The Diffusion of GIS at Municipalities in the Netherlands

MSc Thesis

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Abstract.

The theme of this study is the diffusion of Geographical Information Systems (GIS) at the level of municipalities in the Netherlands.

The consequences of the ICT-revolution are concerning the four main traditional functions of government, which are ordering, structuring, achieving, and caring functions. Local governmental tasks are on most areas, strictly defined by higher governmental bodies. Consequence is that municipalities lack competitive needs. They are authorised to manage their own policies on local scale. From historical growth of automation of the old paper files and drawers into computers, information islands arose. Municipalities now have the need of good overview of this data, because of their tasks. Not only for themselves, they also need this more efficient way of managing their data for data exchange with other governmental bodies. Municipalities are the midpoint of data exchange, but are not that well prepared for this task. GIS technology should increase their efficiency of data management.

This study aimed to develop a better understanding of nature and extend of GIS diffusion across and within municipalities. The objectives are to find benefits of GIS use and the barriers to adoption. Success and fail factors are identified as well as a better understanding of development of GIS diffusion in time.

This study has two research levels. One aims to focus on diffusion at municipalities in the Netherlands in general as where the second level goes more in depth. The overall level is explored by a national questionnaire survey amongst all 538 municipalities in the Netherlands. The in depth study case was done by studying strategic papers, studying implementation methods, attending project group meetings and by means of attending the execution of a User need Study. This is a study case among (potential) GIS users in an organisation from a small sized municipality.

One of the conclusions, beside a better understanding of nature and extend of GIS diffusion across and within municipalities, is that half of the municipalities, which started to implement GIS, do this without a vision or a plan for the future. Another one is that GIS within municipalities, is mainly used to perform a registration and maintenance function instead of supporting in the decision-making process.

GIS use has growth from 21% in 1996 to 39% in 1999.

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Chapter 1: Introduction and outline of the research.

1.1 Introduction.

Geographic Information Systems (GIS) increasingly are used in varied application areas. In all kind of sectors of society, applications, and research areas, GIS systems are very helpful (see for instance Grothe and Scholten 1994, Hernandez *et al.* 1999). Public service in general and especially in municipalities, GIS systems can be tools for supporting the tasks they have to perform

GIS had already in 1994, the attention from about 40 specialists of different municipalities (ten Kroode, 1994). The conclusion was that though municipalities are the midpoint of all kinds of spatial data exchange but that they can not act like that. By then, mostly CAD- (Computer Aided Design) or LIS (Land Information Systems) systems had their entrance, in the mostly bigger, organisations of municipalities (Graafland, 1993).

It was in 1994 that the Dutch association of municipalities (VNG) advertised the statement that municipalities should increase their efficiency and gave some advice to the municipalities, to increase efficiency in data management. Many municipalities realised that this was a true statement. Municipalities use spatial information for the performing of several tasks in all kind of departments. Secondly, the management use spatial information in the process of decision-making. On all these levels, there is the need of a tool to combine several data sources and to make good information out of it. In early researches (ten Kroode, 1994) is found that of all the hours spend on a specific task in a municipality, about 60% of that time is spend on collecting and revising of the needed information. About 40% have to do with the actual working with the information related to that activity. Efficiency gains are here at stake. 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. This means that there is much time efficiency to gain, when data is available at all in a good, quick, and accurate manner.

Not only civilians and other public organisations 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.

Increasingly more municipalities have realised that new GIS technology could make their organisation more efficient. In 1996 about 50% of the Dutch municipalities have said that they do not have or use a GIS system (Grothe & Scholten, 1996 p.132) Mostly the larger municipalities have GIS implemented in their organisation. Although the Netherlands together with Australia, Britain and the United States, can be regarded as among the leaders in the field of GIS (Masser, 1998), most of the smaller local governmental organisations seems to wait for implementing this technology, but why?

1.2 Problem statement.

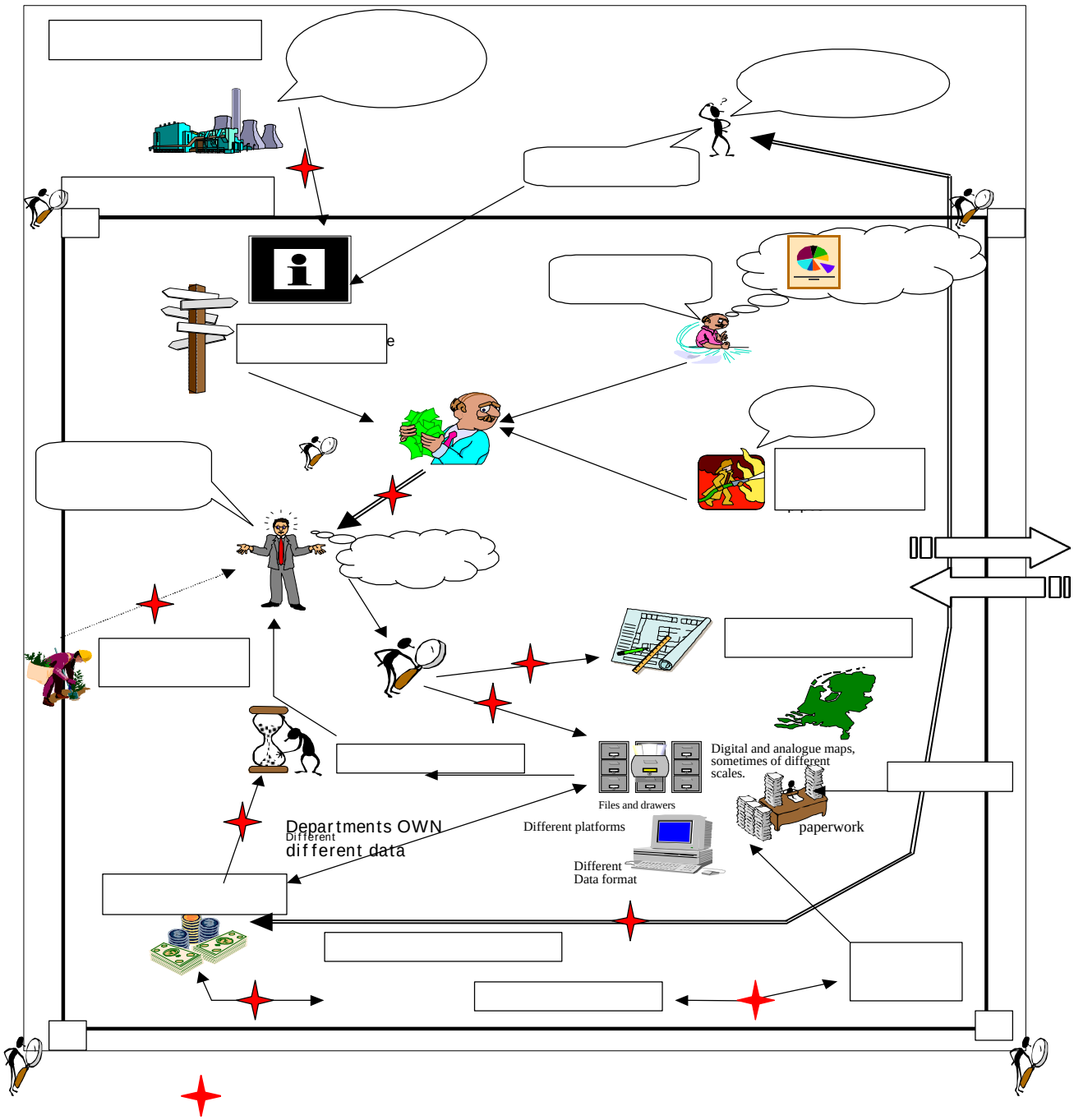
Municipalities are one of the largest application areas for GIS, because they are the owners of many spatial data. The reason is that they need that data for performing their tasks. All kind of application areas may benefit from GIS. GIS can be used in survey, planning, and control tasks. It can replace existing paper records, maps, and drawings. Municipalities may also use GIS for property registration, verdure, sewer and (high) ways maintenance, real estate taxes and several other tasks they have to fulfil. It could increase the internal efficiency, but also the services to the public as well as to businesses and industry.

Municipalities are a kind of organisation on their own (so most people say). The organisation of a municipality can be distinguished from private organisations by their more traditional and hierarchical structure. This mainly relates to the special tasks that a municipality has to fulfil. The tasks are strictly defined en imposed by higher governmental bodies. The government of the Netherlands has four levels.

- Central government, centred in The Hague
- Twelve Provinces
- The regional governments (e.g. waterboards)
- Local government (municipalities)

Because of these strictly defined tasks of municipalities, there is no need to compete with other municipalities in executing those tasks. Municipalities have the authority to manage their own policies. Therefore, there seems to be, at first, no need for a municipality to invest in more, efficient new technologies. 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.

Figure 1.1 Rich Picture analysis of a municipality



Some Examples of View Points from different people, from different departments.	
A	An Information system, which provides info about parcels, environmental issues, sewers, development plans, television/ gas cables, etc.
B	A decision support system (DDS) for the management
C	An inventory and planning system
D	A tax system for house taxes and local rates, with spatial analysis
E	A disaster or fire information system.

From a market research of some Dutch academies and some advice and consultancy agencies (ten Kroode, 1994), appeared that, giving the fact that the data of municipalities are divers and complex, municipalities have lack on good overview of the geographic related data. In addition, an overview on the workflow and information flows is mostly not available. Beside this situation, which is inherited from the past, new developments from outside of the organisation, like the law of the real estates (in Dutch: Wet WOZ ; Wet Onroerende Zaken), and for instance the law of public property restriction (in Dutch: Wet op de publiekrechtelijke beperkingen) have increased the need to have good and clear registrations from within the organisation, but also to increase the possibilities to exchange between organisations (for instance the Cadastre, treasury, water board, etc.).

All these governmental policies, trends and increased inter-administrative relations make it clear that municipalities have to fulfil a junction-function on producing, deliver, receive, and passing through all kind of information, to all kind of organisations (Ravi XXXXX).

In 1996 a big survey (Grothe en Scholten, 1996) in the public sector was done. They researched the use and future use of geo-information and GIS at several relevant public organisations in the Netherlands. Now in 1999, it is interesting to see if, for instance municipalities, are increasingly using geo-information, or are they still the ‘laggards’ of the public sector.

Accessibility and integration of data are the main statements for a good information system. Is, this in the world of municipalities, a fact, are they thinking about this subject, or are the Dutch municipalities staying behind in the world of this new technology? This research must answer these statements.

Is GIS already a common term like word processing- or spreadsheet programs?

1.3 Aims and objectives of the study.

The aim of this research is to develop a better understanding of the nature and extent of GIS diffusion within and across municipalities in the Netherlands, who have already started to implement GIS in their organisation.

The objectives are to find out:

- The benefits of GIS use, and barriers to GIS adoption in Dutch municipalities.
- How passes the diffusion process of GIS in the Netherlands, specifically for the municipalities.
- Which factors explain the introduction in one municipality and the stay behind situation in the other ones?
- How is development of Dutch municipalities in time?
- Technological change, innovation, and the continuing developments in GIS enhance the importance of regular monitoring of GIS adoption in governmental organisations in general and in municipalities specifically. This study is supposed to be an update for earlier reseaches.

1.4 Hypothesis.

- Earlier studies (Grothe *et al*. 1996, Graafland 1989, 1993) mentioned the fact that the number of inhabitants in a municipality and therefore the size of the organisation of that municipality are of possible influence to the success of implementing new GIS technologies
- Smaller municipalities are implementing GIS in departments more than through the whole organisation, as in a 'corporate' GIS use.
- GIS software techniques are increasingly more user- friendly and comprehensive. The reason for struggles in the implementation phase can be organisational ones. In addition, availability of the needed budgets and consistent data are still problems.
- There also tend to be a relationship with bigger municipalities and computer suppliers (Graafland, in: Masser et al. 1996) New techniques are quicker applicable in those organisations for several reasons. Probably money, people, and awareness of influence.
- Early studies (e.g. Masser, 1991) suggests that the initial process of obtaining the necessary commitment for the introduction of a system is influenced by the status and respect the promoting department or group of individuals process within the authority. In other, more popular words, GIS implementation needs a 'champion'.
- The Dutch association of municipalities (VNG) and/or RAVI should be of more help with a structured outline.
- Technical departments within a municipality take the initiative to, at least to look at the possibility, to implement GIS tools into their departments.
- Meta-data is of crucial importance for the development of GIS systems in an organisation.
- To implement GIS systems, some municipalities just buy a system by a supplier and introduce this into the organisation.
- Creating awareness of the benefits of a GIS to the management is of strategic importance for a successful implementation.
- To increase experience, and enthusiasm for using GIS, the (potential) users needs good training and education.

1.5 This Study

The concept within this thesis has been explored by the drawing of a mindmap (Appendix B). In this mindmap, all relevant issues, discussed in this thesis, are forming a base for structure. The subjects are structured around the elements of O.P.A.F.I.T and DATA. In chapter 3.1 O.P.A.F.I.T. is explained. Another base was the drawing of the rich picture (see *figure 1.1*). In this picture, important elements and problems in the organisation of a municipality are mentioned. Some factors, which influence co-operation between departments, and (possible) problem points, are identified.

This study contains two research levels.

1. Total overview of diffusion and its problems across the Netherlands
2. A more in depth study among the (potential) users in a municipality.

1.5.1 Survey and statistical analysis of the questions.

To study the total overview of diffusion and its problems across the Netherlands, this part relies on a big questionnaire survey; sent to all 538 municipalities. Base for this survey and questionnaire were two other big questionnaire surveys of the past. The first one is done by Grothe and Scholten (1996). Another survey with about the same structure as this is done in the retail sector in 1999 by Hernandez *et al,* (1999).

Before the questionnaire was send out, an exploratory survey at some municipalities in the Krimpenerwaard was carried out. To get the questionnaire structured, some colleagues of the municipality of Nederlek played the non-perfect respondent. Finally help from the Dutch Clearinghouse organisation (NCGI), gave the final changes.

The questionnaire was send to all municipalities in the Netherlands. The decision to send it to all municipalities lays in the fact that this study can be a serious update of the study of 1996. Beside this, the thought excised that some organisations might be interested to be involved in this research, like for instance the Dutch association of municipalities (VNG) or the RAVI. It ended up in a co-operation of the municipality of Nederlek, the Free University of Amsterdam (UNIGIS) and the Dutch Clearinghouse organisation (NCGI). Parts of the questionnaire were talked over with the people, and taken from the survey in the retail sector (Hernandez *et al*., 1999). Comparison between the two sectors is therefor possible.

1.5.2 Case studie.

Beside a big national survey involving all 538 municipalities, an in-depth case study was carried out. Mainly to prove some outcomes from the main survey and to get more details about what factors to success and failure are of influence. Are there lessons to be learn? This municipality used for case study research, have successfully implemented GIS techniques into their organisation so far.

For this case study, important documents and reports were studied. Also a questionnaire survey was reviewed as part of the whole initiation phase, this organisation started with.

The questionnaire, used by this organisation to carry out a User Need Study (UNS), is also built around the O.P.A.F.I.T. elements.

1.6 Document overview

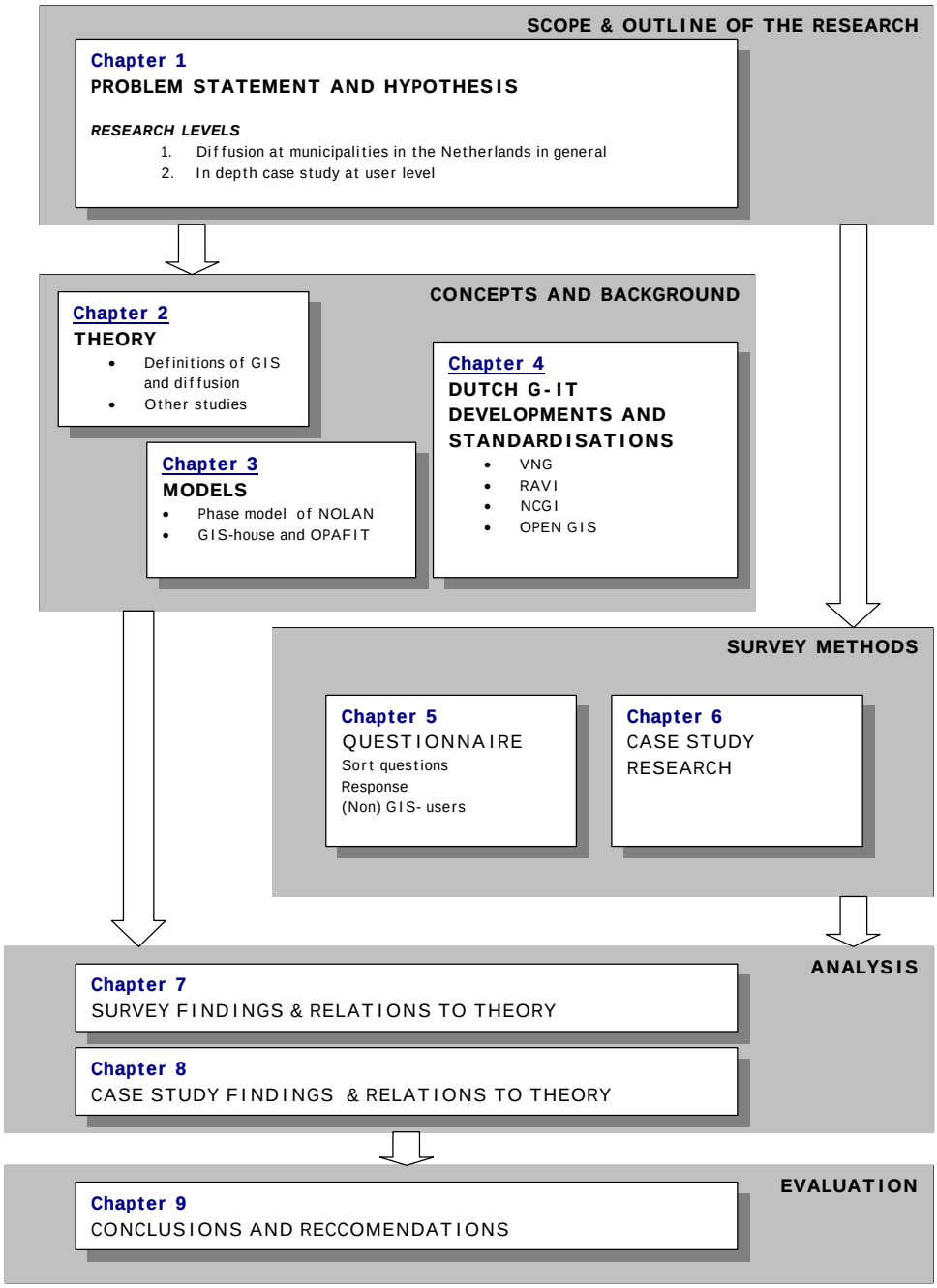
This dissertation consists of five main parts (figure 1.2):

1. Scope and outline of the research
2. Concepts and theoretical background.
3. Survey methods
4. Analysis
5. Evaluation

In Chapter 1 the problem statement and outline of this study is set. Because of the absence of competition needs, strictly defined tasks by higher governmental bodies and the authority to manage their own policies on a local level, municipalities are organisations, which are on their own for determining their data strategies. Their data area is very divers and of large amount, for doing their tasks. Therefore, they are one of the largest potential application areas for GIS. Because of those tasks, the need to exchange data with other governmental bodies and third parties is present. Municipalities fulfil a midpoint function in that. However, the historical growth of island automation prevents this from doing this efficiently and effectively.

The aims of this study are described and the start of the problem statement is pointed out in this chapter. Hypothesis are set, which will be tested in chapter 7and 8.

Figure 1.2 Structure of the thesis.



In Chapter 2 the theoretical background, mainly Graafland (1993, 1996) and Grothe & Scholten (1996), are used to set the context of this study. Definitions of GIS and the general theory of diffusion are set out.

The phase models of Nolan and the interpretations of Graafland and King & Kreamer are used, in chapter 3, to categorise the diffusion of the governmental organisations. The emphasis lays on the need of a good infrastructure in form of a GIS-house model. The infrastructure consists of data, hardware, software, communication, users, finance, and applications. The connection between al these components can be seen as a GIS-house concept.

These components have to depend on country specific standards and organisational agreements. These are pointed out in chapter 4. This is about the Dutch geo-IT developments and standardisation. Also the concepts of meta-data and the OpenGIS developments are of importance of GIS implementation in municipalities.

Chapter 5 and 6 are setting reference to the methodologies used to gather the needed information. Two research levels are set out. The first one is to research diffusion developments in among the municipalities in the Netherlands, done by a questionnaire survey. The second level contains a in depth study case for researching the main findings done by reviewing strategic documents, followed implementation methods and reached results.

Chapter 7 contains the descriptive outcome of the questionnaire, with tables to visualise. The content of the questions is about GIS use, Meta-data, GIS adoption, -use and -development and about the Non GIS users. Space was provided for additional comments of the respondents.

Chapter 8 contains the findings of the case study. The emphasis is about the followed methods, starting with the outcome of the user need study. All needed components and problems are brought together in a Geo Open up Architecture.

Chapter 9 provides the conclusions and recommendations of this study.

Chapter 2: Earlier studies.

2.1 Introduction

In the Netherlands, not much research is done recently in the public sector in general and especially not in municipalities. Those studies available are out of date by now, because of the enormous growth of the GIS industry. The first important research in the Netherlands done by Graafland (1989) was in 428 municipalities. He made an overall survey on the automation within municipalities. The focus was on the relation between administrative data processing and GIS. The second research of importance by Graafland (1992) was in eight Dutch municipalities at 45 municipal departments with GIS. He aimed at testing and adapting a descriptive model, which describes the development of GIS related to administrative data processing in municipals (see chapter 3 about Models). This was an important research, which lays some fundamental models mainly based on the models of Nolan (1982) and King and Kraemer (1984). In chapter 3 these models are worked out in more detail.

In 1992, Heliview did already research GIS use than, but a more recent important academic research in the public sector is from Grothe and Scholten (1996). They researched use, position, and function of geo-information in the Public sector. From the total respondents of all governmental organisations 355 questionnaires were returned by the municipalities (*table 2.1*). These studies in the public sector were important ones. Others, not always scientific researches, like van Nunen, (1998) and DHV (1998) only confirm the statements from these big surveys. A UNIGIS workshop meeting in September 1998 with eight UNIGIS diploma students from municipalities, on the Free University of Amsterdam gave answers to success and fail factors for implementing a relatively new technology into an organisation.

Although in private sector the use of the relatively new technology is increasing (Hernandez *et al*., 1999), the largest (potential) users of GIS technologies are governmental bodies. In this chapter, some findings of earlier studies are worked out. First, some definitions of GIS and diffusion are explained.

2.2 GIS explained.

Campbell (in: Masser *et al*, 1996) stresses that GIS combines the key elements of machines, methods, and knowledge. The innovative character of GIS technology would largely seem to be a reflection of developments in computing capabilities. Computer based versions of GIS have been available since the 1960s and in a manual form for many decades. However, it is the increased capacity and resulting speed with which computer processors can handle the vast data sets associated with geographical information, which has made GIS a commercially attractive product.

In fact, every information-system, that can manage spatial data, can assumed to be a spatial or geographic information system (Grothe & Scholten, 1994). Specific related to the context of the tasks, a municipality has to fulfil, we can distinguish several specific information systems. Ottens & Amer (1991) mentioned the following software systems:

1. *Computer Aided Design (CAD):*

   Graphical systems specifically developed to drawing, designing, and construction tasks.

2. *Automated Mapping (AM):*

   AM is applied to draft and design of high quality (topographical) maps.

3. *Desk Top Mapping (DTM):*

   Computer aided designing and drafting of thematic maps.

4. *Land Information System (LIS)*

   Registration and maintenance of proprietary rights.

5. *Facility Management Systems (FM):*

   Registration and maintenance of infrastructural supplies.

6. *Geographic Information Systems (GIS):*

   Spatial-, analytical instrument to support decisions.

7. *Earth Image Processing and Remote Sensing (IP/RS):*

   To process satellite images.

8. *Global Positioning and Navigation Systems (GPS/NS):*

"Real time" systems for determining position, routes, traffic control, etc.

9. *Co-ordinate Geometry (COGO):*

   Conversion systems for geodetic data applicable into GIS's.

All these systems can be divided into four main categories (Grothe & Scholten, 1996):

1. Systems for gathering spatial data (like IP/RS, COGO, GPS/NS);
2. Systems for designing (like CAD);
3. Systems for registration and business maintenance (AM, FM, LIS);
4. Systems for decision support (DTM, GIS).

According to this study and others (Grothe & Scholten, 1996, Nunen, 1999) the use of GIS in municipalities is, besides small use of decision support, mainly focused, to gather, structure and combine data from different data sources, mainly to ease certain tasks. Desktop Mapping is often the first step for expanding towards a bigger GIS system.

In the first place, GIS's are an information system, which can process much data. They offer functions for collecting, storing, processing, retrieval of spatial data.

The list of definitions of Geographic Information Systems is increasingly growing. Hernandez *et al.* (1999) have summed most important and common ones. Beside this reiteration of some common ones, there are some others added to the list

GIS is:

> *'A group of procedures that provide data input, storage and retrieval, mapping and spatial analysis for both spatial and attribute data to support the decision-making activities of the organisation.' (Grimshaw, 1994, p.26 in: Hernandez* et al*., 1999)*

> *A system for capturing, storing, checking, manipulating, analysing and displaying data which are spatially referenced to the earth.' (DoE, 1987, p.132 in: Hernandez* et al*. (1999))*

> *'A powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world.' (Burrough, 1986, p.6, in: Hernandez* et al*., 1999)*

'A decision support system involving the integration of spatially referenced data in a problem solving environment' (Cowen, 1988, p. 1554 in: Hernandez et al*., 1999)*

'A system of computer hardware, software and procedures designed to support the capture, management, manipulation, analysis and display of spatially referenced data for solving complex planning and management problems.' (FICC, 1988, p.88 in: Hernandez et al*., 1999)*

'A system of hardware, software, data, people, organisations, and institutional arrangements for collecting, storing, analysing and disseminating information about areas of the Earth' (Dueker and Kjerne , 1989).

'The whole of activities and means to provide users with the geographic information needed to carry out tasks and to take decisions in the context of spatial problems'. (Scholten H.J., 1991 in: Douven, W., 1997)

Different people for different application areas make these definitions from different points of view. Some elements are more or less in all definitions. A spatial component makes it **G**eographical. Much data from different sources, different suppliers from different hardware platforms, combined, analysed together and interpreted makes it (new) **I**nformation. The concepts and people in an institutional environment, together with the G and the I makes it a **S**ystem.

In general, there are three main tasks to fulfil with a Geographic Information System (Grothe *et al.,* 1994):

1) To order, maintaining and integrating big amounts of spatial data

2) To analyse the spatial data

3) To present the data or outcome of the analysis in cartographic or thematic maps.

Implementing a system into an organisation comes in different phases. Crain and MacDonald (1994, in: Maguire, 1991) identify three phases during the life cycle of an operational GIS. In the First phase, GIS is mainly used to support inventory activities (the collection and integration of spatial data). In the second phase, more attention is paid to spatial analysis, while in the third phase the level of inventory and analysis applications is fully mature and applications focus more on the support of management (Douven, W., 1997). Models and phases are explored in more depth in chapter 3.

This study should underline these definitions given and define in what stages the most of the municipalities are in.

2.3 What is diffusion?

Several people in literature have several opinions on what diffusion is. Rogers (1993) refers the term 'diffusion' to the process whereby technological innovations such as GIS are adopted and taken up by various user groups. He stated that there are four main elements in the diffusion of new ideas:

an innovation,
which is communicated trough certain channels,
over time,
among members of a social system.

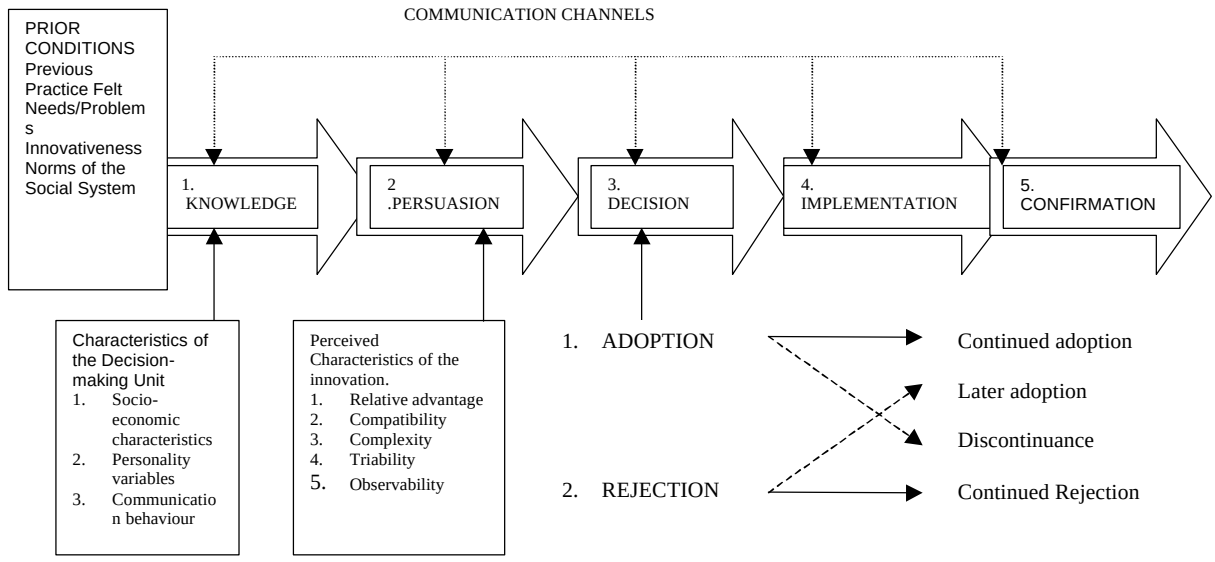
This covers not only the technical quality of the innovation itself but also on the social and political context within which it takes place. Rogers (1993) and others, who researched the topic of diffusion, have a great deal of evidence that the process over time can typically be represented by an S-shaped curve. This implies that the initial rate of adoption of technological innovations is likely to be relatively slow until a critical mass of users is achieved after which the rate of adoption increases very rapidly. A communication channel is the means by which messages get from one individual to another. Mass media channels are usually more effective in creating awareness-knowledge of innovations, whereas interpersonal channels are more effective in forming, and in changing, attitudes toward a new idea, and thus indirectly influencing the decision to adopt or reject a new idea. Most individuals evaluate an innovation that they are considering adopting, not based on scientific research by experts, but through the subjective evaluations of near-peers who have previously adopted the innovation.

Time is involved in diffusion in the innovation-decision process. innovativeness, the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than are other members of a social system, and an innovation's rate of adoption. The innovation-decision process is the mental process through which an individual or other decision-making unit passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision (Rogers 1993).

Rogers (1993) described the diffusion of innovations. An innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption .The characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption. Five attributes of innovation are:

1. Relative advantage
2. Compatibility
3. Complexity
4. Trialability
5. Observability

Figure 2.1 stages in the innovation-decision process (Rogers 1983, p.165)



Two important differences between GIS and most innovations.

a) GIS is an evolving technology, which is constantly changing over time. Under these circumstances, reinvention is an important technological change during the course of implementing their systems.

b) GIS are acquired by organisations rather than individuals, as is the case in much of the classic diffusion research. Because of their greater complexity, there are very large differences between the ways the same technology is utilised in different organisations. Consequently, there is a need for a more sophisticated treatment of organisational and institutional behaviour than has been the case in many past diffusion studies.

Two basic spatial models (Masser *et al*, 1996) of the spatial dimension of the diffusion of technological innovations, which are of interest are the

a) Hierarchical model and

b) The core-periphery model

a) The hierarchical model assumes that adoption will begin in the larger organisations and subsequently diffuse to smaller organisations. Large centres are seen as being more open to the outside world because of their size and more likely to take on the role of pioneers. Conversely, they stated that small centres are less likely to be aware of new developments and less likely to have the necessary resources to experiment with new tools.

b) This model assumes that adoption also will begin in core cities or regions because of their size and their links to the outside world and then spread outwards to peripheral cities or regions which are less cosmopolitan in character and have fewer resources at their disposal (Masser *et al*, 1996).

2.4 Early researches

Research in governmental organisations in the Netherlands, are not much done. There are however some important ones of Graafland (1993) and Grothe & Scholten (1996), but probably out of date by now. There were also some foreign researches recently done in local governments which were used to study diffusion and adoption at an overall level (Masser, 1996).

2.4.1 Foreign research.

Masser *et al.* (1996 and Masser, 1998) studied adoption and diffusion of GIS in different countries in Europe. This showed that while there were many common features between the experiences of the countries researched, with respect to the recent history of diffusion, there were also some important differences between them. One of the most striking differences they found in that study concerned the links between digital data availability and the level of GIS diffusion. The findings of those case studies suggested that the question of digital data availability was not simply a matter of the information rich vs. the information poor. It was much more a question of central and local government attitudes towards the management of information. Countries with relatively low levels of digital data availability and GIS diffusion also tended to be countries were there had been a fragmentation of data sources in the absence of central or local government co-ordination. Conversely, countries were government had created a framework in terms of responsibilities, resources, and standards for the collection and management of geographic information also tended to be those with relatively high levels of digital data availability and GIS diffusion (Masser, 1998).

2.4.2 Graafland.

Graafland (1989) already concluded that the demand of good uniform information systems was present. The instruments were also available, although in a less advanced way they are in now. The only question was: Why do municipalities not use these tools in their way to mature information supplies. This still seems to be the question.

As already mentioned, municipalities have freedom to develop their own policies for coming to better business, dependent on their own demands. Graafland assumes that this is one of the reasons. Differences in needs are there in three sorts.

1. Structural, depend on factors which do not change. This can be the size of the municipality
2. Temporal difference depends on factors, which do change. This can be difference in computer and/or automation experiences.
3. A combination of the two.

One of the conclusions of Graafland (1989, 1993, 1996) is that there are some general growth statistics in municipalities. He concluded that the increasing budgets of IT and automation, complexity of the organisation and the involvement of the management are the growth statistics of a municipality.

According to Graafland (in: Masser, 1996) there tend to be a relation between larger municipalities and computer suppliers. Mostly Municipalities with a co-ordinating department with a strong position have a strong tie with a system supplier or software house.

His findings were also that more than half of the GISs existing in the municipalities investigated have a register function only. Only a small part is used for analysis and a third part for planning. None of the municipalities investigated are GIS used at the level of decision support for (strategic) planning.

He also found in his research that GIS are conditioned by three elements:

1. The size of the organisation.
2. The experience with new technology.
3. External circumstances.

External circumstances in this context can be technological issues and methods. On the other hand, the actions of higher governmental bodies can be of influence. They also can influence the acceptance and implementation with legislation or bonuses. The size of the organisation and the experience with new technology contains also the variables of cost effectiveness of computer systems, specialisation and expertness of the organisation.

Realising integrated systems depends therefore on the technical-, financial-economic-, and organisational possibilities (Graafland, in: VI-matrix, 1999). He implicates with this statements that realising an integrated system in smaller municipalities is more problematic. Technical and financial-economic issues are the main problems. Bigger municipalities can have problems too. Integrating corporate systems can be a problem because of position, experiences and interests in the different departments, a big organisation consists of. That leaves the middle big municipalities. They have the biggest chance of successful implementation, because of the most favourable circumstances.

2.4.3 Grothe and Scholten.

In 1996, Grothe and Scholten researched the use of geo-information and Geographical Information Systems (GIS) at the public sector in the Netherlands. The survey focused on the use, position, and function of GIS in the public sector. By then, they found that about 50,6% was in phase 1 (start) after Nolan, and 29,3% was in phase 2 (diffusion). Only a small number of municipalities found themselves into phase 3 (maintenance), with 16%. Phases of Nolan are explained in paragraph 3.2Another conclusion was that experience was still limited. Causes varied from mainly organisational to more technological ones.

Table 2.2 Recent research to GIS use at Municipalities in the Netherlands.*(after Grothe and Scholten, 1996)*

	Heliview 1992				**GITC 1994**				**Grothe and Scholten 1996**			
	Total Response		GIS use		Total Response		GIS use		Total Response		GIS use	
	Abs.	R/P%	Abs	%	Abs.	R/P%	Abs.	%	Abs.	R/P%	Abs.	%
< 10.000	103	39,7	1	0,9	81	35,3	2	2,4	129	57,5	3	2,3
10 – 20.000	87	42,4	7	8,0	66	30,5	11	16,6	117	54,1	19	16,2
20 – 50.000	55	42,3	18	32,7	50	37,0	24	48	80	58,3	31	39,2
> 50.000	23	43,3	13	56,5	25	44,6	20	80	29	51,7	23	79,3
Total	268	41,4	39	14,5	222	34,9	57	25,6	355	56,0	76	21,4
R/P = Response / Population												

Although population and response rate differ, we see a growth in the world of municipalities. The research of 1994 has a low response rate and therefore not representative in relation to the research of 1994 and 1996. It shows however that all categories have grown. Total growth has increased from 14.5 % to 21.4% in four years.

The fastest growth is in municipalities with more than 50.000 inhabitants. Increase was made from 56,5 % to 79,3%. Second fast is the category municipalities with inhabitants between 10 and 20.000. Increase was made from 8% to 16,2%.

2.4.4 DHV 1998.

The questionnaire of DHV sent to 588 IT- co-ordinators of municipalities' incl. conurbation offices had a total response of 35 %. The questions asked, were mainly about hardware and software. There are no scientific details known about the accuracy of this survey. It is however interesting, in the context of how many municipalities are using GIS software, to see what software and database programs they are using. The topics covered in the survey were networking, PC/mainframes, client-software, database-software, CAD-software, GIS-software, planning/control software, GIS and CAD software joins with planning/control software and about supplying information through the internet. The main conclusions were:

Server-software: Novell is still the leader in the server-software with 60%. Unix is with 22% second most used and Windows NT with 11% became the third most used server-software program. In the future Novell will still be most used (52%), but Windows NT and Unix (22%) will be equally more used. Municipalities are also big users of IBM-AS/400 machines with OS/400 as its software.

Looking at the response about database-software, we see that Oracle is now already the biggest representative (25%) in local government organisations. This will only increase in future to about 42%. Second most used is dBase (24%). This will be replaced by MS-Access in the near future (19%). Informix is third most used (16%).

The questions about the CAD software, shows that Microstation (37%) and AutoCad (32%) are the main leaders. Third most used is software from IGOS (16%), country specific software. The main conclusions are that Microstation will increasingly (41%) be used together with IGOS (19%) at the cost of AutoCad (26%). Municipalities will also replace CAD software with desktop GIS software as, for instance, ArcView.

Looking at the GIS software used in municipalities, we see whenever GIS software is used, this mainly is ArcView (23%), NedView (16%) and Microstation MGE (19%). MapInfo, AutoCad Map, and some others will be decline in future to less than 4%. Sort of GIS software used is mostly the desktop GIS software. Big GIS software programs as for instance ArcInfo (7%) is not used much in municipality organisations yet, but will somewhat increase to 9%.

Interesting is to see are the plans for the Internet. Most municipalities are willing to use that medium in the near future. The techniques for bringing together GIS and Internet will be the logical next step.

2.4.5 Nunen,1999.

The study focused on GIS at municipalities in general, the GIS diffusion process and about GIS on departments of the town and country planning specifically. The main goal was to promote GIS as tool in the decision-making processes in the town and country planning and the town-building areas (Nunen, 1998). This study involved 15 municipalities.

GIS can integrate different data formats from different data sources as explained in section 2.2. In the academic world, GIS's became useful there, for advanced analysis. One of the conclusions of this research was that GIS, in the environmental planning sector of municipalities, was not used for doing such complex analysis. They merely used GIS as tool to explore data, to view and to visualise data.

The main findings of this research were that town and country planning departments could not pull GIS into the organisation. Municipalities want to form first a good base by ordering and reorganising their data and their data management. Town and country planning uses several other sources of information, like the land records and people information. When that information is not up-to-date or not useful for combining and integration, they cannot use a GIS system for policy making. They can use it, however, as a view and query tool for maps with town and country information, just like the paper ones. One of the proposals is also to make the GIS environment more 'user-friendly'.

Other conclusions are similar as some of the conclusions drawn in this study. Implementation can be successful if at least three points are covered.

- Creating awareness to the people who use to work with GIS
- Definition of the base data for the GIS system
- The availability of enough money.

2.4.6 Workshop VU

In September of 1998 eight students of the Dutch UNIGIS diploma network, working at municipalities in the Netherlands, were discussing about the subject "GIS at municipalities". In this workshop students of some big and somewhat smaller municipalities were present. These UNIGIS students are working at the municipalities of

- Amsterdam (718.151 people)
- Eindhoven (198.339 people.)
- Apeldoorn (152.354 people)
- Emmen (105.228 people)
- Barneveld (46.868 people)
- Leidschendam (34.698)
- Rucphen (22.308 people)
- Nederlek (14.843 people).

It was not that clear determining the phase each of them was in. However, nobody reaches phase 4 (after Nolan). Some of them were at the end of a phase and that means a new phase begins or the project fails or at least stand still.

The conclusions drawn were that implementation of a GIS technology related to several subjects. Subjects mentioned were:

- Available budgets
- Structure of the organisation
- Awareness of the management
- Good, accurate data available
- Having a good overview of developments
- Basic registration have to be complete
- Internet technology can be helpful.
- Co-operation of several departments involved
- Corporate GIS or department GIS
- Having and keeping awareness at the management and the (potential) users of several departments is important.
- Working with the available standards (GFO's) helps
- Mix of Bottom Up and Top Down approach will succeed
- The need of 'champions' with a vision.

Other subject was the quickness of implementation of the GIS technology. Some possible causes discussed were:

- Developments from processes to information management
- Developments from automation to information
- From CAD towards GIS
- Municipalities having no clue what information-management is
- Only top down or Bottom up does not work
- Thinking from intern to extern costs time
- The size of the municipality is of importance (it can also be too big)
- The need of a champion
- Processes within a municipality stay separate
- Co-operation with other municipalities can be a solution.

Chapter 3: Models

The benefit to the success of the policy of a municipality can be the way in which the governor Managers, civil servants, servants of the maintenance department, etc are having access to information that fulfil their information needs.

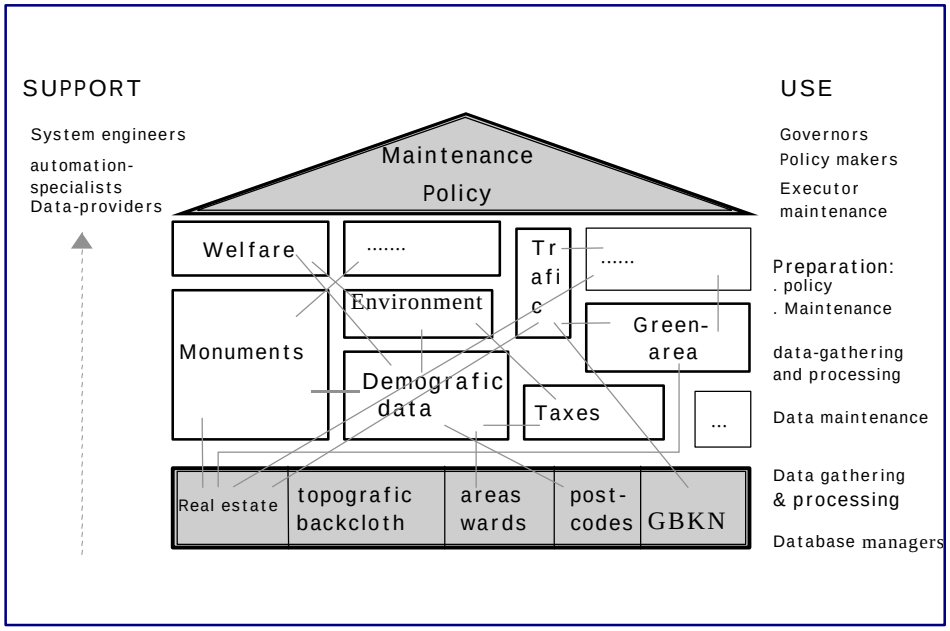
The need of a good spatial related information infrastructure has increased enormous because of all kind of developments and laws. About 80% of the information in a municipality is spatial related. Rhind pointed out the role of the governments (Rhind (1995) cited in Masser (1999)): *Government is almost everywhere the primary sponsor at present of the national geodetic framework and the source of 'framework' data provided by the topography (used in the widest sense). It is also typically the source of geological, soils, meteorological, pollution, demographic, land ownership, taxation, employment and unemployment and many other national datasets, including statistical time series".*

A good structured information infrastructure is therefore of importance for the most departments in a municipality. The infrastructure consists of data, hardware, software, communication, users, finance, and applications. The connection between al these components can be seen as a GIS-house concept (Scholten en Kok, 1993 in: Grothe and Scholten, 1996).

3.1 GIS-House

GIS adoption in organisations contains more action than just buying the hard- and software components. Other factors that play a crucial role are the data, administrations, finances, applications, and the organisation itself with its communication processes and workflow. A model within the development of a vision and structure, were all aspects of an information-structure are having its place, can be the GIS-house and the OPAFIT structure. In this structure, consisting of some concepts, all the aspects of this information infrastructure have its place.

Figure 3.1 The GIS-House concept.



The GIS-house concept consists of four main components and two sides:

- The roof
- The foundation
- The building blocks
- The cement

The roof of the GIS-house consists of the information products made by different data layers and by applying the GIS tools. For example, a development plan or environmental zone plans. These products are the end-products of the data-processes and are mend to support policy- and maintenance decisions. The products are therefore the roof of the GIS-house.

Opposite the roof is the *foundation* or the basis of the GIS-house. Opposite the products of a municipality are the spatial related basedata. These can be the Dutch Basis Map (GBKN), the land record map from the Cadastre, postcode district map or the topographical map (TOP products from the topographical service of the Netherlands). In addition, aerial ortho-photo's can be base data. In addition, a district map with the borders of each district is such foundation. Accuracy, actuality, and uniformity are the main items for a good foundation.

Between the products (roof) and the spatial related base, data are the alphanumeric databases. By means of several processes are alphanumeric databases and the spatial related data integrated and becoming information in form of tables, graphs and especially maps. These alphanumeric data are the *building blocks* of the GIS-house.

The cement is forming the connection between the other three parts of the GIS-house. Cement will make the parts stay on its place and are together a solid mass, were it is nice and good to live. In the geo-information, the cement is represented by the standards, the procedures, information about the data (meta-information) and agreements about all the parts of the information structure.

The GIS-house consists of two main parts. One part is related to the maintenance of the hardware, software, and data. This site is the *supportive part*. The task of this supportive part is to keep the GIS-house in a good condition and that the foundation remains up to date. Although this part is carried out on the background, this part is as important as the part of the other part of the GIS-house.

The other part of the GIS-house is addressed to the production of the information for the departments (intern) but also for external use.

The GIS-house forms the model of the information structure of an organisation. For the execution of the processes, there is the need for some components, which can be gathered in the concept of **OPAFIT.** This stands for:

O = organisational aspects

P = personnel

A = Agreements, procedures and standards

F = Finance

I = Information (function of the GIS)

T = Technological aspects

***O*rganisation.**

The Information system has to be framed in the organisation. This means that there is a need for an organisation-structure that can support and direct the implementation process. In this part of the framework is arranged who has certain tasks and what are his responsibilities.

The role of the management must be recorded in this part. On one site they are the clients of the products and on the other site they are responsible for the investments-decisions taken. It is therefore extremely important to create awareness in the organisation and among the management.

***P*ersonnel.**

This part has quantitative and qualitative aspects. What type of GIS-users are there, how many persons are needed for maintaining the GIS, what should be the level of knowledge about certain parts, do they need additional training, etc.

***A*greements, procedures and standards**

Already in an early stage is the need to confirm the municipality to standards. Standards in Hardware, software, communication, way of information development, user-interfaces, etc. are very important.

Within the organisation sometimes are already several standards. They have to be taken into account.

Agreements, procedures, and standards are refers also to things like:

- What authority has the GIS-working-group?
- How are budgets spent?
- Is there an allowance for having initiatives outside the working-group?

By making good agreements and procedures, it will all be clear to everyone how to act.

***F*inance**

Investments in hardware, software, people, and data have to be clear. Initial investments and structural expenditure have to be clear. It also has to be clear what to get for these investments.

***I*nformation**

In this part is the need of internal and external information worked out. What is the supply and demand of information of the organisation? What are the possible obstacles by exchanging information and integration of data?

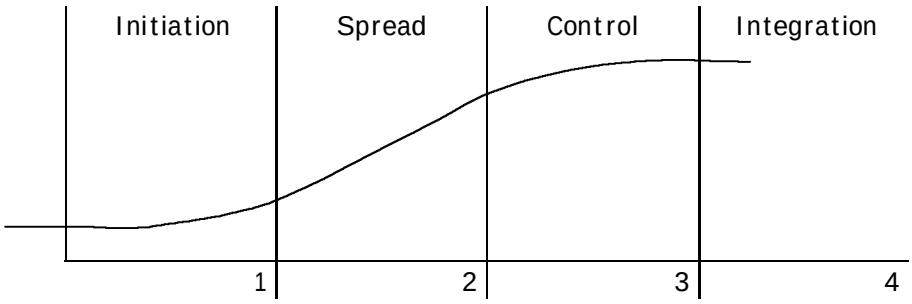
***T*echnology.**

The amount and type of GIS-users and its wanted functionality are the main factors for determining the right hard- and software configurations.

3.2 Nolan

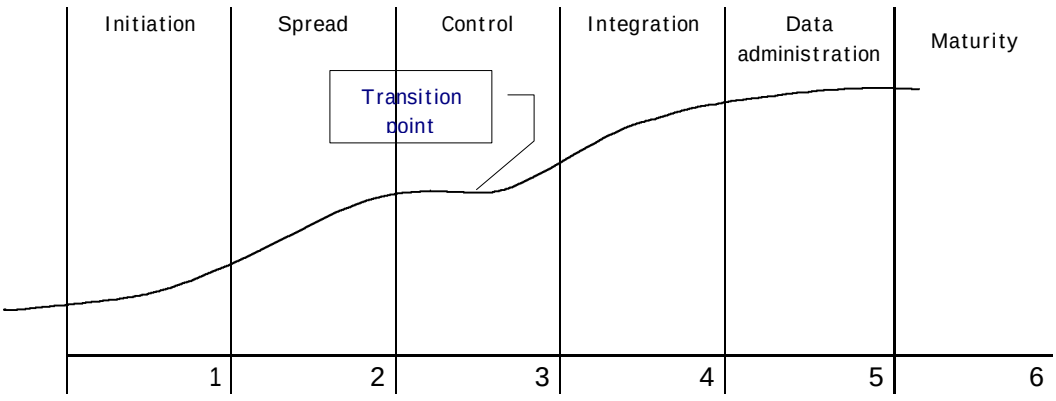
Nolan introduced a phase theory analogue to the growth cycle for organisations who are starting to introduce (administration) automation technology within the organisation (Nolan 1973 and 1974 cited in Graafland,1993). At first there were four phases in his model (figure 2.3).

Figure 3.2 First model developed by Nolan.



Use and further research led in 1979 to a modification of the original model. Two phases were added to it. The four phases are integrated in this six phase model. The model has now two S-shaped curves (figure 2.4).

Figure 3.3. Phases of growth by Nolan, modified model.



This model is common applied (David en Olson, 1987) as conceptual model, for recognising the present phases of growth and for planning of changes, needed for a responsible step into the next phase. In most studies and in this one too, is this model applied for indicating the position of, in this case, the municipalities.

Others like King & Kreamer (1984) and for instance Graafland (1993) in the Netherlands modified this model and gave their own interpretation.

3.3 King and Kraemer

King and Kraemer modified the model of Nolan a little, after their research in the USA. In general, the model is about the same as of Nolan. One of the conclusions of their additional research was that there is a relation between the management policy, which should reduce automation problems and just the presence of those problems. Nolan also concluded that the awareness of the management about the automation problems comes when spread and costs in the organisation have expanded enormous (Graafland, 1993).

Another conclusion of King and Kraemer is that a reason for a fast implementation of automation means is the co-operation of the managers from the municipality and a supplier of soft-and/or hardware. County council and management team can influence the developments of automation by having a vision to information development. They should have a vision and therefore supply a top-down approach. The strategy they recommend (in: Graafland 1993) is, beside the central control and a vision, a flexible implementation. Departments can develop their own solutions within a framework of agreements. Essential is the thought that controlling the process is more important than the architecture of information supply. Departments should find their own solutions within the agreements of standards, exchangeability, and maintenance possibilities.

3.4 Graafland

It is common excepted by now that a phase model is a recognised instrument to categorise a development stage on a certain point. Graafland (1989 en 1993) developed a model for municipalities, based on the models of Nolan (1982) and King and Kraemer (1984). His findings in Dutch municipalities demonstrated that the phases of Nolan together with the characteristics could not be general applied. The common growth characteristics, like increasing of automation budgets, degree of automation, complexity and the concerning of the management can.

The first two phases of development of new technology, have a clear bottom up characteristic. Initiatives from the users, mainly the system operator and suppliers of data who are stimulating the development in the first place. These developments do not lead automatically to integration. Planning and integration of data eventually conflicts with the limitations of the excising organisational structure and organisational culture. Changes of responsibilities in the organisation and bridging the differences in discipline and department culture cannot happen without the careful but persuading influence of the top management. Phases 3 and 4 are characterised by a top-down approach.

Figure 3.4 Phasing of development of new technology

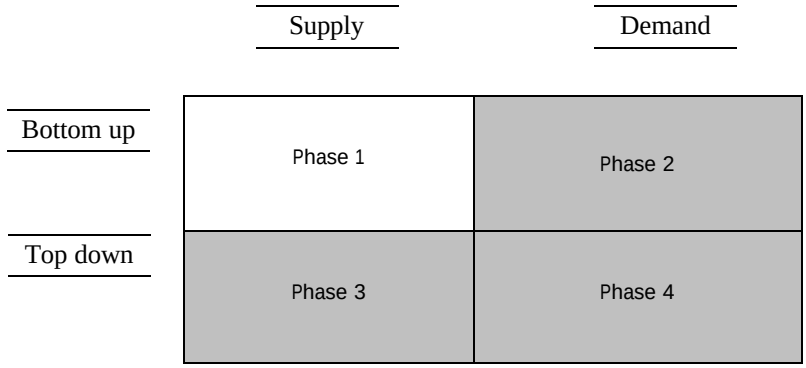


Table 3.5 The characteristics of the four phases according to Graafland:

1.	Initiation	Development of automated applications, enthusiasm, information islands, and big differences between departments.
2.	Local control	Developments of standards, more complex applications and first (internal) data communication, first supporters of infrastructure (basic registrations) and first initiative to that, attempts are made to involve remaining departments in a certain way, a few stay entirely behind, management gets more and more involved and aims at formalisation of decisions about information systems.
3.	Infrastructure development	First basic registrations, infrastructure development gains support, control becomes more top-down, substantial change in organisation with co-ordination at a higher level
4	Integration	Adjustment applications to infrastructure (base registration), integrated (graphical) information systems, organisation wide GIS

According to the theories of Nolan, every phase will end in a crisis. The solution to come out of this crisis is the characteristic to the next phase. Crises of each phase can be formulated as:

End of phase 1: “champions” notice that developments stagnate by the departments, which stay behind.

End of phase 2: management sees that developments of automation are becoming out of control. They recognise the strategic value of automation.

End op phase 3: Too strong formalising of automation. Not much freedom of innovative ideas.

3.5 Conclusions

All models, based on the theories of Nolan, give insight in the development of new technology in a governmental organisation. Effective implementation of GIS’s in governmental organisations depends on: clear leadership, strong interest of the management and the technical capacity (Masser, 1992). By studding the models it became clear that starting with the implementation of new technologies, bottom up approaches are of great importance. However, it is of strategic importance that the management will take over and develops to a top down approach. This is possible if there is a strong vision for the future in the organisation.

Chapter 4: Dutch Geo-IT developments and standardisation.

4.1 Introduction

Geo-information Technology (Geo-IT) in municipalities does not stand on its own. Higher governmental bodies, laws, IT developments, standardisation and the influence of the Dutch association of the municipalities are having an impact on the quickness of municipalities to built on their technology improvements.

4.2 VNG

The Dutch association of municipalities are stimulating the municipalities to increase their quality and improvement of their services. These suggestions of improvement and agreements are, for instance described, in the “Overheidsloket 2000” (OL2000) concept. Within this concept, the spatial information counter, the front office, can be an important condition to improve the quality of information services. This counter will have its function for the civilians and industrial life, but also in the direction to other departments or (public) organisations. The front office should be able to handle most common general questions, and handle routine business like land record information in form of an extract from the register. This front office relies on the back office. This back office should have all the required information put in the registers and databases. For matters of exchanging information, integrating information out of different registers, etc., the organisation should have its data in uniform, standardised databases.

Before this counter can be functional, the behind lying organisation and data should be good organised. It is the most important matter to have good internal information supplies.

It is of great importance that municipalities conform themselves to developments on standardisation. Exchange between departments or municipalities on one site and exchange between municipalities and third party’s on the other will explain the need for good standardisation agreements and to conform to it.

The Dutch association of municipalities have in the GFO's (Gemeentelijk Functioneel Ontwerp) the spatial base data gathered. In addition, they have several datamodels and data dictionary specifically acuminate to the products and tasks of a municipality. RAVI (98-1) gave initiative to standardise the exchange of Geo-information in NEN3610[1] and NEN1878[2]. For several disciplines are standardisation definitions. Like for the exchange of information about taxes and the property information there is STUF-WOZ, STUF TAX and STUF-TAX2, definitions. For sewers there are SUF-RIB exchange definitions, etc (RAVI publications and GFO's)

The VNG concludes that the GFO's are not good applicable for municipalities for its high degree of abstract information. Graafland (1989) described already the wish of municipalities to get a blueprint for implementation. OpenGIS developments, as defined by the Open GIS consortium, should increase the easiness of data exchange. Open means in this case independent of the hardware platforms and of future developments

4.3 RAVI[3]

In the Netherlands, the central government, the provincial governments, the regional governments and the local governments have policies and tasks of their own. All these parties are involved and afflicted with geo-information. To tune and co-ordinate all these party's on all these different scales there was, till may 1993, the advise organ of the ministry of VROM. Co-ordination of the Geo-information was a task of the state secretary of the Ministry of Housing, Spatial Planning, and the Environment (VROM). This co-ordination, decided in 1990 by the "decision of information supplies Central Government (IVR)", was supported by the RAVI. Important then was the 'Structure outline Geo-information' (in Dutch: Structuurschets Vastgoedinformatievoorziening, **SVG**). This outline is used as a model for the reference of the tasks of the RAVI. Recommendations were done on the field of the availability of good, structured (base) data.

[1] NEN 3610 Model for real estate. Terms, definitions and general rules for classification and coding of spatial object.
[2] NEN 1878 Object oriented exchange format for spatial objects.

[3] RAVI: The Dutch Council for Real Estate Information to advise the minister for housing, spatial planning and the environment

Beside the availability of good base data, the recommendations were focused in second place on the inquiring of geo-information. By structuring the supply and demand question, the availability of good data becomes larger. The benefits are clear. The public sector, and with that the municipalities, can make better and quicker decisions, Consistency is increased and redundancy is removed, services to the citizen can be improved.

In 1993 the RAVI was reformed to a deliberation organ of geo-information. This SVG was until 1995 still the outline for recommendations of the base-information structure and its improvement. From then, the new reference was the 'Nationale Geo-Informatie Infrastructuur' (NGII). The NGII is not a detailed reference. Developments are going too fast for that. NGII is described by the elements it contains. It is, like the GIS-house, a reference for policy, data, agreements, standards, technology (hardware, software, communication channels) and knowledge (Jaarboek geo-informatie 1996).

This NGII, which should made it possible to exchange data between organisations, providers as well as clients / consumers. These activities are known as the National Clearinghouse concept. After a successful pilotproject, Idéfix, the start of the 'National Clearinghouse for Geographic Information' (NCGI) was a fact.

4.4 The National Clearinghouse for Geographic Information (NCGI).

From recent research to digital files (action program digital government, 1998) seems that the government has about ten thousand files that potentially can be used outside their own organisation. Only half of it is used, mainly by other governmental organisation, which leaves the other half. The lack of good overview of those files prevents it to become a commercial market place. The start of stimulating that commercial market place has been given in 1998. The NCGI can play a mayor role in it.

The National Clearinghouse for Geographic Information (NCGI) is an initiative of CBS[4], DLG[5], Cadastre Meetkundige dienst, RIVM[6] and RAVI. It is co-ordinated by RAVI. It is like a digital form of the Yellow pages for geo-information, to browse with an Internet browser (http://www.ncgi.nl). The meta-information, provides users with a quick overview of the available spatial data, which possible is usable for his/hers application.

[4] CBS – Statistics Netherlands
[5] DLG – Department of Lands
[6] RIVM - National Institute for Public Health and the Environment

The building, maintenance, etc. of data for a project. costs lots of time and money. To prevent users for building and maintaining all the same data provides the NCGI an overview of the available data. You can look up its quality, its actuality, its costs, etc.

In 1995, RAVI took initiative to build a national Clearinghouse Geo-Information. After pilots and discussions with the VNG, was the signing of an agreement by the state secretary of VROM in the end of 1995 the official start of the clearinghouse. After building the whole project, was in October 1997 the official opening of the NCGI.

Already in the prototype of the clearinghouse, the standard was the European CEN/TC 287, 1996 to describe the data.

If organisations will provide their meta-data to the NCGI, will depend on the situation in their own organisation. Is there a good technical infrastructure in the organisation, with entrance to the Internet, or what is the position of the geo-information within the organisation? Have they digital spatial data of good quality? Is there already a meta-data information system available? Finally, yet importantly, what are the possibilities to buy or get those data trough the Internet?

The American clearinghouse, the National Spatial Data Infrastructure (NSDI), initiated by the Federal Geographic Data Committee (FGDC), is already several years a big success. In addition, in Europe, several national clearinghouses are building the European clearinghouse, ESMI. ESMI stands for ‘European Spatial Meta-data Initiative.

The next phase of these projects has started. They are developing procedures for the exchange of this geo-information. Through an Open GIS environment is the exchange supported by several hard- and software surroundings.

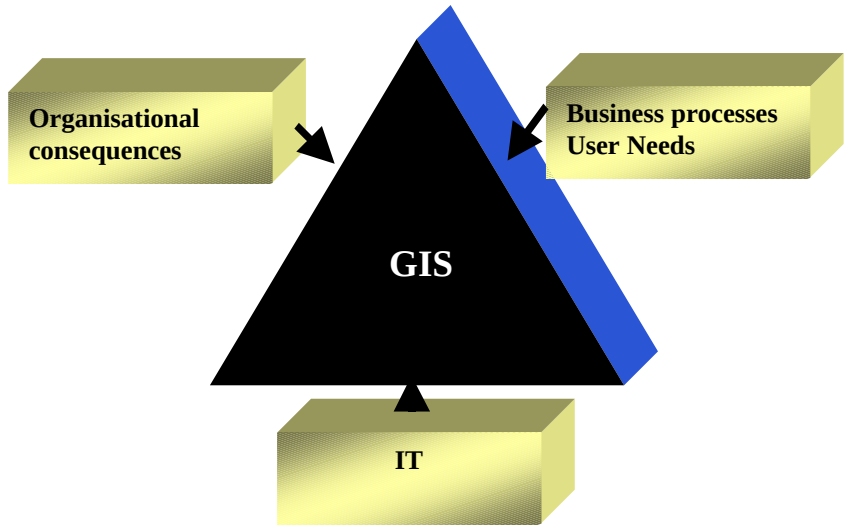
4.5 Open GIS

Open GIS is playing a role quite some time. It is, however, increasingly more common and applied. In the early eighties, software packages with GIS functionality came on the market. They pretended to be the solution to several governmental problem statements. The limitation of these products were that they were software driven, instead of operating from the problem statements.

One can look to the solution of problem statements from three viewpoints.

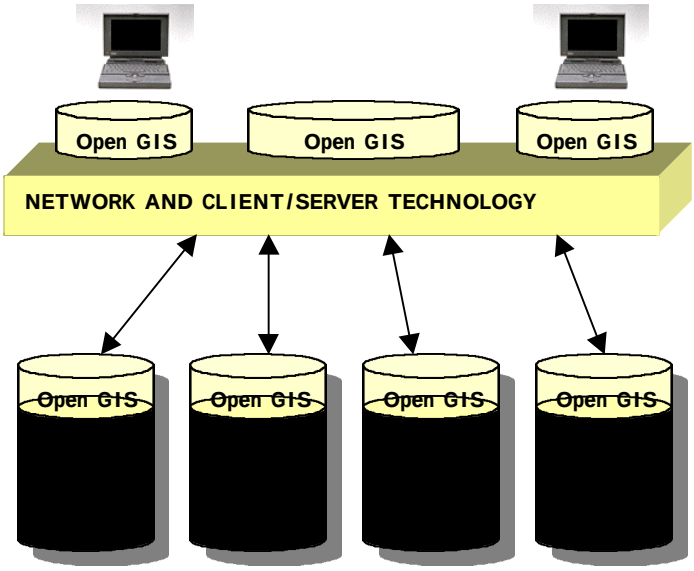
1. From an organisational point of view
2. From the business processes point of view
3. From the information technology point of view

Figure 4.1 viewpoints to problem statements.



"OpenGIS defines transparent access to heterogeneous geodata and geoprocessing resources in a networked environment". The goal of OpenGIS and the OpenGIS project (www.opengis.org) is to provide a comprehensive suite of open interface specifications that enable developers to write inter-operating components that provide these capabilities. The OpenGIS Specification, created by the Open GIS Consortium (OGC) Technical Committee, is a comprehensive software architecture specification that provides a basis for open systems geo-processing. Programming interfaces based on this specification will enable true interoperability between applications on the desktop and over networks, including the Internet.

Figure 4.2. OpenGIS interfaces provide transparent access to distributed geo-data and geo-processing resources (after www.opengis.org).



The first software products, meeting these standard, are on the market now. However there is still a long way to go to get all the noses to the right side. ‘Open’ means for the software-houses also not to be innovative. New techniques invented should be approved by the OpenGIS committee. This could mean losses of leadership positions on the market. The near future will learn.

Chapter 5: Questionnaire survey method.

5.1 Introduction

Definitions of GIS can vary from one to another. In chapter 2.2, a framework outlines what GIS is about and what it can mean for municipalities. GIS is definitely not the same as CAD (Computer Aided Design) systems. The application area is different. However, some CAD software with some extensions beyond basic design software can provide the needed GIS functionality. CAD and GIS software are growing towards each other, despite their difference in application areas and, more important, their datamodel. The letter accompanying the questionnaire (Appendix C) told the recipient that GIS could be supportive in performing some major tasks. Integrating many data from different sources, and different departments is one of them. This integrated data should give (after analysis or not) new information. The results can be graphically presented in, for instance, maps, graphs, or reports. At least a spatial component should be present in the data to tell the analyst or manager “where” it is. This has led to new ways of data searching and increase of efficiency and effectiveness of the organisation in performing their tasks.

Broad view of the application area rather than a tight definition was outlined in the letter. If the respondent thought that he/she could define his/her CAD software, with some extensions, together with his databases and procedures, as a GIS system, used by their organisation to give the same results; he was allowed to do so. No brand names were given, so there could not be any discussion on difference of interpretation on one brand name or the other and if it should be considered a pure GIS system or not.

The survey was held between April and July 1999. The time between then and now, may 2000, is a relatively long time. The discrepancy in time is particular important given the rapid take up of GIS. Many respondents declared to start with GIS soon.

5.2 Population.

The sample for this survey includes all town halls of all 538 (per 01-01-1999) Dutch municipalities. A questionnaire was sent out to all of them (Appendix D). The accompanying letter was addressed to "Burgemeester en Wethouders" (mayor and alderman). The normal procedure in a municipality is that letters addressed in this way are given a unique number. They are (mostly) registered then. If a letter has been registered, it should be answered. This approach gives a better probability that the letter will arrive on the right desk than if the letter is addressed to certain function names or departments within the organisation.

The letter was addressed to the town halls. In big municipalities, there may be several lacations of the city town halls, but these were not addressed. There were 294 questionnaires returned. Section A of the questionnaire divides the respondents into two main groups. These groups are those who do already use GIS, and a second group who do not. 115 respondents responded that they did use GIS. They were asked to go on with section B and to leave section D open. Finally they were asked to fill in the general information of section E. The respondents who responded that they didn't use GIS, were asked after section A, if they would fill in only section D and the general information of section E.

5.3 Questionnaire structure.

The questionnaire contains six main parts. Several questions in each section must provide the answers to the hypothesis as put in chapter 1.

A. Details of the municipality and respondent

Questions covering: geographical location of the municipalities, size of the municipality (number of inhabitants), department of the respondent, function of the respondent, years of working in that function, GIS availability.

B1. GIS uses

Questions covering: year of GIS adoption, GIS departments, GIS policies and application areas, GIS users, Goals of GIS adoption, expectations of GIS

B2. Meta-data

Questions covering: organisation of data, internal-and external use of meta-information, Dutch National Clearinghouse Geo-information,

C. GIS adoption, use and development

Questions covering: nature of GIS acquisition and implementation, level and sort of GIS training, development path of GIS, implementation, and future planned changes to GIS

D. Non GIS users

Questions covering: reasons for non-usage of GIS, factors influencing GIS adoption.

Additional comments.

Space was provided for the respondent to add any additional comments.

5.4 Response and respondent.

In the Netherlands, there are 538 municipalities. 294 of them returned the questionnaire. This is a response, as *tables 5.1* and *5.2* show, of almost 55% of the municipalities. This is a good score. If we look at *table 5.1* only the really small municipalities (<10.000) and the very big (> 100.000) stay a little behind the mean response of 54,6%. Looking at the response in relation to size (number of inhabitants) of the municipality, we can assume that the results are representative for all municipalities in the Netherlands.

Another issue is the spread of the respondents by size. The Netherlands has a lot of small to middle-size municipalities. Table 5.1 shows that 88,8% of the total number of municipalities are smaller than 50.000 inhabitants. That leaves only 11.2% which are bigger than 50.000. Of the returned questionnaires, 88,4% of those municipalities were smaller than 50.000. This spread has to be kept in mind for further analysis of the questions.

Table 5.1 Response after number by inhabitants

	Total Population			Response			R/P
	Abs.	%	Cum %	Abs	%	Cum %	%
< 5.000	20	3,7 %	3,7%	7	2,4 %	2,4%	35,0 %
5.000 – 10.000	106	19,7 %	23,4%	49	16,7 %	19,0%	46,2 %
10.000 – 20.000	186	34,6 %	58,0%	109	37,1 %	56,1%	58,6 %
20.000 – 50.000	166	30,9 %	88,8%	95	32,3 %	88,4%	57,2 %
50.000 – 100.000	33	6,1 %	95,0%	20	6,8 %	95,2%	60,6 %
> 100.000	27	5,0 %	100,0%	14	4,8 %	100,0%	51,9 %
Total	538	100 %		294	100 %		54,6 %
R/P = Response / Population							

Table 5.2 shows the response of the municipalities for each of the twelve provinces. It shows that, except the province of Flevoland, the response is fairly distributed around that 55%. The provinces of Limburg, Drenthe and Friesland have high response rates (66.7 and 67,7%). The conclusion can be made that the findings are representative for all municipalities in the Netherlands. Statistical analysis can be done best by size of the municipality.

Table 5.2 Response municipalities by province

	Total Population		Response		R/P
	Abs.	%	Abs.	%	%
Noord-Holland	70	13,0 %	35	11,9 %	50,0 %
Zuid-Holland	95	17,7 %	50	17,0 %	52,6 %
Zeeland	17	3,2 %	7	2,4 %	41,2 %
Noord-Brabant	70	13,0 %	37	12,6 %	52,9 %
Limburg	54	10,0 %	36	12,2 %	66,7 %
Gelderland	78	14,5 %	49	16,7 %	62,8 %
Utrecht	36	6,7 %	17	5,8 %	47,2 %
Overijssel	44	8,2 %	19	6,5 %	43,2 %
Flevoland	6	1,1 %	1	0,3 %	16,7 %
Drenthe	12	2,2 %	8	2,7 %	66,7 %
Groningen	25	4,6 %	14	4,8 %	56,0 %
Friesland	31	5,8 %	21	7,1 %	67,7 %
Total	**538**	**100 %**	**294**	**100 %**	**54,6 %**
R/P = Response / Population					

5.3.1 Departement of respondent

Looking at the departments, of the GIS users (*table 5.3*) we see that most of them are coming from the department of civil works/municipal works (31%). This seems to be the department, were implementation of GIS is initiated and co-ordinated. Beside this department, we see that the other respondents are working in the I&A department (14%), the (real) estate department (12%), the accommodation, town and country planning and environment department (11%) as well as the Surveying department (10%). The 'other' departments (18%) are mostly a combination of the departments above (e.g. real estate and surveying (5,8%), civil/municipality works and surveying (1,4%), finance and real estate (0,7%), etc.) or a matter of naming and combinations of them. This has mainly to do with the size of the municipality and the tasks of those departments (e.g. municipal works, civil works, town maintenance, etc.).

Table 5.3 Who have responded the questionnaire by department (N=294).

Departments of respondents	Response (%)
Civil works / municipal works	31%
Information and Automation department	14%
(Real) estate department	12%
(V) ROM (accommodation, town and country planning and environment)	11%
Surveying	10%
Finance	2%
General Public affairs	2%
Others	18%
Total	**100%**

In relation to the departments, we see that most of the respondents have a technical background like surveyor, civil engineer, cartographer, etc. We can categorise the functions of the respondents (*table 5.4*). Sometimes a combination of functions was present. Employees can be from several departments. Examples are civil engineers, policy employees, and other (technical) employees. The reason that the surveyor is separately mentioned is due to the fact that a fair number of employees (10%) are surveyors or surveyor-cartographers. 20% of the respondents are department heads and 14% are co-ordinators of I&A. 11% of the respondents already have a specific GIS /Geo function, mostly called (real) estate co-ordinator. One of the respondents was the secretary of the municipality.

Table 5.4 Functions of the respondents

Functions	Abs.	% Of respondents
Employee	101	34%
Department head	60	20%
Co-ordinator I&A	40	14%
(Real) estate / GIS co-ordinator	31	11%
Surveyor	29	10%
(Real) estate employee	25	9%
Head of department of (real) estate	4	1%
System administrator	3	1%
Secretary of the municipality	1	0%
Total	**294**	**100%**

Chapter 6: Case study research.

6.1. Introduction and problem statement to case Nederlek

To explain some of the theoretical parts of this study, a case study is carried out. For this case study, strategic reports and documents about the organisation in general, and the GIS project in more detail, were studied. The municipality of Nederlek consists of the two rural villages, Lekkerkerk and Krimpen a/d Lek. Nederlek has about 15,000 inhabitants and falls in the category of small municipalities. *Table 7.1* shows that 25% of the GIS users fall into this category of small municipalities.

Lekkerkerk became its “reputation” in the early 80’s by its enormous polluted soil scandal. It was one of the first soil pollution areas found in the Netherlands. Later, it seemed that more places in the Netherlands were polluted. Central and local governments started to make environmental policies. The environmental aspect stayed in Nederlek a very important one. One of the action programs in 1995 (Bilardie, 1996) was to make visible the degree of soil pollution on maps and create new policies out of it. Data about soil was present in different formats, mostly not digital. If they were digital, they were on different hardware platforms, like most other data for other application areas in the organisation. Additionally many other authorities were involved in the processes of policy making. Because Nederlek found itself in a situation were data was cut into bits, something must be done. To find and combine data together was difficult. This is were the new technologies benefit came into the organisation.

Just before the environmental policy issue, at the end of 1994, the association of municipalities (VNG) in the Netherlands came to the municipalities for saying that ‘THEY’ have to do better. Better in this context is better data management, increase of efficiency, more accurate data without doubles and failures. The context was the relation to real estate, and other spatial aspects of the data and tasks. Municipalities are the midpoint of many tasks the governments in the Netherlands have to fulfil. They are therefore the midpoint of data exchange between all kind of other governmental bodies or third parties. They should be better prepared for this task.

This visit of the VNG was, at least for Nederlek, the official start to look critical at their administrations. They could not reach some administrations easily, because of different platforms like AS/400©, Novell© environment, and Windows NT© environment and in that time an Apple Macintosh© environment. Different Databases (DB2©, Dbase IV©, and Filemaker Pro©) and some other programs to 'remember' and 'hold' data (like Microsoft© Excel, Word, etc.) were common.

The cartographic and design departments had the same way of data treatment and had the same trouble in finding and combining good, available, data. Different Analogue drawings on different scales were not easily to combine. Cadastral, real estate and people's information are the biggest and the most important databases. They were all on different platforms and different database formats. Most of this data available (either analogue or digital) have a reference to the real world

These two issues, the environmental issue and the start of awareness about the way data was threaten in the organisation were, together with a third factor, the start with Geographic Information technology. This third factor was at least one person in the organisation who needed good overview about the inventory and control data from the municipality. He, and his department were responsible for informing civilians about the places of trees, sewers, cables, electric standards, Cadastral parcels, development plans, etc. and for making proposals about policy issues to the management. This was each time a survival trip through all the data available in all their formats and on all those platforms, to find and combine those data. He already had started to make some of the data better available for his own job, to make his working live easier. The availability of the digital Cadastral map and the large-scale map, were an important factor for starting.

6.2 Case study outline

The municipality of Nederlek started to form a project group GIS, and made a plan of action. This fundamental piece of paper consists the base information to start with (paragraph 8.2). This base information was gathered by a User Need Study (UNS). Because of the importance of the UNS, this subject will be described in more detail in part 8.3. After the base information and needs, gathered in a plan of action, the working group specified in more detail what elements the GIS system should contain. What concepts were there to be used, to open up the existing systems? This is covered in section 8.4. The pilot projects of several applications are covered in section 8.5. Conclusions about the diffusion, successes, and failures are covered in section 8.6

Chapter 7: Outcome of the questionnaire survey.

7.1 GIS use.

As *table 7.1* shows, **39%** of the respondents say that they do use geographical information systems. That leaves **61%** of the Dutch municipalities who do not.

Table 7.1 GIS usage.

	Use GIS		No GIS		Total
	Abs	% GIS users	Abs	% Non-GIS users	Abs
< 5000	1	0,9%	6	3,4%	7
5000 – 10000	10	8,7%	39	21,8%	49
10000 – 20000	29	25,2%	80	44,7%	109
20000 – 50000	47	40,9%	48	26,8%	95
50000 – 100000	14	12,2%	6	3,4%	20
> 100000	14	12,2%	0	0,0%	14
Total	**115**	**100%**	**179**	**100%**	**294**
Total of respondents	**39 %**		**61 %**		**100 %**

From those Non-GIS users of this moment, 80% intend to adopt GIS functionality into their organisation. Nine percent declares do not intend to use GIS functionality in the (near) future. Some of the respondents (11%) responded not knowing the answer or left the question unanswered. This group (179 respondents) of non-GIS users filled in additionally the questions of section D (Appendix D).

Table 7.2 shows the application areas where municipalities use GIS. The main group of applications is registration and maintenance. GIS is used especially for land record-, sewer-, and road maintenance. Municipalities are, in general, not ready yet to use GIS as Decision Support Systems (DSS). The need for municipalities to combine specific information like land records, building permit registration, market information of houses sold, large-scale map in combination with the valuation registration pulls many municipalities toward GIS (47%). This is the issue were information from different departments must come together and more important, must be up-to-date and accurate.

Table 7.2 GIS applications by use.

	% Of GIS users
Registration and maintenance	
Cadastre information (land records information)	87%
Sewer maintenance	63%
Road maintenance.	57%
Cartography	47%
Environment maintenance.	37%
Town and country planning	30%
Other	27%
Policy	
Environmental policy	17%
Location policy	9%
Other	13%
Others	
Taxes (WOZ taxation)	47%
Counter service	30%
Information service	18%
Other	3%

Table 7.3 shows us the year of introducing GIS into the organisations in relation to the size of the municipality (number of inhabitants of the municipality). Only 5% of the municipalities started before 1990 and 25 % started between 1990 and 1994. Since then smaller municipalities also started. 68% of the GIS-users started this last 5 years. 1986 and 1989 were not mentioned by the respondents as start years.).

Table 7.3 Year of GIS installation after number of inhabitants *(percentages are round off)*

Year	< 5000	5000 - 10000	10000 - 20000	20000 - 50000	50000 - 100000	> 100000	Row total (%)	Cumulative (%)
1985						1,7%	1,7%	1,7
1987				0,9%	0,9%		1,7%	3,5
1988					0,9%		0,9%	4,3
1990				3,5%		1,7%	5,2%	9,6
1991					0,9%		0,9%	10,4
1992			0,9%	0,9%	0,9%	0,9%	3,5%	13,9
1993		0,9%	2,6%	1,7%		0,9%	6,1%	20,0
1994			1,7%	7,0%	0,9%	0,9%	10,4%	30,4
1995	0,9%		3,5%	5,2%	0,9%	2,6%	13,0%	43,5
1996		0,9%	4,3%	3,5%	1,7%	0,9%	11,3%	54,8
1997		2,6%	7,0%	4,3%		0,9%	14,8%	69,6
1998			2,6%	6,1%	4,3%	1,7%	14,8%	84,3
1999		3,5%	2,6%	7,0%	0,9%		13,9%	98,3
No response		0,9%		0,9%			1,7%	100
Total (%)	**0,9%**	**8,7%**	**25,2%**	**40,9%**	**12,2%**	**12,2%**	**100%**	

Already in 1985 some big municipalities started with GIS. This situation remained the same until 1992. Until then it was mostly the bigger municipalities (> 20.000 inhabitants) who implemented GIS. Since 1994, GIS growth started in the world of municipalities. This may be the result of the advertisement of the Dutch association of municipalities (VNG). They started to visit municipalities to say that data is too distributed in most of the organisations and that “we” can do better.

GIS has big potential in the (near) future. Of the GIS user respondents, 42% use it only in their own department, mostly the technical and policy departments. 45% have adopted GIS in more than one department. These are mostly a combination of the technical departments and the taxes department.

Only 10% responded that they had adopted GIS through the whole organisation.

Table 7.4 GIS departmental usage.

	Abs.	% Of GIS users
In several departments	52	45 %
Only in one department	48	42 %
Corporate GIS usage	12	10 %
No response	3	3 %
	115	100 %

Table 7.5 shows the extent to which GIS is used by different user types. Of all the GIS users, 50% indicated that they have counter clerks who frequently had hands-on direct use of GIS. 20% have no counter clerk, who uses GIS. Frequent use, directly by maintenance employees is the case in 67% of the municipalities who uses GIS. These are the main two types of users who use GIS directly or indirectly. In general all other types of users, indicated in the questionnaire, are only occasional users who are not working with the programs or applications. Alternatively, they do not use GIS applications at all.

Table 7.5 Types of GIS users (Percentages reported by row totals)

User type	Frequent users		Occasional users		No-use	Row total (%)
	Direct	Indirect	Direct	Indirect		
Counter clerk for instance Cadastral information or environmental information.	**50%**	9%	8%	14%	20%	100 %
Policy employee	15%	15%	18%	**33%**	18%	100 %
Maintenance employee	**67%**	9%	12%	9%	3%	100 %
Head of the department	1%	15%	6%	**43%**	**36%**	100 %
Long term planning employee	7%	8%	14%	**26%**	**44%**	100 %
Management team	0%	6%	1%	**38%**	**55%**	100 %
Mayor and Aldermen	0%	7%	1%	**35%**	**57%**	100 %
Counsellors	0%	3%	0%	**20%**	**77%**	100 %
Outside personnel (like surveyors, gardeners)	4%	16%	3%	**37%**	**39%**	100 %
Others	13%	0%	16%	6%	**66%**	100 %

Some conversations with IT and Geo-IT people from several municipalities (see also chapter X, Case studies) gave the impression that most of them started with GIS techniques, without a good foundation and a vision about it. Where is it they want to be in the (near) future with their Geo-information strategy? The question asked in the questionnaire about this vision, was to prove if this impression was right.

Table 7.6 Presence of GIS vision

Is there in your organisation a plan with a vision and/or objectives defined in it?	% Of GIS users
No	49%
Yes	40%
No response	11%

It seems that this impression was right. Almost 50 % of the GIS users started with GIS without a clear vision for the future. This explains the, sometimes-strange pronouncements of some respondents. These varied from: “GIS already bought, implementation will start later”, or, “ GIS will become next to Microstation © a business application”.

Probably that is one of the reasons why municipalities have only partly gained what their goals were. *Table 7.7* shows the benefits municipalities sought in GIS systems and if they have gained their goals (already). A common characteristic is that of almost all the benefits sought, municipalities have only partly gained what they were seeking. Hernandez (1999) summed up some possible reasons. These include a function of a number of factors, such as the naiveté of users in setting overly ambitious expectations, the over-sell and 'Hype' surrounding GIS, and arguably, most importantly, the organisational complexities and difficulties associated with integrating GIS into an organisation's decision making activities. These conclusions were also found in the research in the retail sector in the Netherlands.

The benefits sought were mainly improved access to information sources (90%), better quality of information (86%), improved information management in the whole organisation (72%) and making more effective use of the means of the organisation (70%).

Table 7.7 GIS benefits sought and gained

Benefits	% Of GIS user who sought	Of which… % Not gained	% Partially gained	% Gained	% Unknown
Improved access to information sources.	90%	2%	45%	46%	7%
Better quality of information.	86%	2%	48%	42%	7%
Improved information management in the whole organisation.	77%	18%	57%	15%	10%
Quicker service to the citizens.	72%	10%	53%	29%	8%
To make more effective use of the means of the organisation.	70%	10%	60%	26%	4%
Better uniformed decisions	63%	17%	57%	17%	10%
Improved spread and distribution of information.	62%	13%	59%	21%	7%
Reducing expenses.	56%	22%	50%	20%	8%
Quicker decision-making.	45%	23%	56%	13%	8%
Presenting alternatives by defining new policy proposals.	45%	17%	48%	21%	13%
Automation of existing methods of analysis.	43%	38%	30%	16%	16%
New forms of analysis.	43%	31%	45%	10%	14%

Important to know is the question of the responsibilities of organising, implementing, and maintaining GIS systems, GIS applications and its data. Is the awareness of the organisation that big that they have put employees especially responsible for this task? of the GIS users, 51% responded that a special person is especially responsible. 46% of the respondents have organised their responsibilities within the existing functions. Three per cent have not responded to the question.

The findings from the attitudinal statements are shown in *table 7.8* . In contrast to the usual hypothesis, we see that in the world of municipalities it is not a general consensus that GIS are often spearheaded by the enthusiasm of one key individual in the organisation. Although 27% responded that this is the case, 25% disagree with this statement. 28% choose neither.

It seems that they all find that GIS has generated interest from departments throughout the organisation, once it has been installed.

GIS has not had as much influence on the organisation, as it could and probably should have. The reason can be that municipalities use GIS mainly for inventory, maintenance, and view purposes.

Once GIS is installed, it generates interest from around the organisation. This could be an important fact to know. Once an application is working, you must let the organisation know what it can. One's imagination comes at work and can be virtually applied in their own line of work.

Table 7.8 GIS statements

	Strongly agree	Agree	Neither	Disagree	Strongly disagree	No response	Total
We started with GIS in our organisation, because ONE person was enthusiastic about this technology.	8 %	**27 %**	***28 %***	**25 %**	10 %	3 %	100 %
GIS has generated interest from departments throughout the organisation.	**15 %**	***75 %***	8 %	2 %	0 %	1 %	100 %
GIS has changed our view about the way that our organisation functions, radically.	3 %	12 %	***37 %***	***37 %***	8 %	3 %	100 %
Education is most essential for the success of implementing GIS in our organisation.	**37 %**	***52 %***	7 %	3 %	0 %	1 %	100%
The perfect scenario for our organisation is to have GIS tools on the desk of every Manager.	10 %	***37 %***	**25 %**	**21 %**	4 %	3 %	100 %
The IT department has a major role in the introducing phase of this new technology.	2 %	**30 %**	**22 %**	***37 %***	8 %	3 %	100 %
GIS technology provides our municipality with greater efficiency in maintenance and planning.	8 %	***59 %***	**22 %**	8 %	0 %	3 %	100 %
To organise and make the data suitable is the most important step to start with the implementation of GIS technology.	**37 %**	***42 %***	12 %	7 %	0 %	2 %	100 %
The Functional Design, base-registration for municipalities (in Dutch: Het Gemeentelijk Functioneel Ontwerp (GFO)) from the Dutch association of municipalities is the base of our GIS.	9 %	**32 %**	***37 %***	**17 %**	2 %	4 %	100 %
GIS is only interesting for our technical departments.	0 %	3 %	2 %	***50 %***	**43 %**	2 %	100 %
GIS has provided us with a more efficient organisation.	0 %	**38 %**	**52 %**	6 %	1 %	3 %	100 %
GIS is fully integrated and used in our organisation.	0 %	4 %	**18 %**	***56 %***	**17 %**	4 %	100 %
The recommendations about GIS, and Geo-information, as published by RAVI, are of great importance in our organisation.	1 %	**30 %**	**46 %**	**17 %**	1 %	5 %	100 %

7.2 Meta data

Organising the data in an organisation is an important issue in the whole process of implementation to start with. Without good data, there is no way that there will be a good GIS system to rely on. 79% agrees to this statement (table 7.X). At least 46% of the GIS-users explained that they have organised data of several departments in a way that they are multifunctionally applicable.

In the steps of collection, cleaning, and organising the data of their own department or several departments, defining the data is a way to get an overview of the available data. Questions like: What data do we have in digital form? Who has it in the organisation? Who has made the data? From what date are those data? For what purpose was that data made or bought? What is the accuracy, etc?

Although 39% of the total respondents use GIS systems, and 79% of the GIS users agree that good data is one of the most important components, still 75% of the GIS-users have said that they don't use meta-data. This interesting outcome, poses the questions: How are they organising their data then? 70 % of the GIS-users at least responded to have the intention to use meta-data in the (near) future. Still leaves 23% who are not going to use Meta-data information at all. 7% have not responded this question. That leaves the question Why aren't they going to use meta-data.

Table 7.9 Outside the organisation sharing of meta-data.

	Yes, within 5 years	Yes, but not within 5 years	No	No response
Would your organisation share this meta-data outside the organisation, for use by others?	27%	40%	18%	15%

To the term (table 7.9), sharing their meta-data outside their own organisation, 27% answered that they would share this, within 5 years. However, 40% responded that they would share it, but not within 5 years. Even 18% responded that they would not share this information outside their organisation at all. 15% have not responded this question. This question was answered by Meta-data users as well as non-meta-data users.

The NCGI is the Dutch clearinghouse initiative (covered in chapter XX). The American version, the FGDC, is a success over there. Amongst the municipalities in the Netherlands, the NCGI is not that well known. 43% of the GIS users responded that they do not know of the existence of the National Clearinghouse Initiative.

Table 7.10 What will effect your decision to join The NCGI, if you are not at this moment?

	% of GIS users
If we have made more progress on the use of digital geo-information in our organisation.	58%
If we frequently make use of digital information which are offer to us, by third parties organisations.	26%
If we have our Meta-data better organised.	23%
If we have realised access to the Internet	18%
If we are going to use Meta-data internally	12%
Other	13%

Some 'other' reasons for municipalities to join the NCGI in the (near) future are:

- "Depends on what they have to offer".
- "When we have our baseregistrations in order".
- "If it has proven benefits for our organisation".
- "When costs and benefits are in balance".
- "When we make geo-information available".
- "If we have the idea that our information is relevant to third parties".
- "If we know more about possibilities and applications.
- "If we have insight in the fact that it should make sense to publish meta- information to others, since we deliver no information or products to others on commercial basis".
- "Reputation NCGI and acceptance process must be further".
- "Our geo-information is complete, so we might publish them".
- "No connection to the NCGI".
- "NCGI is not known enough".

7.3 GIS adoption, use, and development

Tables 7.11, 7.12, and 7.13 show GIS procurement and development in the very first phase of introducing it to the organisation.

Of most importance in the decision making phase for adoption of GIS technology are the (potential) users (50%), the system operators (50%) and the managers of the departments where GIS would be introduced (46%).

Table 7.11 Important decision makers.

	% Of GIS users
(Potential) users	50%
System operators	50%
Managers of the departments where GIS would be introduced.	46%
Local government	17%
Managers of other departments.	7%
Others	22%

The activities done BEFORE the GIS selection procedure were in 76% of cases visits to suppliers of GIS software and services (table 7.12). Tendering (70%) and talks with other GIS users (69%) the next most frequent actions before GIS is introduced in the organisation. Tendering can be a follow up action of the visit to the demonstrations GIS suppliers gave. Running a pilotscheme or benchmark tests are not that common in municipalities (24% and 5%).

Table 7.12 Activities Before the GIS selection

	% Of GIS users
Visit to suppliers.	76%
Tendering	70%
Talks with other GIS users.	69%
System analysis	40%
Costs- Profits analysis	35%
Practicability study	34%
Pilot	24%
Benchmark test	5%
Others	12%

The manner in which GIS were installed is shown in Table 7.13. The most important activity, before GIS installation is to inform the organisation about the possibilities of GIS technology (63%). In addition, demonstrations are often done by the GIS users (56%), to show the (potential) system to the management of the organisation.

Table 7.13 Activities done Before the GIS installation

	% Of GIS users
To inform the organisation about the possibilities of GIS technology.	63%
Demonstrations of (potential) systems to the management of the organisation.	56%
Consulting of the management.	38%
Seminars for awakening process.	35%
Meetings about the organisational aspects.	23%
Demonstrations to (potential) users of the system	2%
Others	3%

Table 7.14 Who received GIS training.

	% Of GIS users
Employees who were supposed to use the system full time.	74%
Only employees within a certain department.	29%
Every employee who thought that he would use the system occasionally.	14%
Only employees with computer knowledge.	0%
Others (please specify)	11%

Table XX showed already that 89% of the GIS users find education of GIS essential for the success of implementing GIS in their organisation. *Table 7.14* shows which members of the organisation, received training. Of the GIS-users, 74% provided training to those employees who were supposed to use the system full time. 29% of the GIS-users provided training only to employees from specific departments. The 'others' varied from nobody yet, specific application employees, system operators, only the counter clerks, specialists to only those were it is relevant for their function.

GIS is clearly introduced into the organisation, by different methods. Most of the GIS user respondents have done this in conjunction with the supplier of the software (63%). It is mostly done (52%) in one important department (technical see *table 7.15*) One or more enthusiastic persons within the organisation introduced GIS into the organisation in 39% of the municipalities

Table 7.15 Development of GIS in the organisation.

	% Of GIS users
With the supplier of the software.	63%
By ONE department in the organisation.	52%
By some enthusiastic persons within the organisation.	39%
Through the whole organisations with working groups.	27%
With a consultant independent from the supplier of the software.	16%
Others (please specify)	4%

Tables 7.16 and 7.17 show the changes to the GIS that have occurred since the initial implementation, and those that are planned over the next five years. Additional GIS products have been bought from the same software suppliers by 51% of the GIS users after the first GIS installation. It seems that on one department, more users use more systems (applications) will be the case in 36%. At least 35% of the GIS users are not hooked on one software supplier.

Table 7.16 Developments after first GIS installation.

	% Of GIS users
Additional GIS products bought from the same supplier.	51%
Several Users within ONE department.	37%
Several GIS systems in use within ONE department.	36%
Additional GIS products bought from another supplier.	35%
Several Users within several departments.	31%
Development of several applications.	30%
Several Users through the whole organisation.	28%
The GIS is seldom used.	14%
A complete change of the original starting points.	3%
Several GIS systems in use within several departments.	2%
Several GIS systems in use through the whole organisation.	1%
Others	11%
The GIS is not used anymore.	0%

It is clear (table 7.17) that GIS will evolve in the next five years to a common used system with several applications, used through the whole organisation. Most of the users stay however with the same supplier (66%).

There are at least 4% of the users, who uses GIS now for reasons they probably do not believe in. They think that the system will either be seldom, or even not used anymore within the next five years.

Table 7.17 Changes which are planned over the next five years.

	% Of GIS users
Several GIS systems in use through the whole organisation.	76%
Development of several applications.	72%
Additional GIS products bought from the same supplier.	66%
Additional GIS products bought from another supplier.	43%
Several GIS systems in use within several departments.	27%
Several GIS systems in use within ONE department.	23%
A complete change of the original starting points.	18%
The GIS will be seldom used.	2%
The GIS will not be used anymore.	2%
Other	10%

7.4 Non-users of GIS

Table 7.18 shows the reasons cited by the municipalities who have not adopted GIS. Almost one third is not sure of the cost effectiveness of the use of GIS. Another 24 % does not have the expertise to use GIS effectively. They probably also do not have the money to hire these expertise.

There are about 12% of the non-GIS users who are not aware of GIS and its possibilities. Another 12% is unconvinced that GIS would provide a solution in user needs.

Table 7.18 GIS statements of the Non-GIS users

Our organisation is...	% of Non-GIS users
Not sure of the cost effectiveness of the use of GIS	27%
Does not have the expertise to use GIS effectively	24%
Deterred by the "high costs" of making data available for GIS use	23%
Deterred by the "high costs" of GIS software	17%
Not aware of GIS and its possibilities	12%
Unconvinced that GIS would provide a solution in user needs	12%
Has not considered the implementation of GIS	12%
Other	20%

Deterred by the “high” costs of GIS software and making data available for GIS use, was mentioned most by municipalities between 5000 – 20000 inhabitants.

The need for proven benefits is high in the world of municipalities (57%). The availability of useful data or improved functionality are the second most important factors that would make non-GIS users seriously consider adopting GIS. Support in form of a “blue print” in form of attendance, for example by the Dutch association of municipalities (VNG) is wanted by 17 % and 14% of these respondents.

Table 7.19. Factors that would make non-GIS users seriously consider adopting GIS.

Factors	% of Non-GIS users
Proven benefits.	57%
Improved functionality	45%
Availability of useful digital data.	44%
More user-friendly systems.	25%
Support of the VNG in form of a scenario.	17%
Attendance with the implementation by for example the Dutch association of municipalities (VNG).	14%
Improved availability of GIS education.	8%
Nothing would change our decision.	4%
Others	15%

From the Non-GIS users have 80% the intention to use GIS in the future (table 5.x)

Table 7.20. Intention of GIS usage in the future.

	% of Non-GIS users
Yes	80%
No	9%
No opinion / no response	11%

The main reason for not having the intention to use GIS in the future are the plans of future joining of several municipalities into one. The other main two reasons for not using GIS in the future are money and other priorities. In addition, the doubt to additional functionality or efficiency is one of those reasons.

7.5 Additional comments of the respondents.

At the end of the questionnaire, the respondent could give any comment he wants about GIS or about the questionnaire. The main sort of comments can be divided into three parts: Tips, reasons why not started with GIS (yet) and others.

Tips

- Start small, evaluate, and extend the project and applications.
- GIS is not a goal for itself, it is a tool. One should have a vision how to use this tool in the organisation.

Reasons why not started with GIS.

- Re-dividing of municipalities.
- Need for extra people
- Costs vs. benefits
- What proven benefits can we expect?
- Not enough knowledge.

Others

- We first should fulfil some conditions before a good start. These are integration of existing databases administrations, use of RDBMS's (other constructions and packages) and a clear maintenance structure for GIS.
- VNG should provide expertise and should provide a national framework.
- Implementation will start soon.
- GIS already bought, implementation will start later.????
- Need for good training.
- Other priorities

Chapter 8: Case study

8.1 Introduction

The most important bases for this organisation to start with consists of a plan of Action. In this Action plan are the findings of the UNS. It leads to effective information about the organisation, the people who are working in that organisation, the data and its flow through the different departments, the need to convert analogue information into digital, etc. Dealing with the findings of the UNS was done by the GOA-concept, explained in chapter 8.4.

From there, this organisation has grown through the first two phases of Nolan. Even some applications and parts of departments reach the third and even the fourth phase and become in the maintenance phase. The organisation as a whole has a long way to go from now on. In general, they started with the third phase. Management involvement is needed more and the project needs this steering from here. Probably some organisational changes are carried out to benefit the project and therefore the organisation.

8.2 Plan of Action.

After getting some experience from the digital availability of the Cadastral map, the large-scale map and Soil Information System it lasted until 1997 (Colijn, 1998) before the municipality officially started to form a project group GIS. The goals of the project were a better and quicker policy preparation and execution, efficiency improvement and to find ways to serve the citizens and the local business and industry on a better and quicker way. By then the first phase of this stand-alone soil-info system (NAZCA©) was finished. This application is based on a solely soil inventory and planning application, which run under ArcView© desktop GIS software, and an Oracle© database.

The projects group GIS wanted to research and describe several points in this plan of action. The most important ones are:

- What are the bottlenecks in the organisation?
- What is it the organisation wants to get out of this project?
- What data is available, in what form and where to find?

- What other organisations have contact with us and on what ways are we exchanging data with them.
- What organisational structures are there now, and does this have to change?
- How do we keep the organisation informed and involved about the progress of the project?

The orientation phase of this plan of action was the definition of the GIS-house (see Chapter x page X). What should be considered to belong to this house? The logical steps of the OPAFIT concept helped to cover all-important subjects. The next step was to find and look at the bottlenecks of the organisation, the available data, exchange of data, and what is it the users want the new system to do for them. A User Need Study (UNS) did this. By means of having interviews and handing out questionnaires to the (potential) users of all kind of data and systems. The management team members were included in this discussion. They formulated their needs. In this way a good overview was made of tasks, needs, wishes, proposals of efficiency, etc.. The next step was looking at the way this could be realised and what consequences this gave to the organisation, personnel, agreements, finance, information, and technology.

8.3 User Need Study (UNS)

Introducing a GIS into an organisation is a complicated job. It does not only consist of building databases, purchasing hard- and software, but it consist also of people and their jobs, work flows, organisational matters, and especially what is it the organisation wants to do with the information system. Very important issues, before even thought about hard- and software and databases are these organisational matters (Reeve D., 1996):

- How does an organisation decide whether it needs a GIS?
- How does an organisation decide what sort of GIS it requires?
- How can an organisation evaluate the success of a GIS project?
- What problems are there to face for those who have the task to introduce new systems into an organisation?
- What is the effect of introducing new technology upon job content, motivation, and Internal politics?

One of the tools for Nederlek, in the first phase of investigating the internal organisation for the need for GIS before subsequently implement the founded GIS strategy was the User Needs Study (UNS). This laid the foundation for the GIS. A UNS answered questions as listed.

The project team of Nederlek went into the organisation and by means of having interviews, handing out a questionnaire, observing existing work processes and analysing data flows, they attempt to determine the demand for GIS, and how the user sees this, upcoming, information system.

How the user sees this information system has to do with the point of view of looking at the system. The demand for information is different for a financial department than for a technical department. The people of the management require other information than people in the field (See diagram xxxxxon page X) Nederlek made a “rich picture diagram” to visualise the problems and workflows and to discuss what can be done about it. The organisation diagram helped too in this process (see diagram xxx appendix X), This graphic presentation of the structure of the organisation is a handy way to give an insight of the place the interviewee stands, in relations to the products or services they produce, perhaps in co-operation with other parts of the organisation. One look at the scheme will make things the interviewee says about the organisational context, clear.

Making a good questionnaire and asking good questions to the interviewee is an art on its own. Some questions of the questionnaire are universal, which is; they can be asked in any organisation. However, some can and must be asked specifically in the context of the organisation. This is important for determining the sort of GIS and the problems related to the different units or departments. Which problems or bottlenecks are there to solve. A questionnaire is not the same for every organisation, only the character of the outcome. The topics (Bernhardsen T., 1992, Reeve D., 1996) that were covered in Nederlek in the UNS are:

Spatial Information Product Requirements

What spatially based information products does the organisation currently produce? How are they produced? How often are they produced? Who produces them? How satisfied are users with the products? What bottlenecks are there?

Spatial Information Product Requirements for the future

What spatially based information products would decision-makers like to have available, which are presently not produced?

Spatial data holdings

- Inventory of the spatial data held by the organisation (databases and maps)?
- Who is responsible for obtaining?
- Who is responsible for maintaining?
- What level of duplication of data is present?
- How are the data held (tape, disk, paper, etc.)?
- What are the volumes of data?
- What security and back-up procedures are there?
- Which department are the key data holders within the organisation?
- What spatial referencing systems are used within the organisation?
- Are there common data standards?
- What spatially referenced data sets does the organisation currently not have access to?
- What are the gaps in the organisations present data sets?
- How does the organisation interact with relevant external organisations concerning transfer of spatial data?

Preliminary specification of GIS functionality

- Which GIS functions would be needed to produce present and required information products?
- Which functions are common to all products (e.g. printing/plotting)?
- Which functions would be specialist requirements limited to only one or a few products?

Attitudes towards GIS

- Which departments have interests in GIS?
- Which are aware of possibilities GIS would offer?
- Which group might provide an appropriate site for a pilot or showcase application?

The answer of the questionnaire should cover these items. Besides these specific questions, there are also a number of general questions, to get a complete picture of the person, his/her colleagues, the unit and the department. In a User Needs Study is it extremely important to find out all the details of the interviewee and his/her work surrounding, like:

- How much does the interviewee know about: GIS in general, the data and data-flow of the unit, relations with other units, and relations with external contacts?
- What kind of work does the interviewee do, in what part of the hierarchy of the organisation is the job. In what context is, the unit settled in the organisation (routine, policymaking, etc.).
- Does the interviewee know about the needs of the rest of the department? How big is the interest in GIS and how willingly are the to help with the initiatives taken?
- If GIS has already had its entrance, what is it they do with it now? What is it they want in addition?
- What is wanted or needed (specific requirements like CAD drawings, exchange with external relations,) or what is possible?

Not every individual interviewee can answer all these topics. Therefore, it is necessary to interview people from all kinds of departments (units), from low until high in the organisation. Some questions are very specific or technical and can only be answered by people of the organisation who work with such material, like system-operators, network-operators, Technical map productions (CAD environment), etc.

The expectations of an interviewee are of different kinds. Certainly, this comes with the choice of the person(s) who are interviewed from that organisation. How long are they working in that organisation? Do they have an overview of the work done by colleagues or do they know the work processes?

At least the interviewee is expected to give some insight of the department that he/she is working on and because of the choice of that interviewee, some details about his/her speciality or job in relation to the other colleagues on that unit. It must be clear that after all interviews a good view of the needs and problems of the users and the organisation must be present. This is perhaps the weaker side of a questionnaire in the UNS. If not interviewed the right person, the information gathered could be of a poor quality.

Interviewee's best can be representative persons of a business unit. Like Nederlek did, from every unit one or two persons. They are expected to give a good insight of the relevance of the unit to the GIS, to their workflow and to their own data, which are involved in their day-to-day work.

In the case of Nederlek, some people of the project team are also representatives of the units. They were able to explain their expectations and needs from their units and departments.

It is also important to conduct one or two persons of the middle management layer (management team). They also have to expect something from the system. What is it they expect to be happening? What are their needs? What sort of information would they like to have?

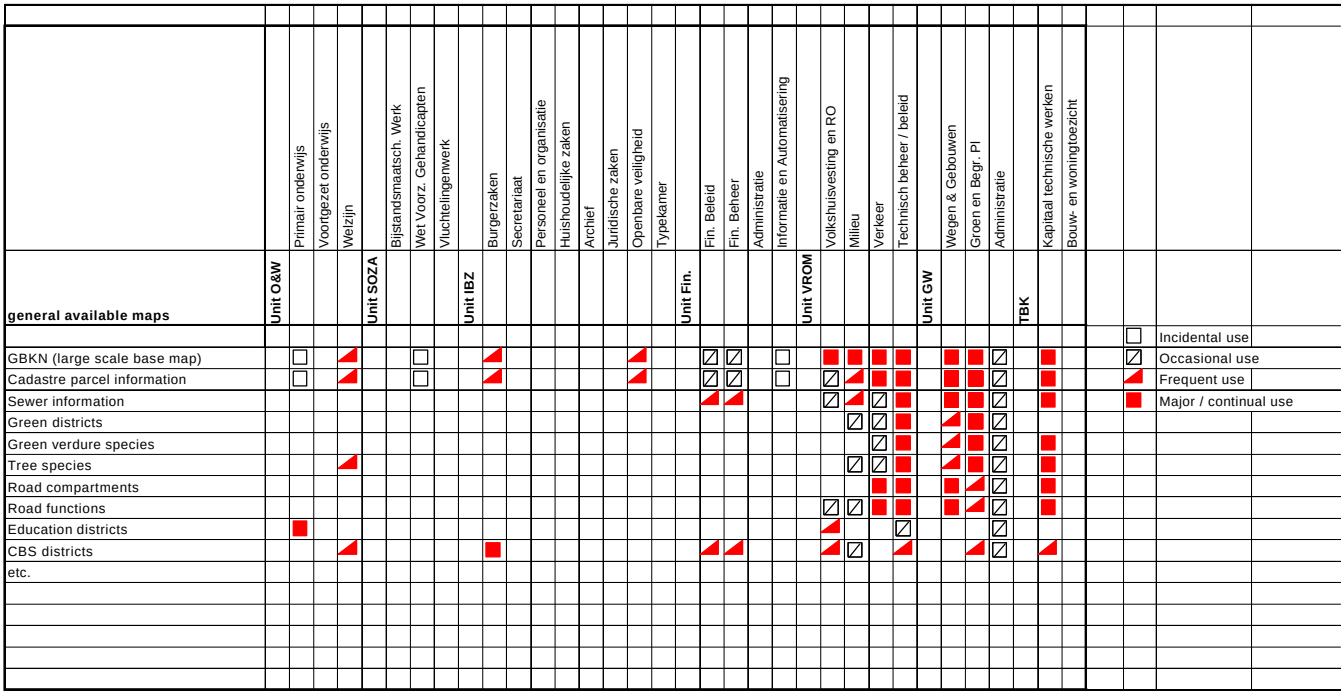
Nederlek ran into units who were at first not aware of the possibilities of GIS and some were in application areas were GIS's are less likely to be applied. Interviewing the wrong persons of the wrong units is always a risk of a UNS. Not interviewing these units is risking missing important and worthwhile GIS data or application areas. Therefore, the project team decided not to exclude any unit or any department. The project team choose ten persons out of 55 employees. These persons were, according to the project team, representative people from the organisation. There were some decision-makers on the list (Secretary of the municipality, some heads of the units) and people who know all about the present hardware, software, and infrastructure. They can give some details about the present data storage and structure of some administrative applications. What hardware platforms are involved? What databases systems are available or needed? What database formats use the present applications? There were also people on the list, who gave some answers about the day to day workflow, the conflicts they go through between departments, between other organisations, the missing links, the missing data, etc.

The questions asked are in appendix XXX. Some of the questions were skipped for some of the persons. This depends on the way the interview develops, about the answers given. Some questions are related to one another, so if the answer to the first question is not satisfactory, it has no sense to ask further about that subject. This list of questions should be treated as a guide for not forgetting some subjects.

A lot of information is gathered from a UNS. There are several ways to analyse this data. One possibility is the graphic presentation of the data in Grid charts. An example of the grid chart display is given in figure 8.1. It gives a good overview of the work parts of the unit in relation to the available and used data. Another way of getting overview of the gathered data is to construct overview tables.

Beside the grid chart and data flow diagrams, Nederlek also produced some tables of what needed data is already digital and in what form, the contacts several departments have with each other and with parties outside the organisation.

Figure 8.1. Principle of Current Map Utilisation grid.(some names are not translated!)



The final product of the User Needs Study, as a part of the total plan, was a report which gives the municipality of Nederlek, at least, a preliminary basis for deciding whether they should proceed further with GIS and what problems were there to face, what spatial data is available. A UNS can be recommended for a municipality. Tasks, and people performing those tasks, are described. When a User Needs Study is carried out the greater the likelihood that more formal structured methods will be used, with the ambition being not merely to prove the case for GIS, but also to provide a secure starting point for formal data design (Ferguson, 1990). Beside the pros, there are some cons. An UNS is time consuming. It is difficult to interview the right amount of persons. The quality of the person who are interviewed is important. A lot of information is missing and some time is lost, when interviewed the wrong persons.

Another difficulty, already mentioned, is that interviewees may well only have limited awareness of GIS and so their answers may underestimate the potential contribution of GIS to their activities. To minimise this chance it best is to raise awareness for GIS by means of papers or introductory presentations, or as Nederlek did, by means of a jolly intranet site.

A User Needs Study is a time consuming method, with an unsure outcome, when not asking the right questions, or the wrong persons are interviewed. However, if it is done right, it will show its value because of the amount of information, which is gathered of the organisation. Its a very structured method, which gives a good starting point, for determining the need for GIS in general and the needs for the users of the different departments specific. For the municipality of Nederlek, it was the right starting point.

Starting with the implementation was for this municipality getting to know the right starting point. Which data is available, which data is needed by what departments for what purposes, is there a multiple version of the same data in different databases, which databases can be linked together, etc.

At the same time the implementations begun, some people went to special courses to learn more about GIS in general and about the software packages, databases and available maps. Even the secretary and some head of the units went to special introductory courses to learn more about what GIS can mean for organisations of municipalities. To rise more awareness to the other management team members, head of the units, mayor and council members, a couple of demonstrations of some early prototype applications, the soil information system and the underlying concepts were given.

This is an important fact. The reason they could show anything at all was lying in the fact that they had some early applications. Environmental subjects, but also the cadastral parcels, were thankful applications to show. One of the goals to start in the first place with GIS was the efficiency and time gain to reach. Cadastral information is stored in an AS/400 IBM© environment. This is only the database information. Before the GIS environment, it took about 15 to 20 minutes to get all the information out of the printer, included a copy of a part of the analogue map. With GIS, it takes only seconds to get the wanted information before printing it.

8.4 Technical and Functional design and the pilot projects worked out.

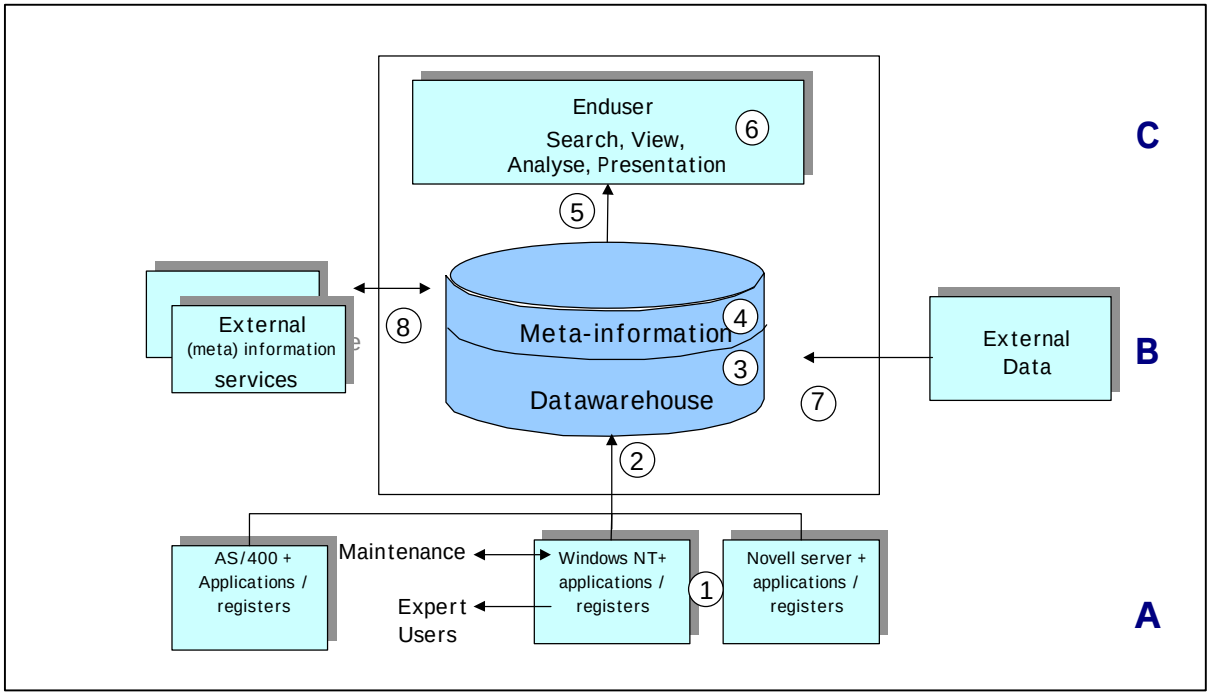
After completion of the plan of action, a first demonstration was given to the Management team and to the Major and Aldermen. They were very enthusiastic, but added an extra obstacle. Because of extreme high pressure on the organisation (Y2K problem, time of the year for finance estimates, Euro preparations, and some other issues) they decided that the start of the implementation was covered by only one department. However, this department should make allowance for the whole organisation.

This smaller project group started with the making of a functional and technical design of the GIS system. The findings would be a framework for the rest of the organisation. Items covered in this stage were; functional design, technical design, datawarehouse, meta-information, open up the geo-information by a concept, and proposals for follow up actions

These items were putting together in a concept, the Geo-information Open up Architecture (GOA).

This concept, applied in Nederlek, consists of three layers (Figure 8.2). The transaction-based systems layer (**A**), the distributed storage layer (**B**), and the front-end layer (**C**).

Figure 8.2 GOA- concept, introduced in the municipality of Nederlek.



In the transaction-based layer are all the base registration databases on the different platforms (***1***). This means the AS/400, Novell, NT platforms. On these platforms are the main registrations like the land records registration, people registration, etc.

The storage layer is an important one. This layer consists of two important elements. One is the datawarehouse (***3***). Here all data is stored which should be corporate used in the organisation. The upload of data out of the transaction layer and the datawarehouse is with standard procedures and formats (***2***). A meta-information system (***4***), put above the datawarehouse provides the needed information for knowing what is stored in the datawarehouse. This layer is supposed to be Read-only. Mutations are done in the original registrations with matching procedures. This datawarehouse will also give insight to historical data. Exchange of data (***7***) or meta-data (***8***) will be done on and with this layer.

The front-end layer consists of end-user software (***6***) for viewing, analysing, presenting, and printing of spatial data. In this case Arcview©, ArcExplorer© together with some specific application software. Also the client software, GeoKey©. The front-end software of the meta-data system (***5***). Meta-data can be viewed with an ordinary Internet browser. From within ArcView© meta-data is viewed with a special Extension. Some formats of the actual data can be imported into ArcView© with this Extension. This Meta-data information system conforms itself by the European standards and the Dutch standard of the Dutch clearinghouse (NCGI).

All layers are connected by the infrastructure present in the organisation.

8.5 Applications.

Applications realised as stand-alone solution or within the GOA the concept are for instance the soil- / environmental application, land records application, developmentplans application, Arial photo's for background information, sewer-,roads and verdure application, and some others more.

8.5.1 Soil-/environmental application.

One of the reasons of starting with GIS in the first place and with the software used now, is the realisation of the first phase of a Soil GIS application. From 1995/1996 has the municipality of Nederlek such a system. It started as a soil information system (Colijn, 1997). From 1998, the system was improved by data from the Province of Zuid-Holland. Together with data of Noise, oil tanks, and other relevant environmental data, the soil information system has expanded to a serious environmental system were the making of new policies is depending on.

On regional level, Nederlek is one of the key players in a regional project for permissions supply and controlling activities for filled up Ditches with material. Connected authorities are all seven municipalities (represented by Nederlek), the Province, the regional environmental body (ISMH), the waterboard, the water cleaning authority and police. All authorities have to view the relevant data. They can see if and where are ditches filled up with material, is there a permission for it, what is the material in it, etc. Base of the system will be the experiences done with the soil information system. The planning is that the first phase of this project is completed at the summer of 2000.

8.5.2 Land records application.

One of the most important information is the Automated Cadastral Register (AKR) together with the land record information (LKI) from the Cadastre. Both information is digital available at the Cadastre. A municipality has a copy of those records to perform several tasks.

To put this data into a GIS system, was dealing with many barriers. It started with the exchange format. One can order data from the Cadastre in NEN1878 format, in SUF format or dxf/dwg AutoCad© format. NEN 1878 and SUF are ASCII formats were data is put in, in a standardised way. A way must be found to convert this 'text' format into a usable layer. All three formats results in the first place of a vector based layer. The other information delivered by the Cadastre, consists of the database information (AKR). This data is also delivered in special exchange formats. Information out of the database can best added to a polygon based layer (objects).

The third barrier was that originally the database information was brought into the AS/400 computer system. Other information out of other databases, like the people's registration, the taxes registration, etc., was added to this.

Nederlek is now able to view the land records in an ArcView application and can add additional data out of that AS/400 to this. Key field is the unique number of the land record registration.

8.5.3 Developmentplans application.

In contradiction to the general findings of Nunen (1999), Nederlek does have an application were development plans are stored. From all plans, five plans are completed now. This includes the minor changes and parts of the plans. As covered earlier a system relies on data. This data has to be digital available. In most of the cases this data are in analogue format. This year (2000) is the year that all those plans are digitised and brought into the GIS environment.

8.5.4 Aerial photo's

1999 was the year of the making of the aerial photos. From the whole area, Nederlek has made otho-photos on a fly scale of 1:6000. The Area of the town was flied on a 1:3000 scale. These are 24-bits and 8-bits photos. Application areas are a topographic background to the cadastral and GBKN maps, illegal building activities, planning activities and for a detailed overview for the real estate valuation.

8.5.5 Sewer-, roads and verdure application.

One of the first application areas were GIS is used, is the planning and maintaining of sewers, trees and verdure and the roads. This data was digital available and therefore quick usable in that particular area. Together with data about electric cables, gas pipelines, water pipes, etc., this can be of great help to the people in the field, who had to dig into the ground. In this year, most of the data from the electricity company comes available.

8.5.6 Other applications.

Beside the mentioned main applications realised, there are more, smaller, applications. They mainly fulfil the needs of individual tasks of persons or departments. Other, bigger, applications are there to come. One of them is an application for the Finance department. This is the W.O.Z. application (in Dutch: “Wet Onroerende Zaken”).

The responsibility for real estate valuation is delegated in the Netherlands to the 538 municipalities. To analyse and combine data with other datasets, this data is best to be visualised in a GIS application. Queries and selections can then be done

The land records registration and aerial photos together with the valuation data must help to perform this task.

8.6 conclusions of case Nederlek

In Nederlek, GIS was introduced at the end of 1994. In 1995, the first application, the soil information system, was implemented. This was on only the department of VROM (see Appendix xx) since then, GIS has developed from one department to multi departmental use. Until 2000, three departments are involved in the GIS project. VROM, Municipal works and Taxes. In addition, the first manager has GIS view functions on his desk. The whole organisation can make use of the Meta-information system, to see what data is available. Year 2000 will be the year to expand to more than three departments and to more on the desks of the managers.

On several application areas (e.g. environment, development plans), the GIS is used as a decision support system (DSS) Beside the environmental application area, mainly soil, GIS is not used to make difficult analysis.

A “champion” did introduce GIS. Now GIS is more common and is used by at least on decision maker directly and the system is influencing the others decision makers in their way to make decisions. The management team recognised the profits these tools can bring to the organisation and provided the means for it. A thorough user need study laid the foundations for this.

Chapter 9: Conclusions and recommendations.

9.1 Introduction.

Because the strictly defined tasks by higher governmental bodies, municipalities have no competitive needs. They are authorised to manage their own policies. From historical growth of automation of the old paper files and drawers, information islands arose. They now have the need of good overview of this data, because of their tasks. They also need more efficient ways of managing their data in favour of other governmental bodies, local industries and to their citizens. Municipalities are the midpoint of data-exchange, but are not that well prepared for this task. GIS technology can be very helpful increasing their efficiency of data management.

This study aimed to develop a better understanding of nature and extend of GIS diffusion across and within municipalities. The objectives were to find benefits of GIS use and the barriers to adoption. Success and fail factors were identifies as well as a better understanding of development of GIS diffusion in time.

This study has two research levels. One aims to focus on diffusion at municipalities in the Netherlands in general as were the second level goes more in depth. The overall level is explored by a national questionnaire survey amongst all municipalities in the Netherlands. The in depth study case was done by studying strategic papers, implementation methods, attending project group meetings and by means of attending the execution of a User need Study. This is a study case among (potential) GIS users in an organisation from a small sized municipality.

9.2 Results.

–Masser (central & local gov. attitudes towards management of information, data availability)
–Graafland
•size of the municipality, automation/experience level, budgets, complexity of the organisation, involvement of the management, Relation larger mun. & suppliers (soft/hardware)
–Grothe & Scholten
•Limited experience (causes organisational & technical)
–DHV, Nunen, VU-workshop
•Uses of programs, Town & countryplanning dep. can not pull GIS into organisations, Implementation success and failure factors. ●

Chapter 3 – Models

●GIS- house concept
●OPAFIT components ●Phase models of Nolan (4 phases, every phase ends in a crisis.)

- Modified models of
  - King and Kreamer
    - Additional research (awareness of management,relation software suppliers & managers, Topdown approach (vision))
  - Graafland
    - First two phases bottom up,, Conflicts with organisational structure and culture
    - Solution, next two phases top down approach

Chapter 4 – Dutch G-IT developments and standardisation

CHAPTER 4 Dutch G-IT developments and standardisation

- VNG
  - OL2000
    - Base data and organisation must be organised, conformation to standards
  - GFO
- RAVI (advise organ of the ministry of VROM)
- NCGI (national clearinghouse for geographic information)
  - Meta-information
- OPEN GIS
  - Comprehensive software architecture spec. as basis for open systems geo-processing
  - From technology driven to problem driven.
- INTERNET and GIS
  - Metadata & data

Chapter 6

Case studies of Nederlek

- Questionnaire (potential) users of the system (UNS)- Reviewing strategic papers
  - Implementation method
  - Functional and technical design.

Hypothesis testing

Chapter 7

Descriptive outcome of the questionnaire, with tables to visualise

- Outcome of the questionnaire
  - Respondent
  - GIS use
  - Meta- data
  - GIS adoption, use and development
  - Non GIS-users
  - Additional comments of the respondents

chapter 8

- Outcome of the UNS
  - GOA – concept-GIS Applications running
  - Available finances
  - (NON) Relationship with software supplier

Conclusions and recommendations.

- Conclusions

●Recommendations

Earlier studies (Grothe et al. 1996, Graafland 1989, 1993) mentioned the fact that the number of inhabitants in a municipality and therefore the size of the organisation of that municipality are of possible influence to the success of implementing new GIS technologies. Bigger municipality organisations are already using GIS techniques more, opposite smaller ones.

Bigger Municipalities are indeed using GIS techniques more opposite smaller ones (table 5.5 and 5.7). They also were the early adopters of GIS. We can conclude from *table 7.1* that the largest group of GIS users who have GIS in, at least in several departments, is between 20.000 and 50.000. Corporate GIS usage is in municipalities between 10.000 and 20.000 the largest group.

Table 9 .1 GIS departmental usage in categories.

	Abs of GIS-users							
	< 5000	5.000 – 10.000	10.000 – 20.000	20.000 – 50.000	50.000 – 100.000	> 100.000	Total Abs	Total %
In several departments		2	10	**25**	8	7	52	45%
Only on one department	1	7	15	19	3	3	48	42%
Corporate GIS use		1	**4**	2	2	3	12	10%
No response to Q.				1	1	1	3	3%
Total Abs.	1	10	29	47	14	14	115	100%
Total %	1%	9%	25%	41%	12%	12%		100%

There also tend to be a relationship with bigger municipalities and computer suppliers (Graafland, in: Masser et al. 1996) New techniques are quicker applicable in those organisations for several reasons. Probably money, people, and awareness are influencing this.

If smaller organisations already started to implement, or have the intention to do so, they are implementing GIS in departments more than through the whole organisation, as in a 'corporate' GIS.

GIS software techniques are increasingly more user- friendly and comprehensive.

25% of the non-users of GIS responded that more user-friendly systems and availability of useful digital data (44%) would make them seriously consider purchasing GIS. They think it can be better.

The reason for struggles in the implement phase should be organisational ones. Also Money and consistent data are still problems.

Most of the organisations are in phase 1 and 2 after Nolan.

Kenmerken:

GIS implementation needs a 'champion'.

Knowledge and experience exchange should be increased between municipalities.

The Dutch association of municipalities (VNG) and/or RAVI should be of more help with a structured outline.

Technical departments within a municipality take the initiative to, at least to look at the possibility, to implement GIS tools into their departments.

Municipalities focus on hot items, instead of creating policy for new technologies.

Education and awareness is a key factor for a successful implementation.

Meta-data is of crucial importance for the development of GIS systems in an organisation.

To implement GIS systems, some municipalities just buy a system by a supplier end introduce this into the organisation.

Creating awareness of the benefits of a GIS to the management is of strategic importance for a successful implementation.

One of the main conclusions, beside the development of better understanding of nature and extend of GIS diffusion across and within municipalities is that the main problem for organisations is creating commitment from the top of the management.

To increase experience, and enthusiasm for using GIS, the (potential) users needs good training and education.

Municipalities are perfect organisations for using GIS, because of its tasks and its data.

Another one is that GIS within municipalities, is mainly used to perform a registration and maintenance function instead of supporting in the decision-making process.

GIS use has growth from 21% in 1996 to 39% in 1999.

Organisation

Corporate GIS/department GIS

Comparison with the last big survey of 1996.

Response differences use and non-use.!!!

Differences of response could be lain in the fact that in 1995, 633 municipalities were written too. Now, 4 years later only 533 municipalities are left. If we look to the number of municipalities in each group, we see that we now have more 'bigger' municipalities.

One other important conclusions is that half of the municipalities which started to implement GIS do this without a vision or a plan for the future.

Future situation at the municipalities.

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	Heliview 1992				GITC 1994				Grothe and Scholten 1996				Colijn 1999			
	Total Response		GIS use		Total Response		GIS use		Total Response		GIS use		Total Response		GIS use	
	Abs.	R/P %	Abs	%	Abs.	R/P %	Abs.	%	Abs.	R/P %	Abs.	%	Abs.	R/P %	Abs.	%
< 10.000	103	39,7	1	0,9	81	35,3	2	2,4	129	57,5	3	2,3	56	44,4	11	19,6
10 – 20.000	87	42,4	7	8,0	66	30,5	11	16,6	117	54,1	19	16,2	109	58,6	29	26,6
20 – 50.000	55	42,3	18	32,7	50	37,0	24	48	80	58,3	31	39,2	95	57,2	47	49,5
> 50.000	23	43,3	13	56,5	25	44,6	20	80	29	51,7	23	79,3	34	56,7	28	82,4
Total	268	41,4	39	14,5	222	34,9	57	25,6	355	56,0	76	21,4	294	54,6	115	39,1
R/P = Response / Population																

to this study and others (Grothe & Scholten, 1996, Nunen, 1999) the use of GIS in municipalities is, besides small use of decision support, mainly focused, to gather, structure and combine data from different data sources. Mainly to easy certain tasks..

At least 90% of the GIS users (table 5.10) sought for improved access to several information sources. About 86% sought for better quality of information. Gaining their goals is however a problem.

The technical departments are the main drivers behind the introduction of GIS into the organisations (31%) followed by the Information and Automation department (14%).

Municipalities do not let GIS influence their view about the way their organisation functions, although they agreed to the statement that GIS provides them with greater efficiency in maintenance and planning.

An important factor to failure of implementing can be the fact that 49% of the GIS users do not have a policy of vision to the future. Where is it they want to be with GIS in their organisation in the future? What is it they want to do in the future?

Technische afdeling
Beheermedewerker en counter clerk.

This study should also give new recommendations and success and fail factors. These will be handled in this chapter According

VNG en RAVi

Although the VNG and RAVI organisation have done some assistance by awareness sessions, by making a datadictionary (GFO) and information books (VNG vastgoedreeks), some municipalities expect more from them. Some more clear handouts and practical tips are welcome.

Tasks of a municipality

Municipalities are the lowest governmental body. A citizen has to go a municipality office for many things. When he moves to another town or country, he should go to the peoples register. For getting a driver's licence or a passport, one must go to the municipality. The municipalities also valuate the worth of the houses. You have to go to the municipality for getting all kinds of permits, like environmental permits, building permits, digging permits (in public ground), etc., etc.

Only for some arrangements like changes on properties or utility works, you have to go to other authorities.

Is GIS just as common as 'word-processing' or 'spreadsheets'? You could say so. Microsoft (and others too) has a tool in its office package, which is called MS-map. Microsoft Office is a well-used package in many municipalities. If there was enough accurate and usable data in this format, it could do well. Up-to-date data in the right (standard) format is the engine of a GIS, also in municipalities.

success and fail factors

The diffusion of innovations is, because of the assumption that technology is socially constructed, the result of interaction between the technology and the potential users within particular cultural and organisational context (Campbell in: Masser *et al*,1996).

Constant (1987, in: Masser *et al* 1996) stresses that it is more important that the technology becomes fashionable rather than that objective measures of its utility indicate a considerable advance over existing techniques, a technology is becoming widely diffused. Context influences both the diffusion and likelihood of successfully implementation any form of technology. Context is the styles of bureaucracy and the approach to decision making. Information systems also diffuse if the main interests within the organisation are confident that the information produced will support their activities and values (Campell, 1996)

Success factors:

- Commitment of the management and the organisation
- The will to accept changes
- Personnel capacity
- The "Champion", who put GIS on the agenda.
- Changes of processes because of GIS

Fail factors:

- Quality of the data supplied by others.
- No databasemanager
- No datamaintenance organisation.
- The time is too long before any results are seen.

Possible problems:

- Project can be too ambitious.
- Not enough personnel or time available.
- Where to start is a possible problem.
- No attention nor support of the management.
- No budget or too little available.
- Departmental barriers and the defence of them.
- Changes of tasks
- No confidence in their own data.
- Financial department does not see the possibilities.

Herindelingen van 633 gemeenten in 1996 tot 538 gemeenten in 1999. Per saldo meer ‘grotere’gemeenten, die echter uit meerdere , voorheen tot de kleinere gemeente behorende groep behoorden.

Recommendations for further research.

The absolute figures found with this study are quick out of date by the enormous growth of IT in general and GIS specifically. As Nunen (1998) already mentioned, less is known about the diffusion on specific departments within the context of the whole organisation. Some departmental findings however were presented in this thesis. The focus was on the diffusion in organisations in general.

Because of the resemblance with the study in the Retail sector, comparisons between the two sectors can be done.

"The final thought"

The question asked by smaller municipalities is:" Can GIS mean as much for us as it does for bigger municipalities, or are it just nice toys"? In fact it does. The tasks for a small municipality are the same as of a large one. The relying data, used for it, is in principle the same. As we speak in models, the roof of the GIS house is the same for all organisations. A big municipality has just more of the same. It is like in real life. One lives in a villa, the other in a simple small house. The effect in smaller municipalities can even be bigger, because of little personnel performing a wide spread of tasks have the need to lighten up those tasks. Struggles for beginning can be for small to middle-small municipalities financial or personnel ones. In general, simple tools for performing the tasks will make the organisation more efficient and effective. GIS tools can such tools. GIS tools even can integrate into the desktop programs and the Internet in municipalities.

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  - ***Auteursrecht op geo-informatie***, Ravi-publicatie 94-2, ISBN 90 72069 35 8
  - ***Perceel en persoon gerelateerd***., GBA persoonsidentificatie in de kadastrale registratie, Ravi-publicatie 94-3, ISBN 90 72069 36 6
  - ***Kwaliteit in perspectief***. Overzicht van de behoefte aan registratie van kwaliteitsmerken over geo-informatie in Nederland, Ravi-publicatie 95-1, ISBN 90 72069 39 0
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  - ***Bescherming en verstrekking van geo-informatie***, Ravi-publicatie 95-6, ISBN 90 72069 40 4
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Chapter 11: Used Internet sites:

- The Open GIS organisation: http://www.opengis.org
- Action program Electronic government. The Dutch governments on the electronic highway which operates efficient and effective: http://www.overheid.nl

Appendix A: Chi-square test

A.1 Introduction.

To keep in track of the tables of the next paragraphs, a very short explanation of the chi-square analysis is covered here. Base of these short enumeration of basics are three books: Norusis M.J. (1988), Vos S. (1983) and Erickson, Nosanchuk (1977).

The chi-square test helps to examine tables whether two variables are associated in the population.

The Chi-square statistic is used to compare the observed frequencies to those that would be expected if the two variables were independent. If there is an association between the two variables, the expected and the measured values will differ strong. If they however hardly differ, there is no association. The actual results differ not much then, from the “no relationship” pattern. Both variables are categorical. The chi-square compares observed to expected values cell by cell, so what matters is the number of comparisons or the number of cells.

Assumptions about the data are needed (Erickson and Nosanckuk,1977):

a) For 2*2 tables, the expected values in each cell should be 10 or more.

b) For tables larger than 2*2, the mean of the expected values should be six or more for tests at the 5% level; for tests at more demanding levels, like 1% or 0.1%, the minimum mean expected value should be somewhat higher.

In other words, the chi-square test should not be used if more than 20 % of the cells have expected values less than 5. It must also be sure that none of the expected values is less than one.

To see how any relationship between the variables is, the tables are given. The variables can be examined then cell by cell.

The observed significance depends both on the degrees of freedom and on the value of the chi-square statistic. A very low probability (value of significance) indicates that it is quite likely the two variables are dependent in the population. Limitations are therefore that because of the dependency of the number of rows and columns, comparison between measures based on different tables are not simply possible.

Chi-Square analysis 1.

The next analysis will count wetter there is a relationship or not between the size of the municipalities and the fact that there could be one person enthusiastic at first for introducing GIS in the organisation. For this analysis, the size of the municipalities is categorised into three groups. These groups can be replaced with the categories “Low”, “Middle” and “High”. However to know the definition of low, middle and high, the labels are exchanged back by the variable names, the categories are divided in. This means that “Low” represents the municipalities smaller than 20.000 inhabitants, Middle represents the municipalities between 20.000 and 50.000 inhabitants. “High” mean in this case more than 50.000 inhabitants. The underlying decision for these categories is viewed in table XX on pageXX. We see that in the Netherlands there are a lot of small municipalities and only a few real big ones. “Big” in the Netherlands means > 50.000 inhabitants. There are only 5% of the municipalities this big. “Small” in the Netherlands is somewhat more discussible. It seems that at least 58% is smaller than 20.000 inhabitants.

Netherlands	Total Population		Cumulative	
	Abs.	%	Abs	%
< 5000	20	3,7%	20	3,7%
5000 – 10000	106	19,7%	126	23,4%
10000 – 20000	186	34,6%	312	58,0%
20000 – 50000	166	30,9%	478	88,8%
50000 – 100000	33	6,1%	511	95,0%
> 100000	27	5,0%	538	100,0%
Total	**538**	**100,0%**		

3 nieuwe categorieen voor gemeentegrootte * een persoon enthousiast Crosstabulation

			een persoon enthousiast			
			1,00	2,00	3,00	Total
3 nieuwe categorieen voor gemeentegrootte	<5.000 - 20.000	Count	15	11	14	40
		Expected Count	14,3	11,4	14,3	40,0
		% of Total	13,4%	9,8%	12,5%	35,7%
		Std. Residual	,2	-,1	-,1	
	20.000 - 50.000	Count	17	13	16	46
		Expected Count	16,4	13,1	16,4	46,0
		% of Total	15,2%	11,6%	14,3%	41,1%
		Std. Residual	,1	,0	-,1	
	>50.000	Count	8	8	10	26
		Expected Count	9,3	7,4	9,3	26,0
		% of Total	7,1%	7,1%	8,9%	23,2%
		Std. Residual	-,4	,2	,2	
Total		Count	40	32	40	112
		Expected Count	40,0	32,0	40,0	112,0
		% of Total	35,7%	28,6%	35,7%	100,0%
		Std. Residual				

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	,367[a]	4	,985
Continuity Correction			
Likelihood Ratio	,373	4	,985
Linear-by-Linear Association	,194	1	,659
N of Valid Cases	112		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 7,43.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	46,296[a]	2	,000
Continuity Correction			
Likelihood Ratio	47,378	2	,000
Linear-by-Linear Association	45,823	1	,000
N of Valid Cases	294		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 13,30.

Case Processing Summary

	Valid		Missing		Total	
	N	Percent		Percent	N	
3 nieuwe categorieen voor gemeentegrootte * wel/geen GIS	294		0	,0%	294	100,0%

Relationship between the size of the municipality and the use –non-use of GIS

3 nieuwe categorieen voor gemeentegrootte * wel/geen GIS Crosstabulation

			wel/geen GIS		
			Ja	Nee	Total
3 nieuwe categorieen voor gemeentegrootte	<5.000 - 20.000	Count	40	125	165
		Expected Count	64,5	100,5	165,0
		% within 3 nieuwe categorieen voor gemeentegrootte	24,2%	75,8%	100,0%
		% within wel/geen GIS	34,8%	69,8%	56,1%
		% of Total	13,6%	42,5%	56,1%
	20.000 - 50.000	Count	47	48	95
		Expected Count	37,2	57,8	95,0
		% within 3 nieuwe categorieen voor gemeentegrootte	49,5%	50,5%	100,0%
		% within wel/geen GIS	40,9%	26,8%	32,3%
		% of Total	16,0%	16,3%	32,3%
	>50.000	Count	28	6	34
		Expected Count	13,3	20,7	34,0
		% within 3 nieuwe categorieen voor gemeentegrootte	82,4%	17,6%	100,0%
		% within wel/geen GIS	24,3%	3,4%	11,6%
		% of Total	9,5%	2,0%	11,6%
Total		Count	115	179	294
		Expected Count	115,0	179,0	294,0
		% within 3 nieuwe categorieen voor gemeentegrootte	39,1%	60,9%	100,0%
		% within wel/geen GIS	100,0%	100,0%	100,0%
		% of Total	39,1%	60,9%	100,0%

Small <20.000

Medium 20.000 – 50.000

Large > 50.000

To find out if another definition would influence the outcome of the chi-square test another definition of small, medium and large is used.

Small <20.000

Medium 20.000 – 100.000

Large >100.000

This change of definition has no influence. The outcome still is that there is a relation between the use of GIS and the size of the municipality and therefore the size of the organisation of that municipality.

Chi-Square analysis 2.

Relatie gemeentegrootte en stelling het perfecte scenario is GIS tools on every desk of the manager

Er is een relatie

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
3 nieuwe categorieen 3> 50000 * recoded stelling 5	115	100,0%	0	,0%	115	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8,979[a]	4	,062
Continuity Correction			
Likelihood Ratio	9,767	4	,045
Linear-by-Linear Association	7,448	1	,006
N of Valid Cases	115		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 7,06.

3 nieuwe categorieen 3> 50000 * recoded stelling 5 Crosstabulation

			recoded stelling 5			
			agree	neither / no answer	disagree	Total
3 nieuwe categorieen 3> 50000	<5.000 - 20.000	Count	25	11	4	40
		Expected Count	18,8	11,1	10,1	40,0
		% of Total	21,7%	9,6%	3,5%	34,8%
	20.000 - 50.000	Count	19	13	15	47
		Expected Count	22,1	13,1	11,9	47,0
		% of Total	16,5%	11,3%	13,0%	40,9%
	>50.000	Count	10	8	10	28
		Expected Count	13,1	7,8	7,1	28,0
		% of Total	8,7%	7,0%	8,7%	24,3%
Total		Count	54	32	29	115
		Expected Count	54,0	32,0	29,0	115,0
		% of Total	47,0%	27,8%	25,2%	100,0%

A

Chi-Square analysis 3.

In this statistic chi-square, crosstabulation, analysis, the hypothesis that size of the municipality is of influence to the relation that IT-departments play a mayor role in the introducing phase of GIS, is tested. Looking, however to the expected counts and the real counts, we must conclude that there is hardly a relation between them. Those figures hardly differ from one another. The Asymp. Sig. Figure of the Pearson Chi-Square test confirms this.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
3 nieuwe categorieen 3> 50000 * recoded stelling it dep major role in introducing phase	115	100,0%	0	,0%	115	100,0%

Chi-Square Tests

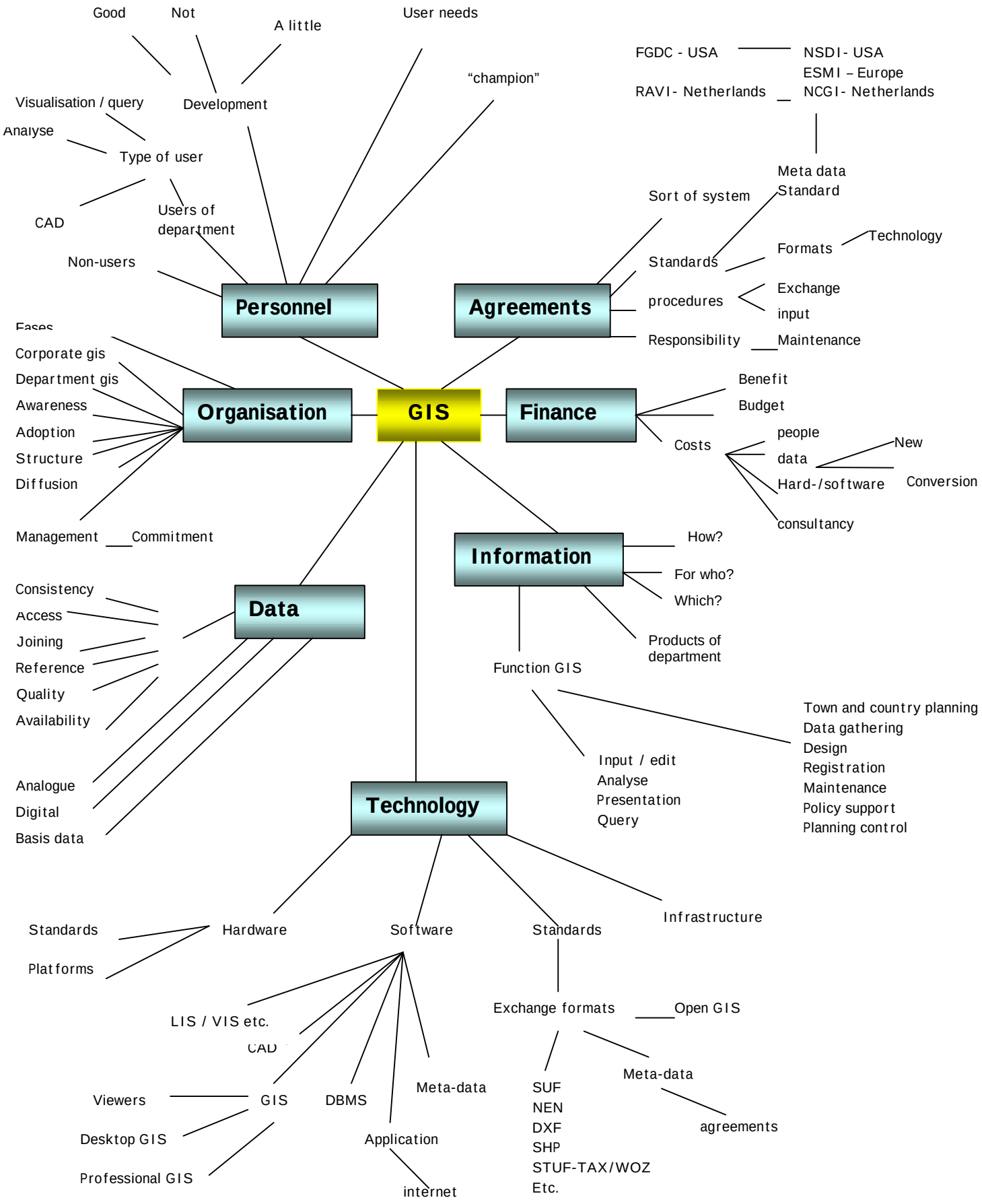
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1,694[a]	4	,792
Continuity Correction			
Likelihood Ratio	1,666	4	,797
Linear-by-Linear Association	,119	1	,730
N of Valid Cases	115		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 6,82.

3 nieuwe categorieen 3> 50000 * recoded stelling it dep major role in introducing phase Crosstabulation

			recoded stelling it dep major role in introducing phase			
			agree	neither / no answer	disagree	Total
3 nieuwe categorieen 3> 50000	<5.000 - 20.000	Count	13	9	18	40
		Expected Count	12,5	9,7	17,7	40,0
		% of Total	11,3%	7,8%	15,7%	34,8%
	20.000 - 50.000	Count	14	10	23	47
		Expected Count	14,7	11,4	20,8	47,0
		% of Total	12,2%	8,7%	20,0%	40,9%
	>50.000	Count	9	9	10	28
		Expected Count	8,8	6,8	12,4	28,0
		% of Total	7,8%	7,8%	8,7%	24,3%
Total		Count	36	28	51	115
		Expected Count	36,0	28,0	51,0	115,0
		% of Total	31,3%	24,3%	44,3%	100,0%

Appendix B: Mind map



Appendix C: Accompanied letter (translated in English).

23 April 1999

About: Questionnaire about the use of Geographic Information Systems (GIS) at municipalities.

Dear major and Aldermen,

To have the right information on the right moment will be increasingly important at municipalities. One of the most striking developments to fulfil these needs lays in the increasingly availability and use of spatial data and geographical information systems (GIS).

Probably the counter clerks and other employees are confronted with questions like:

“I’ve laid my eyes on a piece of land in your municipality, and like to ask the following questions about it:

1. Is this land for sale?
2. What is the price then?
3. What is the Cadastral information from it?
4. What says the town and country planning maps about it?
5. Are there sewers and electric cables underneath it?
6. Is there a possible case of soil pollution?
7. What is the valuation of it?
8. Etceteras.”

Most of the time is answering these simple and logical questions not easy. Information from different persons, mostly working at different departments is needed.

Improvement of the above situation (answering at one counter) needs improved co-operation of the different departments. In addition, it will be needed to integrate a big amount of spatial and administrative data.

Geographical Information Systems can improve the integration of processes and data management.

There is not much known about the use of Geographic Information Systems by organisations of a municipality. One of our post-doctoral students of the Free University is working at the municipality of Nederlek and is researching the use of GIS within municipalities.

One part of this study is to send out a questionnaire for further analysis.

I kindly request you to give this questionnaire to one of your employees within the organisation, who is responsible for spatial- or real estate information (real estate co-ordinator or GIS co-ordinator, head of the department of Information and Automation or head of the department were GIS is, or can be applied.

Even if you do not use GIS now, we are very much interested in your opinion.

The answers will be treated carefully and we guarantee full anonymity. If you are interested in time, in the results of this study we will send them to you.

For questions about this subject you can contact René Colijn, telephone: 0180-667719.

I thank you for your co-operation.

Regards

Prof. Dr. H.J.Scholten

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Free University of Amsterdam
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Emal: unigis@econ.vu.nl

Appendix D: Questionnaire

National survey at

The use of GIS in Dutch municipalities.

In co-operation with

The municipality of Nederlek

The Free University Amsterdam

&

The NCGI (National Clearinghouse Geo-Information)

ALL INFORMATION WILL BE TREATED CONFIDENTIAL.
THE RESULTS WILL ONLY BE USED IN EXTRACTED FORM AND ONLY FOR SCIENTIFIC RESEARCH.

PLEASE SEND BACK THE QUESTIONNAIR NO MATTER YOU USE OR DO NOT USE GIS.

SECTION A – ORGANISATION

1. In which province does your municipality lay? *(Choose with a Ö just ONE answer)*

❑ Noord-Holland	❑ Utrecht
❑ Zuid-Holland	❑ Overijssel
❑ Zeeland	❑ Flevoland
❑ Noord-Brabant	❑ Drenthe
❑ Limburg	❑ Groningen
❑ Gelderland	❑ Friesland

2. How many inhabitants does your municipality have? *(Choose with a Ö just ONE answer))*

❑ < 5.000 inhabitants
❑ 5 - 10.000 inhabitants
❑ 10 - 20.000 inhabitants
❑ 20 - 50.000 inhabitants
❑ 50 - 100.000 inhabitants
❑ > 100.000 inhabitants

3. On what department are you working? *(Choose with a Ö just ONE answer)*

❑ Information and Automation department	❑ (Real) estate department
❑ Civil works / municipal works	❑ Surveying
❑ (V) ROM (accommodation, town and country planning and environment)	❑ Public affairs
❑ Finance	❑ Others *(please specify.)* .....

4. What is your function within the municipality?

.....

5. How many years are you working in your organisation in this function?

.....

6. Does your organisation make use of a Geographic Information System (GIS)? *(Choose with a Ö just ONE answer)*

❑ Yes ⟹ (go to section **B**)

❑ Nee ⟹ (go <u>to</u> quest. 7. And then to section **D**)

7. Do you expect to make use of GIS technology in the near future? *(Choose with a Ö just ONE answer)*

❑ Yes

❑ No, why not? .....

SECTION B – THE USE OF GIS.

1. From when do your organisation make use of GIS software?

From 19…….

2. Where is GIS used? *(Choose with a Ö just ONE answer and specify).*

- ❑ Just in one department, namely ……..
- ❑ Through the whole organisation.
- ❑ In several departments *(please specify)*

……

3. For which policies or applications is GIS used within your organisation? *(Choose with a Ö, several answers possible)*

- ❑ Registration and maintenance.
  - ❑ Sewer maintenance
  - ❑ Road maintenance.
  - ❑ Verdure maintenance
  - ❑ Environment maintenance.
  - ❑ Cadastre information
  - ❑ Town and country planning
  - ❑ Cartography
  - ❑ Others, ……
  - ❑ ……
  - ❑ ……
- ❑ Policy
  - ❑ Environmental policy
  - ❑ Location policy
  - ❑ Others, ……..
  - ❑ ……
  - ❑ ……
  - ❑ ……
- ❑ Others
  - ❑ Taxes (WOZ taxes)
  - ❑ Counter service
  - ❑ Information
  - ❑ Others, ……
  - ❑ ……
  - ❑ ……

4. By whom are GIS programs or the results of GIS applications, used within your organisation /department? *(Please choose with a Ö just ONE answer how often these employees work with GIS and if they use it themselves (directly) or just use the output from a GIS system or application (indirectly).*

User sort	Use often		Use incidental		Do not use
	Directly	*Indirectly*	*Directly*	*Indirectly*	
Counter clerk for instance Cadastral information or environmental information.	❑	❑	❑	❑	❑
Policy employee	❑	❑	❑	❑	❑
Maintenance employee	❑	❑	❑	❑	❑
Head of the department	❑	❑	❑	❑	❑
Long term planning employee	❑	❑	❑	❑	❑
Managementteam	❑	❑	❑	❑	❑
Mayor and Aldermen	❑	❑	❑	❑	❑
counsellors	❑	❑	❑	❑	❑
Outside personnel (like surveyors, gardeners)	❑	❑	❑	❑	❑
Others *(please specify)*	❑	❑	❑	❑	❑

5. Which objectives/ Aims for introducing GIS technology or applications, were set and which are reached, partly reached or not reached. *(please specify with a Ö what was searched for and if these goals are reaced, partly reached or not)*

Objectives / Aims	Searched for	NOT reached	PARTLY reached	Reached
Improved access to information sources.	❑	❑	❑	❑
Better quality of information.	❑	❑	❑	❑
Better uniformed decisions	❑	❑	❑	❑
Quicker decision-making.	❑	❑	❑	❑
Automation of existing methods of analysis.	❑	❑	❑	❑
New forms of analysis.	❑	❑	❑	❑
To make more effective use of the means of the organisation.	❑	❑	❑	❑
Improved spread and distribution of information.	❑	❑	❑	❑
Reducing expenses.	❑	❑	❑	❑
Quicker service to the citizens.	❑	❑	❑	❑
Improved information management or in the whole organisation.	❑	❑	❑	❑
Presenting alternatives by defining new policy proposals.	❑	❑	❑	❑

6. Are employees especially responsible for organising, implementing, and maintaining GIS systems/ applications and its data?

❑ Yes, Special person is especially responsible
❑ No, responsibilities are within the existing functions.

7. Propositions about the use of GIS. *(Give ONE answer per proposition.)*

Stelling	**Strongly agreed**	**Agreed**	**Neutral**	**Not agreed**	**Strongly not agreed**
We started with GIS in our organisation, because ONE person was enthusiastic about this technology.	❑	❑	❑	❑	❑
GIS has its attention in several units/departments in our organisation.	❑	❑	❑	❑	❑
GIS has changed our view about the way that our organisation functions, radically.	❑	❑	❑	❑	❑
Education is most essential for the success of implementing GIS in our organisation.	❑	❑	❑	❑	❑
The perfect scenario for our organisation is to have GIS tools on the desk of every Manager.	❑	❑	❑	❑	❑
The IT department has a major role in the introducing phase of this new technology.	❑	❑	❑	❑	❑
GIS technology provides our municipality with greater efficiency in maintenance and planning.	❑	❑	❑	❑	❑
To organise and make the data suitable is the most important step to start with the implementation of GIS technology.	❑	❑	❑	❑	❑
The Functional Design, base-registration for municipalities (in Dutch: Het Gemeentelijk Functioneel Ontwerp (GFO)) from the Dutch union of municipalities is the base of our GIS.	❑	❑	❑	❑	❑
GIS is only interesting for our technical departments.	❑	❑	❑	❑	❑
GIS has provided us with a more efficient organisation.	❑	❑	❑	❑	❑
GIS is fully integrated and used in our organisation.	❑	❑	❑	❑	❑
The recommendations about GIS, and Geoinformation, as published by RAVI, are of great importance in our organisation.	❑	❑	❑	❑	❑

8. Do you have your data, from different departments, organised and put together in a way that it is multifunctional applicable? *(Choose with a Ö just ONE answer)*

❑ Yes

❑ No

9. Does your organisation make internal use of Meta-information? (Information about the digital data like completeness, update frequency, applications, availability, etc.)**?** *(Choose with a Ö just ONE answer)*

❑ Yes

❑ No

10. Has your organisation the intention to make use of Meta-data? *(Choose with a Ö just ONE answer)*

- ❑ Yes
- ❑ No, why not? .....

.....

11. Does your organisation have the intention to share this meta-data with others outside your own organisation? *(Choose with a Ö just ONE answer)*

- ❑ Yes, within 5 years.
- ❑ Yes, but not within 5 years.
- ❑ No

12. Are you familiar with the existence of the National Clearinghouse Geo-Information (the NCGI)? (The NCGI, http://www.ncgi.nl, is a sort of digital form of the yellow pages which tells you where and how you can get digital geo-information. For instance (soil) statistics, town- and country plans, environmental plans, etc.) *(choose with a Ö just ONE answer)*

- ❑ Yes
- ❑ No

13. What will effect your decision to join The NCGI, if you are not at this moment? *(Choose with a Ö, several answers possible)*

- ❑ If we have made more progress on the use of digital geo-information in our organisation.
- ❑ If we are going to use Meta-data internal.
- ❑ If we have our Meta-data better organised.
- ❑ If we have realised access to the Internet.
- ❑ If we frequently make use of digital information which are offer to us, by third parties organisations.
- ❑ Others..please specify .....

Section C – GIS ACCEPTANCE, USE AND DEVELOPMENT.

The next questions have to do with the acceptance, use and development of GIS within your organisation.

1. Who was of most importance in the decisionmaking proces to make use of GIS technology? *(Choose with a Ö, several answers possible)*

Local government	❑
Managers of the departments were GIS would be introduced.	❑
Managers of other departments.	❑
System engineers	❑
(Potential) users	❑
Others (please specify) _____	❑

2. Which activities were done BEFORE the GIS SELECTION? *(Choose with a ö, several answers possible).*

Practicability study	❑
Costs- Profits analysis	❑
Systemanalysis	❑
Talks with other GIS users.	❑
Visit to suppliers.	❑
Quotation request	❑
Benchmark test	❑
Pilot	❑
Others (please specify) _____	❑

3. Which activities were done BEFORE the INSTALLATION of the GIS system? *(Choose with a ö, several answers possible).*

Seminars for awakening process.	❑
Consulting of the management.	❑
Meetings about the organisational aspects.	❑
Demonstrations of (potential) systems to het management of the organisation.	❑
To inform the organisation about the possibilities of GIS technology.	❑
Others (please specify) _____	❑

4. Is there in your organisation a plan with a vision and/or objectives defined in it?

❑ Yes, Vision is ……

……

❑ No

5. Who were educated in the use of GIS software? *(choose with a ö, several answers possible).*

Employees who were supposed to use the system full time.	❑
Every employee who thought that he would use the system occasionally.	❑
Only employees within a certain department.	❑
Only employees with computerknowledge.	❑
Others (please specify)	❑

6. How was the GIS developed in the organisation? *(Choose with a ö, several answers possible).*

By ONE department in the organisation.	❑
With the supplier of the software.	❑
With a consultant independent from the supplier of the software.	❑
Through the whole organisations with working groups.	❑
By some enthusiastic persons within the organisation.	❑
Others (please specify) _____	❑

7. What developments have happened after the first GIS software installation? *(Choose with a ö, several answers possible).*

Additional GIS products bought from the same supplier.	❑
Additional GIS products bought from another supplier.	❑
A complete change of the original starting points.	❑
Several GIS systems in use within ONE department.	❑
Several GIS systems in use within several departments.	❑
Several GIS systems in use through the whole organisation.	❑
Several Users within ONE department.	❑
Several Users within several departments.	❑
Several Users through the whole organisation.	❑
Development of several applications.	❑
The GIS is seldom used.	❑
The GIS is not used anymore.	❑
Others (please specify) _____	❑

8. What, do you think would happen the next 5 years? *(Choose with a ö, several answers possible)*

Additional GIS products bought from the same supplier.	❑
Additional GIS products bought from another supplier.	❑
A complete change of the original starting points.	❑
Several GIS systems in use within ONE department.	❑
Several GIS systems in use within several departments.	❑
Several GIS systems in use through the whole organisation.	❑
Development of several applications.	❑
The GIS will be seldom used.	❑
The GIS will not be used anymore.	❑
Others (please specify)	❑

(End of the questionnaire, go to SECTION E)

Section D – NON- users of GIS

1. **Which of the following statements are applicable to your municipality?** *(Choose with a Ö, several answers possible).*

Our organisation…

Is not aware of GIS and its possibilities.	❑
Is not convinced that GIS would provide a solution in our needs.	❑
Is discouraged by the "high costs" of GIS software.	❑
Is discouraged by the "high costs" of making data available for use by GIS.	❑
Does not have the expertise to use GIS effectively.	❑
Is not sure of the costs effectiveness of the use of GIS.	❑
Has not considered the implementation of GIS.	❑
Considers the implementation of a GIS.	❑
Others (please specify) _____	❑

2. **Which factors are influencing the decision to seriously introduce GIS into the organisation?** *(Choose with a Ö, several answers possible)*

Improved functionality	❑
Proved benefits.	❑
Attendance with the implementation by for example the Dutch union of municipalities (VNG). Explain by Q3 how you think they can do that.	❑
More user-friendly systems.	❑
Availability of useful digital data.	❑
Support of the VNG in form of a scenario.	❑
Improved availability of GIS education.	❑
Nothing would change our decision.	❑
Others (please specify) _____	❑

3. **Additional comments about the use or non-use of a GIS system.**

_____

_____

Section E - Summary

1. Would you like to get a copy of the summary of this survey?
(Also in time on the Internet on http://www.econ.vu.nl/UNIGIS)

- ❑ **Yes, sent me by E-mail** (Fill in your E-mail address at the section Personal details)
- ❑ **Yes, sent met by post.**
- ❑ **No**

Personal details.

Name: _____

_____

Function: _____

_____

Municipality: _____

_____

Department: _____

_____

Address and PC: _____

_____

_____

Telephone: _____

_____

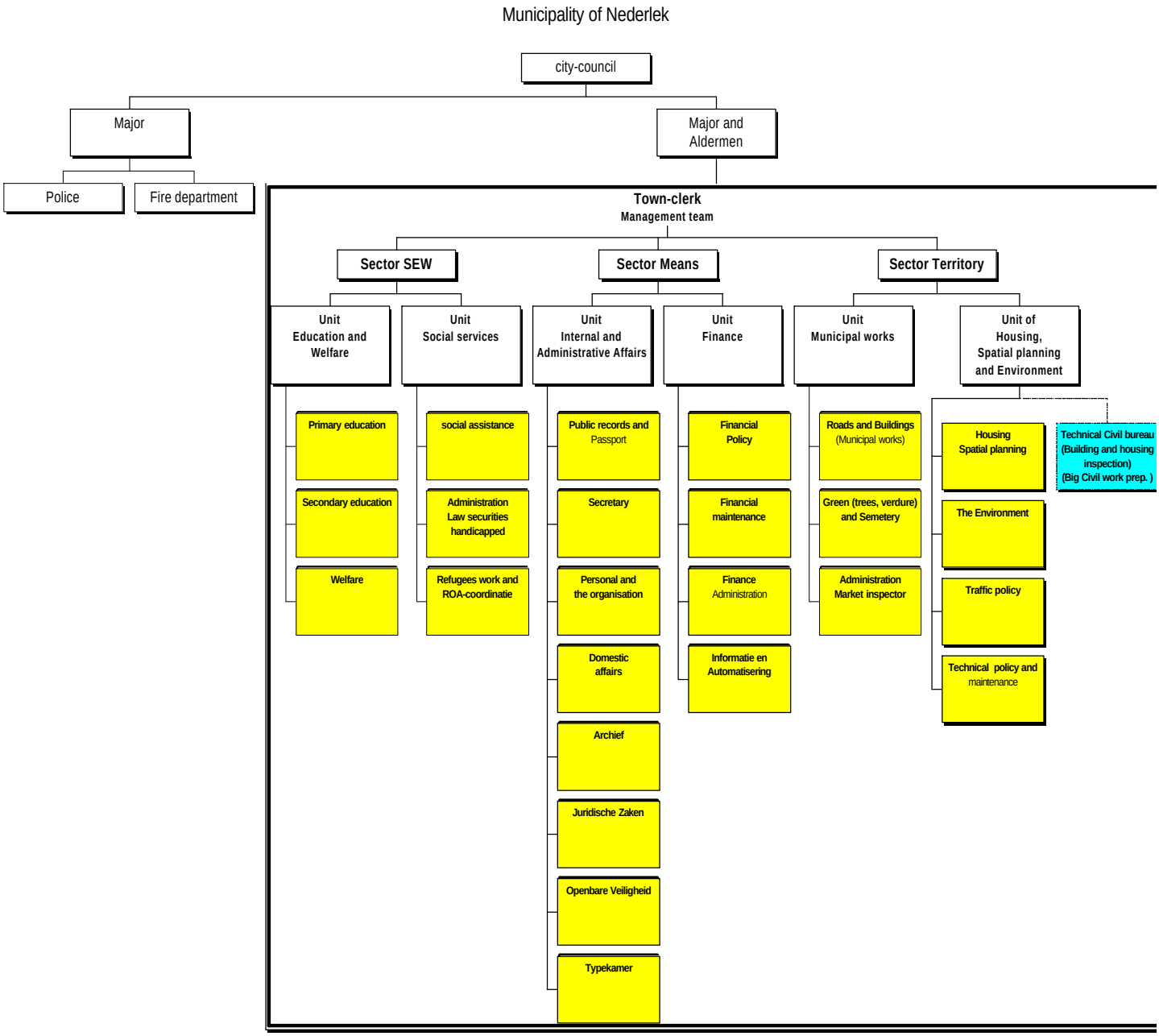
Email: _____

❑ ***Don't forget to fill in your E-mail address!!*** _____

Please send back the questionnaire in the accompanied envelope.

THANK YOU VERRY MUCH FOR YOUR TIME AND EFFORT.

Appendix E: Nederlek organisation diagram



Appendix F: Diskette