	F=1.984	0.147
	26-50 employees	4.0751		
	51-100 employees	4.6741		
	More than 100 employees	4.3438		

It can be seen from Table 19 that the hypothesis is rejected since the significance value (.147) is higher than .05. Therefore, there is no difference among the number of employees in municipalities using GIS in terms of their success in GIS diffusion.

Hypothesis 8

To test Hypothesis 8, ANOVA analysis has been conducted so that GIS success is differentiated according to the satisfaction of GIS projects at municipalities. Table 20 describes the results of the ANOVA analyses that have been conducted in order to see whether the satisfaction levels of GIS differ in terms of success of municipalities in GIS diffusion. Satisfaction levels of GIS applications are very important for a successful GIS diffusion in a municipality. If there is satisfaction about new tools or techniques, they will inevitably be successful at the end.

Table 20. ANOVA for Satisfaction Levels of GIS Applications and Success in GIS Diffusion

		Mean	F/t Value	Sig.
Hypothesis 8 (Accepted)	Poor	1.6250	F=22.352	0.000
	Fair	3.9792		
	Good	3.8685		
	Very good	4.6317		

It can be seen from Table 20 that the hypothesis is accepted since the significance value (.000) is lower than .05. Therefore, there is a difference among satisfaction levels of municipalities with GIS in terms of their success in GIS diffusion.

CHAPTER 7

CONCLUSION, IMPLICATIONS AND LIMITATION

Thesis intends to develop a better understanding of the nature and success of GIS diffusion at municipalities in Istanbul. An extensive survey has been conducted about GIS, diffusion process of GIS, the usage of GIS and the future of GIS. The objectives are to determine the benefits of GIS use and the barriers to adoption at municipalities in Istanbul. Success and failure factors, as well as a better understanding of development of GIS diffusion in time, were identified. Then, the interviews are held with the experts of GIS in the field. After the survey and interviews, diffusion of GIS is analyzed in detail, hypotheses are framed and a questionnaire was generated and delivered to municipalities in the online environment. At the end of data gathering process, descriptive statistics, reliability tests, regression and ANOVA analyses are performed by using SPSS 15 with data collected from 40 municipalities. Since Istanbul is the largest city in Turkey with its population of nearly 15 million people, the questionnaire is focused on municipalities in Istanbul. All municipalities have participated in this study.

Municipalities are governmental organizations which are solely authorized in their internal policies, but are dependent to central government. Since they are independent in their internal affairs, there is no competition among them. This affects the implementation of new technologies at governmental organizations positively. Municipalities used to perform their tasks manually. However, governmental organizations like municipalities should increase their service quality, speed and

reliability in some respects. Therefore, they should have data and information of high quality. In addition, they should use plausible tools and techniques in favor of other governmental organizations, private industries and their citizens. GIS technology is also very helpful in increasing efficiency of data management.

Based on the research findings of analyses in previous sections, the conclusions are as follows:

- Since GIS tools have concrete superiority over CAD tools, GIS is useful and should be used in all departments by all municipalities in Turkey.
- Almost all departments of municipalities should use GIS tools for some applications.
- Awareness is a key factor for a successful implementation but education is the least important factor to affect success. Examining successful projects and successful municipalities are the most important factors which should be evaluated very carefully before implementation.
- In implementing GIS systems, some municipalities just buy a system from a supplier end introduce this into the organization. They are inclined to think that they will develop GIS tools in-house instead of buying package tools in the future.
- Budget, managerial support, useful data and number and quality of employees are key factors for non-user municipalities to use GIS in the future. Therefore, it can be accepted that these four factors are important problems to be overcome by non-user municipalities.
- Technical departments and GIS-related departments within a municipality take the initiative to implement GIS tools in their departments and the entire organization.

- Municipalities are not the only decision-makers. They procure consultancy services from private companies. Afterwards, they take the initiative to carry on GIS projects.
- Live projects will be successful eventually which refers to the acceptance of that project and cultural norms at municipalities.
- Knowledge and experience exchange should be increased among municipalities, as there is no competition between them. To increase experience and knowledge for using GIS tools, the potential users need training and education.
- Because of their requirements and power, municipalities are perfect organizations to use GIS tools.
- Municipalities mainly perform registration and maintenance functions instead of support in the decision-making process.
- Another important conclusion is that almost half of the municipalities, which have started to implement GIS, accomplish this without a vision or a plan for the future.
- An important failure factor to implement GIS is the fact that 49% of the GIS users do not have a policy.

Success and Failure Factors

The diffusion process of IT/IS technologies increases the interaction between organizations and citizens. IT/IS technologies will be accepted and diffused in a governmental organizations if its advantages are proven. Before and after implementing IT/IS technologies, the advantages and disadvantages of them should be clearly defined.

Not only advantages, but also success factors should be investigated very carefully. Municipalities simply follow the successful projects and implementations handled by other municipalities. In this part, both success and failure factors are explained:

Success factors, as a summary of findings of questionnaires, are as follows:

- Determination and support of the management and the organization
- Desire to accept changes
- Examination of successful projects and municipalities
- Personnel capacity and education
- The leader who puts GIS on the agenda
- Accurate consultant selection
- Budget
- High quality of data
- Live projects

Failure factors, as a summary of findings of questionnaires, are as follows:

- Low quality and redundant data
- Time not decided upon carefully
- Not enough personnel
- Neither attention nor support of the management.
- Not enough budget
- Departmental barriers
- Changes of tasks

Limitations

In this study, there are some limitations about interviews, questionnaire survey and time. First of all, conducting interviews with experts of GIS has been really difficult due to time constraints. Second, most of municipalities have been hesitant to allocate time to answer the questionnaire. Therefore, follow-up e-mails and phone calls have been made to all of the municipalities to reply this survey. Especially, reserved time for interviews and questionnaire has not been enough to complete on time because of these two reasons. Finally, the most important limitation is that not all employees working in GIS-related departments at municipalities in İstanbul have filled in the questionnaire.

Future Studies

In this study, the indispensible growth of IT/IS in general and GIS specifically can be figured out. The use and diffusion of GIS are known less in specific departments within the context of the entire organization. Some departmental findings however are presented in this study. The focus is on the diffusion at municipalities in general. Since larger municipalities require serious implementation with respect to budget and employees, it is really an expensive decision to make. However, it is relatively easy and fast for smaller municipalities to make a decision about GIS implementation. In general, simple and cheaper GIS tools for performing some useful tasks will render the municipalities more efficient and effective. Therefore, there should be more concrete research about diffusion of GIS at smaller municipalities.

Another important area for further research is the GIS tools that can be integrated in desktop programs and the Internet at municipalities. The reaction of citizens to the online GIS tools should be examined in detail. Not only desktop services, but also mobile services of municipalities should be examined with respect to their advantages. The survey findings offer insight in the general characteristics of the employees, who implement GIS in their organizations, and their perceptions. In addition, the questionnaire represents the main problems they face with implementation. This kind of research should be made with all employees of municipalities who deal with GIS more or less. In further research, such a study should be done in all municipalities in Turkey. In this way, both awareness and accuracy of research will increase. Also, a well-defined national strategy can be developed to manage GIS projects in the country. Even though there is a growing awareness of the concept of GIS in Turkey, the technology usage and the capability of GIS are not clear to many people yet.

Another important point that should be concentrated on is the attitude of private companies towards GIS tools and techniques. GIS is assumed to be a kind of governmental tool or technique but it is a misunderstanding. Almost all sectors can benefit from GIS tools and techniques. The advantages and usefulness of GIS tools in private sector should be examined carefully for further research.

Shortly, the context of this survey can be narrowed down to smaller municipalities. Moreover, the diffusion of GIS in all municipalities in Turkey can be examined by enlarging the context of survey. And the context of survey can also concentrate on specific areas such as private companies.

Finally, the same study can be done with the support of case studies. These case studies should be chosen very carefully. As a recommendation, three different case

studies may consist of a smaller municipality, a respectively larger municipality and the largest municipality in Istanbul. In this way, it will be much clearer to understand the diffusion of GIS at municipalities in Istanbul.

APPENDIX: QUESTIONNAIRE

COĞRAFİ BİLGİ SİSTEMLERİ (CBS) 'NİN BELEDİYELERDEKİ KULLANIMI, VE YAYGINLIĞI

Sayın yetkili,

Boğaziçi Üniversitesi Bilgi Sistemleri Uygulama ve Araştırma Merkezi'nde "Coğrafi Bilgi Sistemleri (CBS)'nin Belediyelerdeki Kullanımı, Yaygınlığı ve Seviyesi" konulu bir araştırma projesi yürütülmektedir.

Aşağıda bu çalışmayla ilgili bir anket sunulmaktadır. Bu çalışmanın bir bölümü ayrıca Yönetim Bilişim Sistemleri Bölümü öğrencilerinden Mahmut Çavur'un yüksek lisans tezini de oluşturmaktadır.

Görüşleriniz proje çalışmamıza ışık tutacaktır. Anket sonuçları toplu olarak değerlendirilecek ve elde edilen sonuçlar bilimsel bir rapora dönüştürülerek yayınlanacaktır. Bu rapor arzu eden katılımcı belediyelere gönderilecektir.

Anketin yapılması hususunda destek vermenizi rica eder , değerli vaktinizi bize ayırdığınız ve bu çalışmaya katkıda bulunduğunuz için teşekkür ederiz.

Saygılarımızla,

Prof.Dr. Meltem Özturan Mahmut Çavur

Merkez Müdürü/Tez Danışmanı

E-Mail: ozturanm@boun.edu.tr E-mail: mahmut.cavur@boun.edu.tr

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1. KISIM - Lütfen kendiniz ile ilgili aşağıdaki soruları cevaplayınız.

(1. SORU CEVAPLANMASI ZORUNLU SORUDUR !)

1. Hangi belediyede çalışıyorsunuz?

Adalar	
Arnavutköy	
Ataşehir	
Avcılar	
Bağcılar	
Bahçelievler	
Bakırköy	
Başakşehir	
Bayrampaşa	
Beşiktaş	
Beykoz	
Beylikdüzü	
Beyoğlu	
Büyükçekmece	
Çatalca	
Çekmeköy	
Esenler	
Esenyurt	
Eyüp	
Fatih	
Gaziosmanpaşa	
Güngören	
İstanbul Büyükşehir Belediyesi	
Kadıköy	
Kâğıthane	
Kartal	
Küçükçekmece	
Maltepe	
Pendik	
Sancaktepe	
Sarıyer	
Silivri	
Sultanbeyli	

Sultangazi	
Şişli	
Şişli	
Tuzla	
Ümraniye	
Üsküdar	
Zeytinburnu	

2. Belediye içinde hangi birimde çalışıyorsunuz?

Kültür ve Sosyal İşler Daire Başkanlığı	
Sağlık ve Sosyal Hizmetler Daire Başkanlığı	
Zabıta Daire Başkanlığı	
Destek Hizmetleri Daire Başkanlığı	
İnsan Kaynakları ve Eğitim Daire Başkanlığı	
Fen İşleri Daire Başkanlığı	
Çevre Koruma ve Kontrol Daire Başkanlığı	
Etüd ve Projeler Daire Başkanlığı	
İmar ve Şehircilik Daire Başkanlığı	
Deprem Risk Yönetim ve Kentsel İyileştirme Daire Başkanlığı	
Ulaşım Daire Başkanlığı	
Bilgi Teknolojileri Daire Başkanlığı	
İtfaiye Daire Başkanlığı	
Strateji Geliştirme Daire Başkanlığı	
Emlak Yönetimi Daire Başkanlığı	
Diğer	

3. Mesleğiniz nedir? Belirtiniz.

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4. Belediye içindeki göreviniz/konumunuz nedir? Belirtiniz.

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5. Bulunduğunuz belediyede kaç yıldır bu görevde çalışıyorsunuz?

0-1 yıl	
1-5 yıl	
5-10 yıl	
10-20 yıl	

6. Coğrafi Bilgi Sistemleri (CBS) hakkında bilgi sahibi misiniz?

Evet	
Hayır (8. soruya geçiniz.)	

7. Aşağıdaki alanlar hakkındaki bilgi seviyenizi belirtiniz .

	Hiç Yok	Az	Orta	İyi
Jeoloji				
Veritabanı				
Coğrafi Bilgi Sistemleri (CBS)				
Programları				
Bilgisayar Destekli Tasarım				
(CAD) Programları				
GIS yayınlandığı WEB				

8. Coğrafi Bilgi Sistemleri (CBS) hakkında nereden bilgi sahibi oldunuz? (Birden fazla seçenek işaretleyebilirsiniz)

Üniversite	
Özel Bir Kurs	
Özel Bir Kurum	
Kişisel Çaba	
Bir Kamu Kurumu	
Diğer: (Belirtiniz)	

9. CBS'nin CAD (Bilgisayar Destekli Tasarım) araçlarına göre hangi tür üstünlükleri olduğunu düşünüyorsunuz? (Birden fazla seçenek işaretleyebilirsiniz)

İlişkisel bir veritabanı içermesi	
Katman sistemiyle çalışması	
Görsellik içermesi	
Coğrafi veri ile sözel verileri eşleyebilmesi	

Karar verme sistemi olarak çalışması	
Raporlama yeteneğinin olması	
Performansının yüksek olması	
Analiz yapabilmesi	
Kullanıcı arayüzünün anlaşılır ve kolay olması	
CBS yazılımlarının kullanımının kolay olması	
Hiç bir üstünlüğü olduğunu düşünmüyorum	
Diğer:	

2. KISIM – Lütfen çalıştığınız belediye ile ilgili aşağıdaki soruları cevaplayınız.

(2. SORU CEVAPLANMASI ZORUNLU SORUDUR !)

1. Belediyenizin sınırları içinde yaşayan yaklaşık nüfus ne kadardır?

< 20.000 kişi	
20.000-50.000 kişi	
50.000-150.000 kişi	
150.000-300.000 kişi	
300.000-500.000 kişi	
>500.000 kişi	

2. Belediyeniz Coğrafi Bilgi Sistemleri'ni (CBS) kullanmakta mıdır?

Evet	
Hayır , ancak yakın zamanda kullanılması planlanmaktadır (Bölüm IV ’e geçiniz)	
Hayır (Bölüm IV ’e geçiniz)	

3. Belediyeniz Coğrafi Bilgi Sistemleri'ni (CBS) kaç yıldır kullanmaktadır?

0-1 yıl	
1-2 yıl	
2-5 yıl	
5-10 yıl	
10-20 yıl	

4. Coğrafi BilgiSistemlerini (CBS) belediyenizde hangi uygulamalarda kullanmaktasınız? (Birden fazla seçenek işaretleyebilirsiniz)

Yol Bakım,Onarım	
Park-Bahçe Bakım,Onarım	
Çevre Bakım, Onarım	
Kadastro Bilgi	
Şehir ve Bölge Planlama	
Kartografya	
Çevre Planlaması	
Yer Planlaması	
Vergi İşlemleri	
Gişe Hizmeti	
Bilgilendirme Amaçlı	
Diğer:	

5. Belediyenizde CBS programları ve/veya CBS uygulamalarının sonuçları hangi birimler tarafından ne sıklıkta kullanılmaktadır?

	Hiç Kullanılmaz (1)	Arasıra Kullanılır (2)	Her Zaman Kullanılır (3)
Memur (Kadastro Bilgi İşlem, Çevre Bilgi İşlem, vb.)			
Planlama Çalışanları			
Bakım-Onarım Çalışanları			
Departman Yöneticileri			
Üst Düzey Yöneticiler			
Belediye Başkanı ve Belediye Meclis Üyesi			
Danışmanlar			
Arazi Çalışanları (Kadastrocu, Arazi Mühendisi, vb.)			

6. Belediyenizde CBS teknolojisi ve CBS uygulamaları ile aşağıdaki amaçlara hangi oranda ulaşılmıştır?

	Hiç Ulaşılmadı (1)	Kısmen Ulaşıldı (2)	Ne Ulaşıldı Ne Ulaşılmadı (3)	Ulaşıldı (4)	Tamamen Ulaşıldı (5)

Veri kaynağına ulaşım hızı arttı.					
Verinin kalitesi arttı.					
Daha iyi kararlar alınmaya başlandı.					
Daha hızlı kararlar alınmaya başlandı.					
Mevcut analiz metotlarında otomasyona geçildi.					
Yeni analiz metotları geliştirildi.					
Belediye daha etkin çalışmaya başladı.					
Verinin paylaşım şekli değişti ve iyileşti.					
Harcamalar azaldı.					
Vatandaşa verilen hizmetin hızı arttı.					
Vatandaşa yapılan hizmetin kalitesi arttı.					
Belediyenin tamamında verinin yönetim kalitesi arttı.					
Coğrafi verilerde bir standart oluştu.					
Belediye içindeki birimlerde işbirliği arttı.					
Diğer belediyeler ile işbirliği arttı.					
Diğer devlet kurumları ile işbirliği arttı.					

7. Belediyenizde toplamda yaklaşık kaç tane çalışanınız Coğrafi Bilgi Sistemleri (CBS) uygulamalarından DİREKT SORUMLUDUR ? (Lütfen rakam ile belirtiniz)

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8. Belediyenizde toplamda yaklaşık kaç tane çalışanınız Coğrafi Bilgi Sistemlerini (CBS) KULLANMAKTADIR ? (Lütfen rakam ile belirtiniz)

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9. Belediyenizde CBS kullanımının yaygınlaşma nedenlerine ilişkin aşağıdaki görüşlere katılma derecenizi belirtiniz .

	Kesinlikle Katılmıyorum (1)	Katılmıyorum (2)	Ne Katılıyorum Ne Katılmıyorum (3)	Katılıyorum (4)	Kesinlikle Katılıyorum (5)
Birim müdürlerinin CBS yazılımlarını kullanıyor olması					
Bilgi İşlem'in CBS yazılımlarını etkin bir şekilde kullanıyor olması					
CBS teknolojisinin bakım-onarım ve planlama konularında yoğun bir şekilde kullanılıyor olması					
Coğrafi verilerin CBS yardımıyla organize ve standardize ediliyor olması					
Teknik birimlerin CBS yazılımlarını etkin bir şekilde kullanıyor olması					
CBS'nin belediyede işbirliği içinde çalışmayı sağlıyor olması					
CBS'nin belediyede diğer sistemlere tamamen entegre edilip uygulanıyor olması					
CBS'nin belediyede bazı birimlerin dikkatini çekmiş olması					
CBS'nin belediyenin bazı fonksiyonlarında önemli değişikliklere sebep oluyor olması					
CBS konusunda belediyede eğitimli çalışanların bulunması					
Belediyenin bir çalışanının bu konuda çok istekli olması					

10. CBS uygulamaları sırasında belediyenizde yaşanan problemlerin hangileri olduğunu belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

Bütçe sorunları	
Bürokratik sorunlar	
Kalifiye olmayan belediye çalışanlarının projelere atanması	
Projelere yetersiz sayıda çalışan ayrılması	
Kalitesiz veri üretilmesi	
Yönetimin yetersiz desteği	
Yönetimin ve karar-vericilerin vizyon eksikliği	
Projelerde zaman kısıtlamalarının olması	
Veri yetersizliği (Coğrafi ve coğrafi olmayan veri)	
Belediyenin yetersiz bir altyapıya sahip olması	
Belediye çalışanlarının yeni sisteme gösterdikleri direnç	
Veri paylaşım sıkıntıları	
Vatandaşın özel bilgilerini paylaşmama eğilimleri	
CAD-CBS yazılımlarının bilinçsiz bir şekilde kullanılması	
Aynı projede farklı CBS araçlarının kullanılması	
Özel sektörle yaşanan sıkıntılar	
Bütçe yetersizliği	
Projelerin birden fazla özel şirketle yürütülmesi	
Belediyede CBS yazılımlarının kullanımı ile ilgili bir sorun yaşanmamıştır	
Diğer: (Belirtiniz)	

11. 10. soruda bürokratik sorunları işaretlediyseniz bu sorunların aşağıdaklerden hangileri olduğunu belirtiniz.(Birden fazla seçenek işaretleyebilirsiniz)

Farklı birimler kendi verilerini paylaşmak istemiyorlar.	
Farklı birimlerden veri almak zaman alıyor.	
Kalitesiz ve çelişkili veri paylaşılıyor.	
Yönetim kadrosunun proje başladıktan sonra projeyelere verdiği destek yetersiz kalıyor.	
Onay süreçleri uzun zaman alıyor.	
Yönetimden maddi konuda yeterli ve zamanında destek alınmıyor.	
Diğer: (Belirtiniz)	

12. CBS yazılımlarının kullanımı ile ilgili belediyenizde yaşadığınız sorunların neler olduğunu belirtiniz. (Birden fazla seçeneği işaretleyebilirsiniz)

Kullanıcı ara yüzünün karmaşık olması	
Yetersiz veritabanı desteği	
Düşük performans	
3-D (3 Boyut) yeteneklerinin yetersiz olması	
Yazılımın yüksek fiyatı	
Grafiksel verilerde çok yavaş çalışması	
Başka yazılımlarla veri paylaşımının esnek olmaması	
Belediyede CBS yazılımlarının kullanımı ile ilgili bir sorun yaşanmamıştır	
Diğer: (Belirtiniz)	

3. KISIM – Lütfen CBS'nin belediyeniz tarafından benimsenmesi, kullanılması ve geliştirilmesi ile ilgili aşağıdaki soruları cevaplayınız.

1. Belediyenizde hangi birim Coğrafi Bilgi Sistemlerinden (CBS) ve uygulamalarından birinci derecede sorumludur?

Fen İşleri Daire Başkanlığı	
Çevre Koruma ve Kontrol Daire Başkanlığı	
Etüd ve Projeler Daire Başkanlığı	
Şehir Planlama Müdürlüğü	
Planlama Müdürlüğü	
İmar Müdürlüğü	
Harita Müdürlüğü	
Kentsel Dönüşüm Müdürlüğü	
Bilgi Teknolojileri Daire Başkanlığı	
Coğrafi Bilgi Sistemi Müdürlüğü	
Diğer	

2. Belediyenizde hangi tür veritabanı sistemi kullanılmaktadır?

Merkezi Veritabanı Sistemi	
Her birimin kendi veritabanı sistemi var	
Diğer	

3. CBS projelerinin ve uygulamalarının belediyenizde yapılmasından kim(ler)in sorumlu olduğunu belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

Belediyenin kendisi	
Özel sektör	
Danışman(lar)	
Bir devlet kurumu	
Üniversite(ler)	
Diğer: (Belirtiniz)	

4. Belediyenizdeki CBS projelerinde ve uygulamalarında karar vericilerin kim(ler) olduğunu belirtiniz . (Birden fazla seçenek işaretleyebilirsiniz.)

Belediye içindeki CBS'nin UYGULANILDIĞI/KULLANILDIĞI birim müdürleri	
Belediye içindeki CBS'nin UYGULANILMADIĞI/KULLANILMADIĞI birim müdürleri	
Belediye içinde CBS'den sorumlu bir birim	
Belediye için CBS projesi yapan özel sektör	
Belediye içindeki potansiyel kullanıcılar	
CBS projelerinde etkin olan bir devlet kurumu	
Belediye için CBS danışmanlığı yapan kişi(ler)	
Belediye için CBS danışmanlığı yapan üniversite(ler)	
Diğer: (Belirtiniz)	

5. CBS'ye GEÇMEYE KARAR VERMEDEN ÖNCE bu sistemin belediyenize uygun olup olmadığını anlamak için neler yapıldığını belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

Pilot çalışma	
Gelir-gider analizi	
Sistem analizi	
Altyapı analizi	
Diğer CBS kullanıcılarından bilgi alma	
Tedarikçileri ziyaret etme	
Teklifler alma	
Daha önce yapılmış başarılı projeleri inceleme	
Belediye çalışanlarını eğitme	
Diğer: (Belirtiniz)	

6. Belediyenizde CBS'ye GEÇMEYE KARAR VERDİKTEN SONRA uygulamaya geçmeden önce neler yapıldığını belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

Bilinçlendirme seminerlerinin yapılması	
Pilot çalışma yapılması	
Yönetim kadrosuna danışmanlık hizmetlerinin yapılması	
Yönetim kadrosu için demolar, sunumlar, raporlar hazırlanması	
Olasılıklar konusunda belediyedeki ilgili kişilerin bilgilendirilmesi	
Daha önce başarıya ulaşmış CBS projelerinin incelenmesi	
Gerekli altyapının sağlanması	
Belediye çalışanlarının eğitilmesi	
Diğer: (Belirtiniz)	

7. Belediyenizde CBS konusunda kim(ler)in eğitim aldığını belirtiniz .

CBS'yi tam zamanlı kullanan çalışanlar	
CBS'yi kullanma ihtimali olan bütün çalışanlar	
Sadece belirli birimlerdeki çalışanlar	
Sadece bilgisayar bilgisi olan çalışanlar	
CBS'yi öğrenme konusunda gönüllü bütün çalışanlar	
Üst düzey yöneticiler (belediye başkanı, danışmanlar, vb.)	
Birim müdürleri	
Diğer: (Belirtiniz)	

8. CBS teknolojisi belediyenizde kim(ler) tarafından uygulamaya konulduğunu belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

CBS' den sorumlu bir belediye birimi tarafından	
CBS' den sorumlu bir devlet birimi tarafından	
CBS yazılımının sağlayıcısı tarafından	
CBS yazılımı sağlayıcısından bağımsız bir danışman şirket tarafından	
Bütün belediye içinde farklı birimlerden bir araya gelmiş bir proje grubu tarafından	
Belediye içinde CBS'ye karşı çok istekli olan kişi(ler) tarafından	
Diğer: (Belirtiniz)	

9. CBS teknolojisi belediyenizde ilk defa uygulanmaya başladıktan sonra belediyenizde ne gibi değişiklikler gözlendiğini belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

Aynı CBS yazılımı tedarikçisinden başka CBS araçları alınmıştır.	
Farklı CBS yazılımı tedarikçisinden başka CBS araçları alınmıştır.	
CBS birden fazla departmanda kullanılmaya başlanmıştır.	
CBS belediyenin bütün birimlerinde kullanılmaya başlanmıştır.	
CBS ile ilgili ihtiyaç duyulan birkaç uygulama daha geliştirilmiştir.	
CBS belediyede ara sıra kullanılmaktadır.	
Belediyede CBS ile ilgili herhangi bir değişiklik gözlenmemiştir.	
CBS'nin belediyede kullanımından vazgeçilmiştir.	
Diğer: (Belirtiniz)	

10. Genel olarak CBS'nin belediyenizde kullanılmasından duyulan memnuniyet düzeyinizi belirtiniz.

	1	2	3	4	5	
Az						Çok

11. Önümüzdeki 5 yıl içinde belediyenizde CBS konusunda ne gibi faaliyet(ler) yapılması düşünülmektedir? (Birden fazla seçenek işaretleyebilirsiniz)

Aynı CBS yazılımı tedarikçisinden başka CBS araçlarının alınması.	
Farklı CBS yazılımı tedarikçisinden başka CBS araçlarının alınması.	
CBS'nin birden fazla birimde kullanılmaya başlanması.	
CBS'nin belediyedeki bütün birimlerde kullanılmaya başlanması.	
CBS ile ilgili ihtiyaç duyulan birkaç uygulamanın daha geliştirmesi.	
Belediye sınırları içinde yaşayan halkın da aktif olarak içinde bulunduğu CBS uygulamalarının yapılması.	
Bütün CBS ile ilgili işlerin Internet üzerinden online bir şekilde yapabildiği bir sisteme geçilmesi.	
Belediyenin CBS ile ilgili projelerin tamamını danışman ya da özel sektöre ihtiyaç duymadan kendisinin yapabilmesi.	
CBS ile ilgili bütün işlemlerin cep telefonu/cep bilgisayarı ile entegre bir şekilde çalışacak hale getirilebilmesi.	
CBS yazılım uygulamalarının belediye tarafından geliştirilmesi.	
Diğer: (Belirtiniz)	

12. Halen belediyenizde sürdürülmekte olan CBS projelerinin hangi konularda olduğunu belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

Su	
Çevre temizlik ve atık	
Elektrik	

Yol	
Kent Bilgi Sistemi	
Numarataj (Adres Bilgi Sistemi)	
Veri toplama ve harita altlığı oluşturma	
Yazılım geliştirme	
Vergi İşleri	
Diğer: (Belirtiniz)	

13. Belediyenizde planlandığı şekilde tamamlanmamış veya yarım kalmış CBS projeleri varsa başarısızlık nedenlerinin ne(ler) olduğunu belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

Üst düzey yönetimin destek vermemesi	
Proje liderinin olmaması veya yetersiz olması	
Yetersiz planlama	
CBS proje ve uygulamalarının amaçlarının iyi belirlenmemiş olması	
Gerçekçi olmayan zaman sınırlamaları	
Kanun veya kuralların proje devam ederken zamanla değişmesi	
Organizasyonda köklü değişikliklerin olması (Yönetimin değişmesi, vb.)	
Projeninin amacının dışına çıkması	
Takım ruhunun olmaması ya da zamanla kaybedilmesi	
Projelerde denetim eksikliğinin olması	
Veri konusunda bir standart olmaması	
Belediye sınırları içinde yaşayan halkın kültürel ve sosyal yetersizlikleri	
CBS'ye geçmeden önce yeterli analiz yapılmaması	
Yapılan denemelerin ve incelenen projelerin yeterli bir şekilde değerlendirilememesi	
Yeterli bütçenin ayrılmış olmaması	
Bilgi düzeyi yetersiz çalışanların projeye atanması	
Çalışan sayısının yetersiz olması	
Yanlış yazılım ve araçların seçilmiş olması	
Yanlış kişi, şirket veya kurumlarla çalışılmış olması	
Diğer: (Belirtiniz)	

4. KISIM – Lütfen belediyenizde henüz CBS kullanılmıyor olması ile ilgili aşağıdaki soruları cevaplayınız .

1. Belediyenizde CBS uygulama ve yazılımlarının KULLANILMAMA nedenlerini belirtiniz. (Birden fazla seçenek işaretleyebilirsiniz)

BELEDİYEMİZ ...	
CBS ‘nin getirmiş olduğu avantajlardan habersiz .	
CBS ‘nin belediyeye herhangi bir değer katacağına inanmıyor.	
CBS yazılımlarının belediyeye maliyet açısından çok fazla yük olacağını düşünüyor.	
CBS için gerekli verilerin toplanması, organizasyonu, hatalarının ayıklanması işlemlerinin belediyeye çok büyük maliyetler getireceğine inanıyor.	
CBS konusunda projeleri aktif bir şekilde yürütecek uzman kişiler çalıştırmıyor.	
CBS uygulama ve yazılımlarının gelir-gider dengeleri açısından yararlı bir iş olacağına inanmıyor.	
Diğer: (Belirtiniz)	

2. Belediyenizde CBS kullanımının ne şekilde başlatılabileceği düşünülmektedir. (Birden fazla seçenek işaretleyebilirsiniz)

Daha fonksiyonlu CBS yazılım araçlarının kullanılmasıyla	
Başka belediyelerce yararı ispatlanmış uygulamaların devreye sokulmasıyla	
Kullanımı kolay CBS yazılımlarının alınmasıyla	
Daha kaliteli verinin üretilmesiyle	
Üst düzey yöneticilerin destek vermesiyle	
Yeterli bütçenin ayrılmasıyla	
Yeterli sayıda çalışana ulaşılmasıyla	
Kalifiye çalışanların işe alınmasıyla	
Diğer: (Belirtiniz)	

5. KISIM. Lütfen eklemek istediğiniz görüşleriniz varsa belirtiniz .

Görüşleriniz ...

Anket sonuçlarını almak istiyor musunuz?

Evet	
Hayır	

Anketimize ayırdığınız zamandan ve özveriden dolayı teşekkür ederiz.

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